Interprofessional learning programs using simulation in obstetrics and gynaecology

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Thesis by published works

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Doctor of Philosophy

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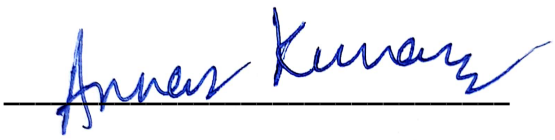
Statement of authentication

This thesis is submitted to Monash University, in fulfillment of requirement of Doctor of Philosophy.

The work presented in this thesis is to the best of my knowledge and belief, original unless specified in the text. I hereby declare that I have not submitted this work either full or in part, for a degree at this or any other institution.



Date: 17th May 2018

Arunaz Kumar

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Certificate of declaration

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes five original papers published in peer-reviewed journals, a book chapter and two unpublished publications that are currently under review. The core theme of the thesis is simulation-based education in an interprofessional setting. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself as the student, working within the Department of Obstetric and Gynaecology under the supervision of Prof. Euan Wallace and Prof. Debra Nestel.

The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research.

In the case of chapter numbers 2.3,4,5,6 and 7 my contribution to the work involved the following:

Thesis Chapter	**Publication Title**	**Status** *(published, in press, accepted or returned for revision)*	**Nature and % of student contribution**	**Co-author name(s) Nature and % of Co-author's contribution***	**Co-author(s), Monash student Y/N***
2	Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting?	Published	75%. Concept, intervention, collecting data, analysis and writing first draft	1. Carole Gilmour. Concept, intervention 5 % 2. Debra Nestel. Supervision and manuscript preparation input into manuscript 5% 3. Robyn Aldridge. Intervention 5% 4. Gayle McLelland. Concept, intervention 5% 5. Euan Wallace. Supervision, concept, manuscript preparation 5%	No

3	Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study	Published	75%. Concept, intervention, data collection, data analysis, paper-writing	1. Euan Wallace. Concept, manuscript editing 5% 2. Christine East. Intervention, manuscript editing 2% 3. Helen Hall. Intervention 3% 4. Gayle McLelland. Intervention 5% 5. Debra Nestel. Supervision, data collection, data analysis, manuscript editing 10%	No
4	Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation	Published	65%. Concept, intervention, data collection, writing first draft	1. Debra Nestel. Concept, editing paper 5% 2. Christine East. Intervention 2% 3. Margaret Hay. Data analysis 5% 4. Irene Lichtwark. Data analsyis 4% 5. Gayle McLelland. Intervention 2 % 6. Deidre Bentley. Intervention 2% 7. Helen Hall. Intervention 2% 8. Shavi Fernando. Intervention 2% 9. Sebastian Hobson. Intervention 2% 10. Luke Larmour. Intervention 2% 11. Philip Dekoninck. Intervention 2% 12. Euan M. Wallace. Concept, supervision, editing paper 5%	No
4	Simulation based training in a publicly funded home birth	Published	70% Concept, intervention data collection, data analysis, first paper draft	1. Debra Nestel. Editing paper 5% 2. Sally Stoyles Intervention 5% 3. Christine East Editing paper 5%	No

	programme in Australia: A qualitative study			4. Euan M. Wallace. Concept, editing paper draft 5% 5. Colleen White Intervention 10%	
4	In-situ simulation of a home birth	Published	80% Concept, first paper draft	1. Debra Nestel 20% Paper editing	No
5	Effect of an in-situ simulation program on home birth practice in Australia	Under review	70% Concept, intervention, data analyisis, first paper draft	1. Euan M Wallace. Concept 5% 2. Cathy Smith. Data analysis 5% 3. Debra Nestel. Concept, Data collection and analysis 20%	No
6	Interprofessional education and practice guide No 9: Sustaining interprofessional simulation using change management principles	Under review	70%, concept, paper draft, revision	1. Fiona Kent. 10% editing paper 2. Euan M Wallace. editing paper 4% 3. Gayle McLelland. editing final draft 2% 4. Deirdre Bentley. editing final draft 2% 5. Angela Koutsoukos. editing final draft 2% 6. Debra Nestel. supervision 10%	No
7	Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed	Published	70%, concept, data collection, data evaluation, writing first paper draft	1. Sam Sturrock. Data collection, analysis 4% 2. Euan M Wallace. Concept, editing paper 4% 3. Debra Nestel. Editing final draft 2% 4. Donna Lucey. intervention 2% 5. Sally Stoyles. Intervention 2% 6. Jenny Morgan. intervention 2% 7. Peter Neil.	No

	methods study			8. Intervention 2% 9. Michelle Schlipalius. intervention 2% 10. Philip Dekoninck. data analyisis 10%	

**If no co-authors, leave fields blank*

I have / have not renumbered sections of submitted or published papers in order to generate a consistent presentation within the thesis.

Student signature:  **Date:** 17.5.18

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's and co-authors' contributions to this work. In instances where I am not the responsible author I have consulted with the responsible author to agree on the respective contributions of the authors.

Main Supervisor signature:  **Date:** 17.5.18

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Publications arising from the thesis

1. **Kumar, A.**, Gilmour, C., Nestel, D., Aldridge, R., McLelland, G., & Wallace, E. (2014). Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting? Australian and New Zealand Journal of Obstetrics and Gynaecology, 54(6), 589-592. doi: 10.1111/ajo.12252

2. **Kumar, A.,** Nestel, D., Stoyles, S., East, C., Wallace, E. M., & White, C. Simulation based training in a publicly funded home birth programme in Australia: A qualitative study. Women and Birth, 29, 47-53. doi: 10.1016/j.wombi.2015.07.186

3. **Kumar A**. In-situ simulation of home births. Simulated Patient Methodology: Theory, Evidence and Practice. Nestel D, Bearman M, Editors. Wiley Blackwell

4. **Kumar, A.,** Wallace, E. M., East, C., McClelland, G., Hall, H., Leech, M., & Nestel, D. (2017). Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study. Clinical Simulation in Nursing, 13(5), 217-227. doi: 10.1016/j.ecns. 2017.01.010

5. **Kumar, A**., Nestel, D., East, C., Hay, M., Lichtwark, I., McLelland, G., . . . Wallace, E. M. (2017). Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation. Australian and New Zealand Journal of Obstetrics and Gynaecology. doi: 10.1111/ajo.12659

6. **Kumar, A.,** Kent, F., Wallace, E. M., McLelland, G., Bentley, D., Koutsoukos, A., & Nestel, D. (2018). Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles. J Interprof Care, 1-8. doi: 10.1080/13561820.2018.1511525

7. **Kumar, A.,** Wallace, E. M., Smith, C., & Nestel, D. (2018). Effect of an in-situ simulation workshop on home birth practice in Australia. Women and Birth. doi: 10.1016/j.wombi.2018.08.172

8. **Kumar, A**., Sturrock, S., Wallace, E. M., Nestel, D., Lucey, D., Stoyles, S., Dekoninck, P. (2018). Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study. BMJ Open, 8(2), e017451. doi: 10.1136/bmjopen-2017-017451

Conference presentations undertaken as the studies progressed

1. Hider K, White C, Wallace EM, **Kumar A**. A risk management approach supports safe publicly funded home births. PSANZ Annual Congress 2012, Hobart.
2. **Kumar A**. Simulation in Obstetrics and Gynaecology: A Multidisciplinary Approach. IMSH 2013, Orlando.
3. **Kumar A**. Simulation based Interprofessional education. AMEE conference 2013, Prague.
4. **Kumar A**. Simulation based Inter - Professional Obstetrics and Gynaecology Education. Sim Health 2013, Brisbane.
5. **Kumar A**. Evaluation of an obstetric and gynaecology simulation program for teaching clinical skills to medical and midwifery students. Victorian Showcase of Educational Research meeting 2014, Melbourne.
6. **Kumar A**, Hall H, McDonald S, Nestel D, Wallace EM. An Obstetrics and Gynaecology simulation program in clinical skills for medical and midwifery students. A pre-test post-test evaluation. RCOG World Congress 2015, Brisbane.
7. **Kumar A**, Bentley D, Nestel D, Wallace EM. Introduction of an open-book short answer question assessment as a formative tool for medical students in an obstetric and gynaecology curriculum. RCOG World Congress 2015, Brisbane.
8. **Kumar A**, Hall H, McDonald S, Nestel D, Wallace EM. An Obstetrics simulation program in clinical skills for medical and midwifery students. A pre-test post-test evaluation. PSANZ Congress 2015, Melbourne.
9. Stoyles S, White C, **Kumar A**, Kervin D. Obstetric emergency management in homebirth. Multidisciplinary scenario based training. PSANZ Congress 2015, Melbourne.
10. **Kumar A**. Introduction of an open-book short answer question assessment as a formative tool for medical students in an obstetric and gynaecology curriculum. Victorian Showcase of Educational Research meeting 2015, Melbourne.

11. **Kumar A**. Simulation in homebirth. Victorian Showcase of Educational Research meeting 2015, Melbourne.

12. **Kumar A**, Wallace E , McLelland G, East C, Nestel D. An obstetrics and gynaecology simulation program for medical students. A pre-test post-test evaluation. Ottawa conference, Perth 2016.

13. **Kumar A**, Nestel D, McClelland G, Wallace EM. Interprofessional simulation program for medical and midwifery students – a pre-test and post-test evaluation: AMEE conference, Helsinki, 2017

14. **Kumar A**., Wallace, E. M., East, C., McClelland, G., Hall, H., Leech, M., & Nestel, D. Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study; IMSH 2018 Los Angeles USA

15. **Kumar A**, Nestel D, Stoyles S, East C, Wallace EM, White C. Simulation based training in a publicly funded home birth programme in Australia: a qualitative study; IMSH 2018 Los Angeles USA

Additional publications undertaken during my candidature but not part of the thesis

1. Dendle C, Baulch J, Pellicano R, Hay M, Lichtwark I, Ayoub S, Clarke DM, Morand EF, **Kumar A**, Leech M, Horne K. Medical student psychological distress and academic performance. Med Teach. 2018; Jan 21:1-7

2. Walker R, **Kumar A**, Blumfield M, Truby H. Maternal nutrition and weight management in pregnancy: a nudge in the right direction. Nutrition Bulletin 2018 (in press)

3. Maddock B, **Kumar A**, Kent F.Creating a Collaborative Care Curriculum Framework. Clinical Teacher 2018

Preface

Background

At the time of commencing the PhD, I was the clinical curriculum and assessment lead for medical students, for obstetrics and gyanecology component of the undergraduate medicine (MBBS) course at Monash University. The exposure to teaching and supervising medical students made me aware of the lack of scaffold learning provided to students for examining women. This lack of preparation was more apparent when the students tried to perform intimate gynaecological examination. This problem often led to students having incomplete log books with decreased learning opportunities as they were not "clinic-ready", making it difficult for them to get the required experience. I wanted to make it easier for the students to get experience in these examinations but they lacked the confidence, even when they were encouraged to proceed with performing examinations on patients under expert supervision.

Undergraduate interprofessional experience in obstetrics

I was also aware of the scant interprofessional experience in most of the MBBS course. In the Women's Health component of undergraduate study, the only exposure to learners from another discipline was in the birth unit, where midwifery and medical students were competing for opportunities to observe a woman in labour. Medical students often reported that midwifery students were given a preference in allocations and had better opportunity to participate in births. The midwives, who were supervising the students reported that medical students had very short clinical rotations leading to a limited exposure to births and it was not possible for the medical students to get more "hands-on" experience with very little prior preparation. The tension between medical and midwifery staff was not just limited to the undergraduate course. Even in practicing health professionals, there was a continued variation in clinical practice of the medical and midwifery staff. Many of these discrepancies in clinical management were thought to arise from their course delivery at the undergraduate level. It was also observed that prior to the introduction of interprofessional education in the health service, they struggled to work together as a "team" in emergency time-critical situations.

When I started my role in the position of the clinical supervisor for medical students, I was approached to set up a medical and midwifery interprofessional program at the school. This gave me incentive to start the simulation-based education (WHIPLS program) for both medical and midwifery students and also provide the two professional groups, an opportunity to learn from each other.

What led to the studies in the thesis?

In 2010, I completed in Graduate Certificate of Health Professional Education at Monash University. As part of an assignment, I chose to write about simulation, which provided me with a background on how simulation can assist learners to gain experience on simulators prior to examining patients. Hence, I thought of introducing the WHIPLS program for medical students. I was also aware of the need of teaching these skills to the midwifery student cohort and approached their supervisors to consider their involvement in the workshop.

At the same time, I qualified as an obstetrician and gynaecologist from the Royal College of Obstetrics and Gynaecology in Australia and New Zealand (RANZCOG). I commenced a consultant job at Casey hospital, Monash Health. At this time, Victorian Managed Insurance Authority (VMIA) was planning to launch the Practical Obstetric Multiprofessional Training (PROMPT) program in the state of Victoria, Australia. The PROMPT program started from Bristol after a Confidential Enquiry into Maternal & Child Health (CEMACH 1997) reported that substandard care in maternal deaths in the UK, contributed by absence of multiprofessional team working. Since 2002, the PROMPT program has been introduced in many sites globally. I was sent on a PROMPT training course and was one of the clinical leaders to set up the PROMPT program at Casey hospital, Monash Health. Although I was not a PROMPT facilitator, I was involved in it's initial introduction.

In 2010, I was also appointed the medical lead to set up the Home birth program, where Casey midwives looked after women giving birth in the comfort of their own homes. There was a lot of anxiety around this program especially due to lack of prior training of

the midwives and the concern about organising an emergency transfer to the hospital in case of an obstetric and neonatal emergency.

Each of these opportunities facilitated the introduction of interprofessional simulation-based education for undergraduate medical and midwifery students in WHIPLS program, the medical and midwifery staff in the healthcare workforce, and the home birth midwives and paramedical staff in the home birth based setting. I was instrumental in setting up and implementing these programs, both for Monash University and Monash Health.

I was keen to evaluate if the students found the learning beneficial and also assess "how much" the students had learnt. I did not want to limit the evaluation to just a post-intervention quality assurance activity but wanted to contribute to the literature by employing a methodical approach and providing evidence to make changes to the curriculum. The Department of Obstetrics and Gynaecology and the Faculty of Medicine at the university were keen to support research in interprofessional or simulation based education. At that time, I was unaware of theoretical frameworks but subsequently learnt about the various learning theories and frameworks by receiving guidance from my research supervisors and through educational courses. I enrolled in the Research Essentials Skills in Medical Education (RESME) that helped me select the Kirkpatrick's model. This model provided the framework to answer my research questions. After familiarization with the framework, I was able to draft out clear research questions to assess the effectiveness of my interprofessional simulation programs and develop evaluation strategies with a rigorous approach that could be implemented in this setting.

The following chapter provides an introduction to the thesis and the Kirkpatrick's evaluation framework that was used as the framework to guide the studies performed in the thesis.

Abstract

Introduction

Interprofessional team members need to collaborate and work together to provide safe and high quality healthcare. Introduction of interprofessional teaching programs can address the learning needs of individual professional teams and also attempt to close the gap between different teams having varying clinical practices. Interprofessional collaborative practice has the potential to improve patient outcomes, adherence to clinical protocols, patient satisfaction, decrease human errors, and improve clinical process outcomes (1). Simulation can facilitate learning skills and acquiring knowledge in a safe and supportive learning environment. Combining interprofessional and simulation-based education (SBE) provides learners with exposure to real clinical problems managed as a health care team with different roles and responsibilities. It provides a basis for developing understanding and respect among professional teams, on which safe health practices can be built. This thesis investigates the role of interprofessional simulation-based education in the undergraduate domain at Monash University and also in practicing health professionals at Monash Health.

Aims

The aim of the research reported in this thesis was to explore the effect of interprofessional simulation-based education on medical and midwifery students and clinicians. The studies in this research aimed to answer the following questions:

1. What did the participants learn from the interprofessional simulation program?
2. In what way did the interprofessional simulation impact participants' thoughts and feelings about interprofessional education (IPE) and interprofessional collaborative practice (IPCP)?
3. In what way did interprofessional simulation affect institutional practice?
4. In what way did the interprofessional simulation impact patient outcome?

Methods

The Kirkpatrick's 6-level framework (2, 3) (Table 1) has been used to guide the research as it provided a link between the educational context (medical and midwifery students/workforce), mechanism (interprofessional simulation) and the likely outcome (effect on the participants' learning/attitude or healthcare system)(4).

The following three interventions were designed and studied in the thesis:

1. Women's Health Interprofessional Learning by Simulation (WHIPLS) program for medical and midwifery undergraduate students
2. Home birth simulation was introduced for midwifery and paramedical workforce to assist with safe and efficient transfer of women in labour/ their newborn babies birthing at home to hospital in an obstetric/ neonatal emergency.
3. Practical Obstetric Multiprofessional Training (PROMPT) for obstetric and midwifery staff in hospital for safe and timely management of obstetric/ newborn emergency in the birth unit.

The data collection methods that were used were written surveys, pre-test and post-test questionnaires, focus groups, interviews and (evaluation of data) from the Birthing Outcome System (BOS)® at Monash Health.

Table 1 Modification of the Kirkpatrick's framework (adapted from Barr's six level classification)

Level	Measurement	Example	Paper number
1	Participant reaction	Were they satisfied with the IPE activity?	Paper 1 and 2
2a	Change in participants' attitudes	Do they feel different about the interprofessional team or towards a team-based approach?	Paper 2 and 3
2b	Change in participants' knowledge or skills	What was the learning acquired from the IPE activity?	Paper 4 and paper 7
3	Behavioural change	Was there an observable	Paper 5

		change in participant performance in the practice setting?	
4a	Change in organizational practice	Was there a wider change in the institutional practice as result of the IPE activity?	Paper 6
4b	Change in clinical outcome	Was there any benefit to the patients/clients as a result of the IPE activity?	Paper 7

Adapted from (3)

Results

In this section, I present a brief summary of the papers and how each paper addresses the research questions listed above. The papers are based on the three projects, Women's Health Interprofessional Learning by Simulation (WHIPLS), Home birth simulation and the Practical Obstetric Multiprofessional Training (PROMPT). Each paper attempts to address one or more of the Kirkpatrick's framework (indicated in brackets with the paper number). Hereafter, I use the term "I" when I am referring to myself writing the PhD thesis and refer to as "we" when I address a topic where the research team was involved.

The summary and main findings from each paper are outlined below:

Publication 1. (representing Level 1 Kirkpatrick's framework)

Kumar, A., Gilmour, C., Nestel, D., Aldridge, R., McLelland, G., & Wallace, E. (2014). Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting? Australian and New Zealand Journal of Obstetrics and Gynaecology, 54(6), 589-592. doi: 10.1111/ajo.12252

This paper evaluated how medical and midwifery students perceived the WHIPLS program immediately after attendance.

Problem: Medical and midwifery students find it difficult to acquire intimate vaginal examination skills and performing births without prior orientation in a simulation setting. Teaching these skills on patients, results in increased student, anxiety. Simulation-based education has been extensively used in managing emergency situations, but not often used in providing core clinical examination skills or birthing procedures.

Gap: Very little is known about how simulation-based education affects medical and midwifery students in learning core clinical examination skills. A gap exists in understanding of how medical and midwifery students perceive learning these skill using task-trainers in interprofessional teams.

Approach to the problem: In this paper, we present an interprofessional simulation (WHIPLS) program for medical and midwifery students. The half-day program was designed to teach vaginal exam to teach gyanecology and labour, and performing births on low-fidelity task trainers.

Results: The feedback on the program was positive with respect to the relevance of the teaching content, quality of simulation, and perception of confidence in performing the examination/ skill on a real patient after attending the workshop.

Conclusion: Interprofessional core skills training, using low fidelity simulation models in medicine and midwifery students, had a good acceptance and both groups of students felt more confident about examining women in clinical practice after attending the WHIPLS program.

Publication 2. (representing Level 1 and 2b Kirkpatrick's framework)

Kumar, A., Nestel, D., Stoyles, S., East, C., Wallace, E. M., & White, C. Simulation based training in a publicly funded home birth programme in Australia: A qualitative study. Women and Birth, 29, 47-53. doi: 10.1016/j.wombi.2015.07.186

This paper demonstrates the benefit of simulation-based education for midwifery and paramedical staff in obstetric home birth based emergencies.

Problem: Birth at home is a safe and appropriate choice for healthy women with a low risk pregnancy. However there is a small risk of emergencies requiring immediate, skilled management to optimise maternal and neonatal outcomes. Midwifery and paramedical staff need to work efficiently as a team to provide safe management and transfer of women to hospital for women birthing at home in case of unforeseen obstetric complications.

Gap: Simulation-based education has shown to decrease obstetric complications in a hospital setting (5) but less is known about its use in a home birth based setting.

Approach to the problem: In this paper, we present a simulated emergency training program in the home environment for the midwives, and paramedical staff, who may need to manage a home-based obstetric or a neonatal emergency. Here, we describe the results of a participant evaluation of that emergency training program.

Method: Participants attending home birth simulation workshop were required to manage simulated birth emergencies in real time with limited availability of resources to suit the setting of the home birth. They completed a pre-test and a post-test evaluation form, exploring the content and utility of the workshops. Content analysis was performed on qualitative data regarding the most important learning from the simulation activity.

Results: Home birth simulation workshops were found to be useful by midwives that provide care to women who are having a planned home birth and to paramedical staff who are involved in transfer of these women to hospital in an emergency. Simulation provided a lens through which their practice could be viewed.

Developing clear communication and teamwork were found to be the key learning principles guiding their practice. Seventy-three participants attended the workshop (midwifery = 46, and paramedical = 27). The most frequently identified key learning elements were related to communication (among midwives, paramedical and hospital staff and with the woman's partner), followed by recognising the role of other health

care professionals, developing an understanding of the process and the importance of planning ahead.

Conclusion: Simulation based education was reported to be helpful for home birth practice of midwifery and paramedical staff.

Publication 3. (representing Level 2a Kirkpatrick's framework)

Kumar, A., Wallace, E. M., East, C., McClelland, G., Hall, H., Leech, M., & Nestel, D. (2017). Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study. Clinical Simulation in Nursing, 13(5), 217-227. doi: 10.1016/j.ecns.2017.01.010

In this study, through a qualitative research design, we report the medical and midwifery students' approach to their learning and attitude towards each other's team.

Problem: The development of understanding and respect for other professional groups is important for effective functioning of health care teams that need to work together(6). Simulation can be used to teach IPE competencies(7) at an undergraduate level. However, very few interprofessional learning programs exist at the undergraduate level.

Gap: The short-term benefit of improving teamwork and communication and the long-term impact on positive changes in behaviour and attitudes have been studied in working teams, but with limited implementation or understanding at the undergraduate level.

Approach to the problem: We used the WHIPLS program to achieve acquisition of clinical skills related to IPE and development of an understanding of other team's role and relationship, corresponding to level 2a learning outcome (a change in attitude towards an interprofessional group). The present study explores students' perceptions of the impact of WHIPLS program and attitude regarding the other professional team three months after the intervention.

Method: We assessed this through thematic analysis of independently run focus groups three months after the attendance of the WHIPLS program and their respective clinical placements.

Results: Medical students reported the importance of ‘‘learning by doing’’ through simulation as the key theme. Feedback obtained from midwifery students was focused on ‘‘relationship of power’’ compared with the other discipline. Interprofessional learning had a positive influence on the attitudes of medical and midwifery students, in spite of the disparity in their background knowledge and experience.

Conclusion: Interprofessional competencies are better appreciated at a relatively mature level of clinical practice. Core skills in women's health taught through simulation were found to be helpful by both midwifery and medical students. However, the key learning was about developing respect and a supportive relationship ‘‘of equals’’ with each other.

Publication 4. (representing Level 2b Kirkpatrick's framework)

Kumar, A., Nestel, D., East, C., Hay, M., Lichtwark, I., McLelland, G., Wallace, E. M. (2017). Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation. Australian and New Zealand Journal of Obstetrics and Gynaecology. doi: 10.1111/ajo.12659

In this study, we used a pre-test and post-test research design to demonstrate improvement in participant learning though the WHIPLS program.

Problem: Simulation-based education programs are increasingly being used to teach obstetrics and gynaecology examinations, but it is difficult to establish student learning acquired through them.

Gap: Assessment of interprofessional simulation can address a change in learning clinical skills or knowledge that represents level 2b of the Kirkpatrick's framework. Assessments test student learning but their role in learning itself is rarely recognised.

Approach to the problem: We undertook this study to assess medical and midwifery student learning (knowledge of the skills) through the WHIPLS program using a pre-test and post-test design and also to evaluate use of assessment as a method of learning.

Method: Over 24 months, 405 medical and 104 midwifery students participated in the WHIPLS program and were assessed before and after the program using a multiple choice question test. Numerical data were analysed using paired t-test and one-way analysis of variance. Students' perceptions of the role of assessment in learning were qualitatively analysed.

Results: The post-test scores were significantly higher than the pre-test ($P < 0.001$) with improvements in scores in both medical and midwifery groups. Students described the benefit of assessment on learning in preparation of the assessment, reinforcement of learning occurring during assessment and reflection on performance cementing previous learning as a post-assessment effect.

Conclusion: Both medical and midwifery students demonstrated a significant improvement in their test scores and for most students the examination process itself, was a positive learning experience.

Publication 5. (representing Level 2a, 2b and 3 Kirkpatrick's framework)

Kumar, A., Wallace, E. M., Smith, C., & Nestel, D. (2018). Effect of an in-situ simulation workshop on home birth practice in Australia. Women and Birth. doi: 10.1016/j.wombi.2018.08.172

This paper aims to assess the impact of in-situ simulation of home birth on clinical practice at Monash Health as evidence of transfer of learning.

Problem: Home birth complications may require both midwifery and paramedical teams to work together to manage obstetric emergencies in a time-critical, low-resource setting at home and transfer to a hospital safely.

Gap: Multiprofessional obstetric training programs have been reported to improve clinical technical skills and teamwork, leadership and communication
(5, 8) and also improve patient outcome(9). However, these have not been either demonstrated or reported in a home birth setting.

Approach to the problem: In paper 2, we have reported, what was learnt by midwifery and paramedic staff from the home birth simulation. In this paper, using a qualitative research design, we take this evaluation further by interviewing home birth midwives to assess what learning was applied to their clinical practice.

Method: Midwifery staff members who perform home births at Monash Health and also participated in the home birth simulation at least once (n=23) were invited to attend an interview. The midwives described how the attendance of home birth simulation has changed their management of home births in making them more aware and better prepared for obstetric or neonatal emergencies.

Results: The key theme was about the changes that have occurred in their clinical practice due to the attendance of the home birth simulation. The midwifery staff and facilitators observation was that the staff was more efficient in managing the home birth emergency in simulation after repeated attendance.

Conclusion: Midwifery staff found that the learning from home birth simulation was useful and were also able to transfer the learning to their home birth practice.

Publication 6. (representing Level 4a Kirkpatrick's framework)

Kumar, A., Kent, F., Wallace, E. M., McLelland, G., Bentley, D., Koutsoukos, A., & Nestel, D. (2018). Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles. J Interprof Care, 1-8. doi: 10.1080/13561820.2018.1511525

Problem: Interprofessional simulation programs are frequently introduced for teaching undergraduates but very few sustain due to various problems like lack of support from

institutions and training resources, roster issues and challenges with developing a curriculum overlap.

Gap: Very little is known about how sustainability can be achieved in these interprofessional educations programs. Interprofessional programs are being encouraged to form a part of the curriculum(10) but steps to achieve it are poorly defined. Embedding interprofessional education in curriculum by using evaluation(10) to gain recognition from institutions and educational bodies has been recognized but needs further work.

Approach to the problem: In this paper, we present our six-year experience of the Women's Health Interprofessional Learning through Simulation (WHIPLS) program for pre-registration medical and midwifery students that was initially introduced as an experiment to teach clinical skills in an interprofessional environment, but eventually became a core component of the clinical curriculum.

Methods: We describe the steps that were required to attain this outcome using the Kotter's 8-step plan for management change.

Results: The key learning points promoting sustainability were identifying overlap in course curriculum, planning for leadership and implementation, creating institutional buy-in, aligning with national goals, focusing on the learner, translating into routine practice, keeping the program simple, accepting innovation, and considering strategic evaluation.

Conclusion: Our explanation of WHIPLS program through Kotter's 8-step evaluation shows that sustainability of an interprofessional program can be achieved by using a systematic approach from the inception of the program to its implantation and integration.

Publication 7. (representing Level 1, 2b, 4a and 4b Kirkpatrick's framework)

Kumar, A., Sturrock, S., Wallace, E. M., Nestel, D., Lucey, D., Stoyles, S., Dekoninck, P. (2018). Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study. BMJ Open, 8(2), e017451. doi: 10.1136/bmjopen-2017-017451

In this paper, we use a mixed methods approach to provide evidence for multiple levels of Kirkpatrick's framework applied to the Practical Obstetric Multiprofessional training (PROMPT) program. We demonstrate evidence for level 4b of the framework by a quantitative analysis of the birthing outcomes using a pre-test and post-test design.

Problem: Due to unpredictable nature of obstetric emergencies, training needs to be optimised to achieve the best practice in safe management of these challenging situations. Interprofessional training programs have been used for training medical and midwifery staff for a few decades, although little is known about their relation to patient outcome.

Gap: Only a few studies have evaluated simulation-based intervention through multiple "lenses" of assessment, as reported in a recent review on obstetric emergencies.(11) Most researchers have limited evaluations to either level 1 or 2 with some studies demonstrating a change in team behaviour and retention of skills.(12) Studies looking at clinical outcome are scant.(11, 13-15)

Approach to the problem: The aim of this study was to evaluate the implementation of the Practical Obstetric Multi-Professional Training (PROMPT) simulation using the Kirkpatrick's framework. We explored participants' acquisition of knowledge and skills, its impact on clinical outcomes and organisational change to integrate the PROMPT program as a credentialing tool. We also aimed to assess participants' perception of usefulness of PROMPT in their clinical practice.

Methods: Medical and midwifery staff (providing obstetric care at Monash Health Victoria), attended the PROMPT program between 2013 and 2015 (n=508) which is a simulation program taught in multidisciplinary teams to facilitate teaching emergency obstetric skills. Clinical outcomes were compared before and after embedding PROMPT in educational practice in two cohorts 2011-2012 (n=15,361 births) and 2014-2015 (n=12,388 births). We also assessed knowledge gained by participants through a qualitative analysis and description of process of embedding PROMPT in educational practice.

Results: There was a change in the management of postpartum haemorrhage by early recognition and intervention. The key learning themes described by participants were being prepared with a prior understanding of procedures and equipment, communication, leadership, and learning in a safe, supportive environment. Participants reported a positive learning experience and increase in confidence in managing emergency obstetric situations, through the PROMPT program which was perceived as a realistic demonstration of the emergencies.

Conclusion: Participants reported an improvement of both clinical and non-technical skills highlighting principles of teamwork, communication, leadership and prioritisation in an emergency situation. An improvement was observed in management of postpartum haemorrhage but no significant change was noted in clinical outcomes over a two-year period after PROMPT. However, the skills acquired by medical and midwifery staff justify embedding PROMPT in educational programs.

Conclusion of the thesis

The work demonstrated in this thesis is a significant contribution to the literature in the field of interprofessional simulation based education. The work demonstrates benefit of Interprofessional simulation with examples for all levels of the six-level Kirkpatrick's framework, hence justifying its inclusion in undergraduate curricula and for interprofessional staff in clinical practice.

As demonstrated in paper 1, both undergraduate medical and midwifery participants perceived an improved confidence and competence in performing core clinical skills/ procedures relevant to their curriculum. Paper 4 showed that both groups of medical and midwifery students demonstrated improvement in learning after attendance of the WHIPLS program. They also described a positive attitude towards formative assessment tagged to the simulation. In paper 3, the medical and midwifery students learnt about each other's clinical background, while learning core clinical skills through the WHIPLS program. The program also helped them to develop and attitude of being supportive and respectful towards the interprofessional team. Finally, the benefits of the WHIPLS program encouraged the medical and midwifery course providers to seek institutional support. That led to it being embedded in the undergraduate curriculum at Monash University, as we have shown in paper 6.

The series from papers on WHIPLS justify its use in the training program at the undergraduate level. This has also been supported by other studies supporting IPE in the curriculum(16). The interprofessional competency standards for undergraduates have been recognized by O'Keefe et al. Participants are able to explain interprofessional practice to patients, describe the practice of other professions and have a patient-centred approach with involvement of other professional groups where necessary. Besides, they should be able to give constructive feedback in a culturally sensitive way to interprofessional colleagues and resolve conflict regarding patient care with them(17).

Our other two papers on home birth simulation studied learning in midwifery and paramedical staff. As seen in paper 2, home birth midwives and paramedical staff found the home birth simulation useful for their practice. Home birth midwives and paramedical staff thought the key learning from the home birth simulation related to having better communication, being prepared for an emergency both mentally and with equipment. In paper 5, home birth midwives were able to translate their learning from the simulation to changing their clinical practice. The key themes were applying learning to clinical practice, valuing realism, learning in teams, facilitating simulation and managing variation. We also suggest its role as evidence for level 4a of the Kirkpatrick's

framework, as attendance of home birth simulation has become a mandatory annual requirement for home birth midwives.

Similar to the home birth simulation, the practicing health care staff in the hospital (medical and midwifery teams) participating in the Practical Obstetric Multiprofessional training (PROMPT) program found it useful for clinical practice. The key learning reported after attendance of the PROMPT workshop by medical and midwifery staff was being prepared with a prior understanding of procedures and equipment, communication, leadership, and learning in a safe, supportive environment. It is interesting to note that, these are again very similar learning messages, noted in the home birth simulation. However, in this cohort, we were able to evaluate program effectiveness by evaluating patient outcome. The birthing outcome data assessed two years before and after the PROMPT workshop was embedded in clinical practice at Monash Health demonstrated a decrease in incidence of postpartum hemorrhage. This was suggested to be due to more aggressive management of postpartum hemorrhage likely to be a result of regular PROMPT attendance.

The distinguished feature about the paper of PROMPT evaluation (Paper 7) is that it evaluates multiple levels of Kirkpatrick's framework, with benefits noted at each level demonstrated. This program is in keeping with the recommendations from INACSL (International Nursing Association for Clinical Simulation and Nursing) suggesting use of an evaluation framework to guide simulation-based interprofessional education(18). According to the INACSL best practice guidelines, the simulation-based interprofessional program should included multiple experiences to achieve the outcome, use realistic scenarios relevant to the practice of the professionals, share mutual goals for the learning experiences, and have activities which focus on learning objectives, participants' knowledge, skills and experiences. We think that our interprofessional simulation based studies provide a meaningful evidence to support these key concepts.

The details of all the above-mentioned studies are described in the later chapters along with the published papers. The next few chapters describe the background for starting this research and provide the justification for the theoretical framework used.

Chapter 1

Role of interprofessional simulation training programs in obstetrics and gynaecology

1.1 Section 1: Why was the study conducted?

The chapter has two sections; the first section discusses the role of interprofessional Simulation Based Education (SBE) in obstetrics and gynaecology and the second section describes the current use of the Kirkpatrick's evaluation framework. The first section provides an orientation to how simulation assists learning in the context of healthcare. I specifically discuss the role of SBE in the field of obstetrics and gynaecology. I provide an overview of using simulation in the setting of Interprofessional Education (IPE) as this was the main focus of my research.

Penny Walters presents to her GP for a routine pap smear. She has been regular with her pap smears but always gets anxious that it will be a painful experience for her. She enters the clinic room and finds a medical student sitting with the doctor. The doctor enquires if the student can perform the test under his supervision. She wants to help the student but afraid if he has enough experience to perform the test. She asks the student if he has ever performed this procedure before…

Sandra Barnes is a year-3 midwifery student towards the end of her clinical placement. During her training, she has seen the midwives perform vaginal examinations and births but does not feel confident about performing them herself even under expert supervision….

Obstetrics and gynaecology training can be difficult for both undergraduate and postgraduate learners. Due to the physically intimate nature of this specialty,

teaching core examination skills is a challenge for clinical educators. Undergraduate medical curricula are usually designed to equip students with a basic level of core competence in performing examination and taking clinical decisions suited to an intern level. However, due to challenges related to teaching these intimate clinical examinations, many students are unable to acquire skills expected of a junior doctor.

Medical curricula usually consist of clinical rotations, which expose students to a variety of medical and surgical specialties. This exposure is necessary for students to get a basic level of knowledge and understanding of each discipline. It also influences the student' decisions about choosing a specialty, which they may be interested in as a long-term career option. Unfortunately, due to the nature of obstetrics and gynaecology, medical students face gender bias when it comes to performing intimate examination(19-21). Many male medical students either miss out on learning opportunities or get disillusioned from pursuing this specialty (22). As a result, there has been an increase in female obstetricians and gynaecologists and female general practitioners providing care for women's health compared to the male practitioners(23). If the decreased preference in male medical students is occurring due to lack of adequate clinical exposure or understanding of the subject (rather than personal choice), alternate measures need to be sought for providing the required training(24-26).

The difficulty in learning clinical skills is accentuated due to increase in numbers of medical students, with limited clinical opportunities available to learn on patients. There may have been an increase in private medical schools in many countries and an expansion in capacity of the established medical schools for example in the UK, New Zealand and Australia (27). The patients available for performing clinical examination may not have increased in the same proportion. As described above, not all patients that are approached by medical students will consent to a vaginal or a speculum examination. With increased number of students and an increase in clinicians relying on investigations like imaging techniques to make clinical assessments, over the years, there has been a noticeable drop in students' confidence in performing clinical examination skills(28).

In obstetrics, students face the additional challenge of encountering unexpected clinical emergencies during birth. Most medical training programs across the globe are unable to provide sufficient experience to learners in diagnosing and managing a clinical emergency as it requires skills like team-working, prioritizing, understanding of one's limitations in scope of practice and escalating decisions, where required(29). The challenge for teaching and learning these skills is not just limited to undergraduate/ pre-registration programs but also for practicing clinicians. Many of these skills can be learnt on the job; however, the added clinical workload and complexity makes the clinical workspace an unsuitable learning environment. After encountering a difficult clinical situation or a procedure, learners may feel stressed (24)or even experience psychological harm, unless they have had a prior exposure to training in a safe and stress-free environment(30).

1.1.1 How can simulation help?

The word, "simulate", means to imitate or enact. In the context of healthcare, simulation is a safe educational modality to teach clinical knowledge, facilitate acquisition of skills and/or develop a change in behavior (31). Simulation can use simple task-trainers (pelvic trainers or birthing models) advanced technology (birth or haptic virtual reality simulators) and/or human input replicating the condition or a situation (with real medical/nursing/ midwifery teams). It is an immersive experience, where participants need to be engaged and "buy-into" the make-believe situation for achieving its optimum benefit.

Simulation is defined by Gaba as "An educational technique that replaces or amplifies real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner" (32). In health care, artificial clinical situations can be created to mimic the real world problems for learners of varying degree of expertise. Simple problems can be created for novices versus added level of complexity for experts. Simulation-based education can provide scaffold learning by breaking learning into independent steps with components of hands-on learning skills followed by a debrief. Using a customized simulation design, the teaching can be tailored to address the learning needs of the participants.

Novices find it challenging to connect theory with clinical practice. While knowledge can be acquired through textbooks and didactic lectures, procedural clinical skills are more difficult to acquire and can be learnt mainly by interactive online learning, demonstration of procedures or by hands-on practice. While all these methods contribute independently towards learning, the active participant who is actually practicing the skill, may still struggle to see their application in the clinical context. In the interest of patient safety, these skills are best learnt initially on a simulator rather than a real patient. Simulation is considered safe, as the pitch and pace of learning can be changed in a "created" situation as opposed to learning in a clinical setting. Although learning in real time and with real equipment improves realism in simulation, different aspects of the scenario can be altered (based on the objective of simulation) to suit the learner needs. Simulation based education can teach skills, which are difficult to learn on patients and offer the comfort of repeated practice, till the skill can be mastered. The simulated scenarios can be either sped up or slowed down. Repeated practice can help to achieve perfection in tasks, and more frequent simulations can be conducted to reinforce learning and skill retention(33).

Simulation can address learning of procedural skills (34) [using part-task trainers or modern-day realistic simulators(35)], communication and team working skills (using human patient simulation) or both, using a hybrid technique(36). It can identify and correct system errors by simulating organisation processes (31) and improve clinical performance by simulating clinical problems. Simulation can improve team-based communication skills(37) by simulating real-life situations like conflict, breaking bad news, ethical dilemmas or human error(38). All of these contribute to improving patient safety(31), especially when used with increased realism, in an in-situ setting (39).

1.1.2 Simulation in the context of obstetrics and gynaecology

Simulation can be used to achieve mastery in a procedural skill (40), where an important or a difficult skill is learnt. An example can be of a gynaecology bimanual or a speculum examination. It is an important skill for undergraduate medical students, but difficult to teach on patients, as it can be uncomfortable or even

painful for women(41). Prior practice on a task trainer can facilitate familiarity with the instruments and technique. This will make the teaching of a subsequent examination much easier on either a simulated (42) or a real woman (30). Simulated patients or the clinical teaching associates (CTAs) can assist very junior learners in technique of vaginal examination and also communication prior to examination on real patients(43). It is suggested to improve confidence and comfort levels of the learners and decrease anxiety(44). Alternatively, simulation can be used for a rarely practiced skill that is difficult for participants to be exposed to in real life. An example from obstetrics will be of a rarely required procedural skill like maneuvers needed to deliver shoulders when dystocia occurs, where both time and skill level are crucial(45).

Gynaecology simulation programs (either supervised or self directed) for trainee residents and registrars can be created to improve surgical skills. Suturing of open wounds (like episiotomy and a third degree perineal repair) can be taught using task trainers, with evidence of improved knowledge and confidence(46); and at the same time also improve accuracy and speed (47). Learning these surgical skills at a medical student level has been shown to increase an interest in pursuing the specialty (48). Laparoscopy is another skill that can be successfully taught using box trainers or the newer virtual reality simulators(49). Simulation can also mimic a system-based problem that is created to improve organisational process to improve work efficiency and patient care. This may include processes like transfer of patient to operation theatre for an emergency caesarean section or calling for an emergency code for an obstetric emergency.

Obstetrics and gynaecology is a wide specialty with a variety of age groups (from menarche to menopause), and patient backgrounds. While obstetrics can be dealing with physiological processes, a complication can arise very quickly. This makes teaching communication challenging. There is only a limited amount of teaching time allocated specially to the undergraduate program. Simulation can be used for improving non-technical skills, like communication and teamwork(50), and can also be used for assessing these skills(51). Observed Structured Clinical Exam (OSCE) is one such example(52), used commonly to assess communication for both undergraduates and postgraduates. However, for the purpose of

assessment of communication, it can be challenging to standardize OSCE checklists(53). When used with debriefing, it can be an effective tool for teaching clinical assessment, patient management and communication(54).

1.1.3 How can interprofessional education (IPE) programs help?

Clinical staff members that need to participate in an obstetric emergency (or any other medical/surgical emergency) not only need to demonstrate competence in clinical management or procedural skills but also display efficiency in team-working and communication skills. This is because, management of an obstetric emergency requires an intense degree of input from all teams involved in patent care, including obstetricians, anaesthetists, pediatricians nurses and midwives for providing optimum patient care(5, 55). This raises the need for introducing multiprofessional training programs, where participants from different professions can be trained together, or even better, an *interprofessional* program where they have the opportunity of learning with, from and about each other(56).

Poor communication among staff members that work together in teams can affect patient safety(57). Lack of understanding of each other's roles in clinical practice, or respect for their contribution in clinical care, can compromise the capacity of the team to provide optimum care(58). Interprofessional programs not only address the problem of up-skilling clinical staff in teams, but also facilitate appreciation for each other's roles, which is crucial for developing their own individual professional and their team-based interprofessional identity (59).

Interprofessional programs have been shown to be effective in improving participant attitudes, mutual support, communication and situational assessment (60),(61). The key points being evaluated were interprofessionalism, issues related to interprofessional activities/practice and interprofessional competencies(62). These are measurable outcomes leading to emergence of extensive literature on their evaluation, using various frameworks (1, 63). One such framework is the Kirkpatrick's framework (64), described in the next section of this chapter. The evaluation can assess participants' perception or degree of satisfaction, their knowledge, skills and attitudes, team behavior or change in clinical practice or outcome. However, recent times have noted a push to "embed" these learning

programs into “interprofessional practice”(65). The “ binding together’ of all IPE projects with inclusion of observed performance (in a stressful setting, like the OSCE) is difficult, but achievable, specially if the learning objectives and evaluation strategies are considered at the outset.

IPE programs that include data collection, can inform us about achievements attained through collaborative care. The competency of the individual clinician and team-based interprofessional behaviours can be assessed independently, using these program-based assessments. The initiation of building team-based learning (both *intraprofessional and interprofessional*) and networking, leads to building trust between teams and team members. It prepares the students to be a part of the interprofessional workforce and optimize patient care by efficient use of individual team-based skills.

1.1.4 Why combine simulation and interprofessional programs?

Interprofessional simulation combines the team-based learning with SBE. Most of these programs aim to create real time, real life-like scenarios (designed as clinical problems) that need to be managed as a team. The interprofessional simulation learning process may combine the principles of teams acquiring “technical skills” (that may be procedural), along with the “Non-Technical Skills” (related to communication and teamwork). Acquiring Non-Technical skills (NTS) facilitates preparation for Crisis-Resource Management (CRM) and capacity development resulting in improved patient care(66). These skills are relevant for both undergraduate and postgraduate learners, for clinical specialties, related to medicine, nursing and allied health. It prepares them to manage unexpected and rare emergencies (which can occur relatively more frequently in the field of obstetrics), and enhance their CRM performance translated to clinical practice leading to better patient outcome (67). Besides, it also leads to students acquiring respect and understanding of each others’ roles and promotes a positive transformation on stereotypes and approach to collaborative care(68).

In spite of its proven benefits, interprofessional simulation is still quite uncommon, specially in undergraduate or pre-registration training (7). In the clinical

workforce, recently, there has been a shift towards training in teams using a simulated scenario followed by debrief (69). This has been driven by increased fear of litigation and due to an expectation of improved clinical standards of best practice. These interprofessional simulation initiatives are now being encouraged by licensing institutions and also attract funding through hospitals to minimise litigation. However, rigorous research to prove the benefit to the participants and to the health organization or patients is still lacking. There exists a gap in knowledge and understanding of "how" these health-education training programs impact on student learning, retention and translation into patient care.

These questions are best addressed by studies on large interprofessional student cohorts, participating in systematically organised interprofessional simulation programs. These programs can look at various aspects of student learning, attitudes towards teams and patient care, and a demonstrable change in behavior. Longitudinal studies where participants can be followed up over duration of time to assess their clinical or teamwork performance are valuable to show a change in practice. Patient outcome data is difficult to acquire and it is also difficult to demonstrate a cause-effect relationship between the learning programs and clinical outcome. However, a positive trend in patient care, supplemented by evidence of learning achieved/ retained provides further insight into the long-term benefits on these programs.

1.2 Section 2: Use of Kirkpatrick's evaluation framework

1.2.1 Section overview

This section provides an introduction of the Kirkpatrick's framework and its use in healthcare. In this section, I have also tried to provide a justification for choosing this framework in the thesis. Kirkpatrick's framework was originally designed as a business framework, however it has been tested in other industries as well, including healthcare and education. In this section, I describe how the different levels of Kirkpatrick's framework apply to healthcare simulation education.

1.2.2 Curriculum evaluation

Curriculum development requires an insight into the process of how learning occurs, that eventually leads to a change in clinical practice(16). The various steps starting from what participants think of a learning program, what they learn and how these learning attributes contribute to patient care, requires a systematic approach towards evaluation. This can only be provided, using a theoretical framework(4, 70). A theory based evaluation (71) leads to an understanding of the cause and effect relationship between intervention and outcome(72). Not only does it explain the result achieved at each step, but it also shows a link between the different steps of evaluation and, if the sequence of this evaluation is plausible(72). As explained by Judd and Kenny in their article on "process analysis", the three reasons to use theory based evaluation, are to study the origin of the outcome with establishment of cause-effect relationship, test the theory to make it generalizable for other contexts, and study other variables that can influence the outcome(73).

1.2.3 Description of Kirkpatrick's framework

Various frameworks have been introduced to evaluate interprofessional education/curriculum(16, 64, 74, 75). A commonly used evaluation tool has been the Kirkpatrick's four level framework(76, 77), which was originally introduced as a business framework, but found its application in other industries including education and healthcare. As per Kirkpatrick, the three reasons to evaluate training programs were to justify the money spent on training department/faculty, to provide reasoning for continuation of the program and to consider strategies for future improvements(76). As per the business framework, the consumer satisfaction was essential (referred to the level 1 as the reaction of the participants). In a successful program, there is an expectation of an improvement in knowledge, skills and/or attitudes (level 2), as a change in behavior (level 3) cannot be expected unless and until learning has already been achieved. Assessing results (level 4) is the most difficult step in the process and directions towards answering questions related to quality improvement, increased productivity, effect on interpersonal communications and human relations or monetary benefits of the program.

The four level Kirkpatrick framework has gained popularity as it involves asking simple questions, can be contextualised for a variety of applications, resulting in easily measurable outcomes. The added benefit of the higher-levels of the Kirkpatrick's evaluations focusing on observable/ measurable change in behaviour and results makes it a robust assessment framework(75).

1.2.4 Critical reviews on the Kirkpatrick's framework

In spite of the generalised approach and ease of applicability, there have been critical reviews discussing shortcomings of the four-level framework. The criticism and an alternate model offered by Holton in 1996, was that the Kirkpatrick's framework did not take into account the influence of other variables that can modify the outcome(78). These variables have been listed as being motivational approach of the participants, their personal attributes and trainability and transfer of training conditions. Bates suggested an additional framework to address not only if training was effective, but also what could be done to make it "effective"(79).

In a review, a comparison was demonstrated where the Kirkpatrick's framework compared to other evaluation framework like the simple linearly arranged logic model(80) (with input, activities, output and outcomes) or the Computer-integrated Process Planning and Scheduling model (CIPP) (75, 81). The logic model however was unable to establish connections between the various levels, hence not helpful in explaining the cause-effect relationships. The CIPP model takes into account that learning can be variable and learners can have variable characteristics with influence from other factors that can eventually affect the product. It can explain the different stages involved in the process along the way leading to the outcome.

Criticism of the Kirkpatrick's framework was having its focus only on the outcome and not the process(74). If focus is purely on the outcome and not "how" those outcomes are achieved, the research could miss the strategic influences a program has on a learner's approach, which may not be demonstrated through measurable outcomes. The numerical hierarchy described in the Kirkpatrick's framework and

an assumption of the cause-effect and inter-relationships between the various levels has been questioned(82).

1.2.5 Barr's six level modification of the Kirkpatrick's framework

Barr et al described the modified Kirkpatrick's' model with a six-level framework (3, 64), where level 2 further helps to clarify learning of skills or knowledge, as these are two different learning attributes, that may be learnt independently. Besides, learning may vary, based on individual learner characteristics or a change in process. The level 4 (which was earlier clustered under results) was also described individually to reflect a change in policies or organizational practice (level 4a) and patient's clinical outcome (level 4b).

While the modified Kirkpatrick's (six-level) framework evaluation still remains outcome-driven, it provides a clearer understanding of the "change" that has occurred at an individual level. Although a direct connection cannot be assumed between the different levels, the findings providing evidence for each level further strengthens the relationship between the individual levels. The evidence provided by a lower level of the framework in many cases, provides an opportunity to explore if the framework can be tested for the higher levels. If however, the lower level demonstrated a negative reaction by the participants, it is not necessary that they will not learn anything from the program but at least it guides the researchers to modify the program slightly to make it more acceptable to the participants. In this case, the assumed hierarchy can be challenged as a negative learning experience. This can further hinder learning and may prevent the occurrence of the desired behavioural change that may risk causing program failure. "How" learning occurs is as important as "how much" learning occurs. Kirkpatrick's lower levels (although regarded as being relatively poor in rigour in literature reviews(83)) may provide deeper insight into the mechanism by which the learning is acquired that can inform "what works" and "what does not work" in a learning program. This is not only necessary in the internal evaluation process to justify a program's continuation, but can provide a conceptual understanding of the cognition pathway followed by the learner. Hence, we provide an argument in favour of all levels of

Kirkpatrick's framework having their individual role in contributing to the evidence.

In research, every question answered usually gives rise to more questions. While the evaluation at each level of the Kirkpatrick's framework provides an outcome-based answer, it encourages further questioning into the process by which the learning phenomenon (or the lack of it) can be explained. In the thesis, I have used the modified Kirkpatrick's six-level framework to provide the evaluation model for the complete thesis. In spite of the critical reviews mentioned above, the framework provided a simplistic and a complete background overview for me to ask the relevant questions. I have supplemented the use of this framework with a learning theory based approach (where applicable) to provide the theoretical conceptual framework to guide individual studies compiled in the thesis.

In this chapter, I have described the background that led to this research. The need for both simulation based and interprofessional learning programs has been emphasized in both undergraduate curriculum and for clinicians in practice. Through my studies, I have explored the use of such innovative learning programs in the field of obstetrics and gynaecology. In the following chapters, I describe the various studies undertaken in the thesis that are linked to each level of the Kirkpatrick's framework.

Chapter 2

Medical and midwifery students' reaction to the Women's health Interprofessional Learning by Simulation (WHIPLS) program: Level 1 of Kirkpatrick's framework

Kumar, A., Gilmour, C., Nestel, D., Aldridge, R., McLelland, G., & Wallace, E. (2014). Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting? Australian and New Zealand Journal of Obstetrics and Gynaecology, 54(6), 589-592. doi: 10.1111/ajo.12252

2.1 Introduction

In this chapter, I describe the WHIPLS program, as evidence for level 1 Kirkpatrick's framework by measuring participants' reaction. I report how the program was developed and its introduction, as a shared learning opportunity for medical and midwifery students. I describe the evaluation undertaken when the program was piloted. The WHIPLS program was the first intervention introduced and led by me (with assistance from the midwifery course supervisors) as part of my PhD, and formed the background for other future interprofessional projects using Simulation-Based Education (SBE). This led to the publication in the Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) in 2014, describing the educational intervention, medical and midwifery students' reaction to it with some description of the learning acquired from the program.

2.1.1 The extent of the problem

As described in the preface, my educational research career started in 2010 when I commenced the position of the Curriculum and Assessment Lead (CAL) for the

obstetric and gynaecology component of the MBBS program at Monash University. My role as a supervisor for medical students in an MBBS degree required oversight of clinical skills in their 10-week obstetric and gynaecology rotation.

I observed that students struggled to attain confidence and competence in learning core examination skills over the rotation. This was because students found it difficult to learn intimate (and to some extent painful) examination directly on patents without having previous hands-on exposure to these clinical skills. Besides, the clinicians supervising the procedure were occasionally reluctant to teach. This was due to the risk of causing patient discomfort, when a novice examined her. To add to the complexity, Monash is a large university and one of the few in Australia, that offers an undergraduate medical degree, resulting in the course being very popular. Due to a high student-patient ratio, there is limited opportunity available for students to examine patients (in operating theatres and outpatients clinics).

2.1.2 Opportunity to start the WHIPLS program

When I accepted the role of clinical supervisor, I had just recently completed a one-year Graduate Certificate in Health Professional Education at Monash University. In the course, I learnt about the concept of *scaffold* learning. I wanted to provide my students an opportunity to learn, with skills taught in a systematic sequence under supervision. This was particularly relevant in teaching core examination and procedural skills due to the challenges described above. I developed a workshop using simulation with students learning on low-technology manikin/part-task trainers to teach core clinical assessment and perform key procedures.

This process coincided with acquisition of a grant funded by the (now disestablished) Health Workforce Australia (HWA) called Increased Clinical Teaching Capacity (ICTC) to encourage Interprofessional Education (IPE) at the School of Clinical Sciences (SCS) at Monash University. As a grant recipient, I was encouraged to design an IPE program, to assist undergraduate medical and midwifery students learn clinical skills and procedures.

2.1.3 Planning the WHIPLS program

I approached the supervisors of the midwifery course at Monash University with a proposal to develop a combined medical and midwifery program to teach examination of women, management of labour and conduct a normal birth. I also wanted to include some gynaecology teaching, as it was important for medical students to learn basic gynaecology examination skills (speculum and a bimanual examination and also how to perform pap smears). Although this was not a core examination skill in the midwifery curriculum, it was thought to be of benefit to them. This was because these skills could be used to examine women at their first visit in pregnancy (especially if they were due for a pap smear) or if they presented with a suspicion of rupture of membranes in pregnancy (where a speculum examination would be required).

There was also a marked disparity in numbers of students enrolled in the course, with yearly medical students at the SCS being close to 280. This led to 70 students in every 10-week rotation and 40 midwifery students being enrolled annually, resulting in 10 students attending each time. The program was planned to coincide with the start of a new rotation of medical students (occurring four times a year), as these skills were best introduced as a prior introduction to clinical exposure.

The planning and understanding of common learning objectives required many meetings by course supervisors for both the teams. Once the learning objectives had been agreed upon, a draft of the program was created with joint facilitation by the two teams. The process of training and recruitment of facilitators by each team and acquisition of the equipment was carried out. The funds acquired from the ICTC grant were used for buying four manikins and the facilitators were paid for their time spent on teaching for the first year. It was agreed the program would be introduced as a pilot, following which evaluation would guide, if the program were to be continued and in what form.

2.2 WHIPLS program evaluation: Students' reaction and satisfaction with simulation activity

The evaluation for the WHIPLS program was planned in stages using the six-level modified Kirkpatrick's framework. This has been described in detail in a previous

chapter on the overview of the Kirkpatrick's framework. The initial evaluation intended to assess how medical and midwifery students perceived the WHIPLS program, referred to as "student reaction to the activity". This evaluation was considered necessary for sustaining the program, to facilitate its delivery for future years.

2.2.1 Data collection

The evaluation comprised an anonymous paper-based questionnaire that required approximately 15 minutes of the students' time and was conducted immediately after the program. I was very new to educational research at the time, and this form of evaluation was very easy to obtain leading to a *gentle* introduction of research methods. Slowly, I gained confidence in evaluating my educational programs. This encouraged me to ask more difficult and complex research questions as a next step in evaluation.

The questionnaire was designed as a double-sided A4 document with each statement followed by a 5-scale Likert's rating. The questionnaire was instituted anonymously but did require the students to identify, if they were medical or midwifery students. The key question addressed was related to the content of the WHIPLS program being relevant to their educational course. Each skill was identified and evaluated individually. The evaluation also addressed, if there was sufficient time allocated to the learning of each skill or if opportunity of repeated practice was required. As this was an interprofessional program where medical and midwifery students had an opportunity to interact with each other, students were asked, if they thought this form of interprofessional teaching and learning was beneficial (See Appendix 1 for the questionnaire).

As a limitation to this evaluation, I recognize that the questionnaire used was not validated. Other scales (84-86), far more generalizable, have evaluated the impact of interprofessional/ simulation programs. However, this was an initial pilot evaluation of the WHIPLS program and the student perspective was considered to be crucial for achieving a "buy-in by the consumer". This questionnaire was also

beneficial to get feedback from the students to guide the program with a long-term aim to make curriculum change that we shall demonstrate in the latter chapters.

2.2.2 Research impact

From a research perspective, this form of evaluation is often considered to have little value referring to students' satisfaction with the educational activity. However, in the current context, this was a key step that led to the implementation and sustainability of the WHIPLS program (described in a latter chapter) as this evaluation represented the "student voice". The WHIPLS program was voted one of the top 10 programs in the MBBS course in Monash and students valued the evaluation as they got an opportunity to give feedback about program. The evaluation also led to minor modifications in the program content and delivery. Although, this evaluation only refers to the lower level Kirkpatrick's evaluation, student engagement in the program may have possibly led to "a sequential effect", which was observed later in student learning. In a recent meta-analysis, the trigger from improved outcome was reported to start from student reaction itself, (although only a weak association was documented)(87).

2.2.3 Disparity in the learning groups

Prior to the introduction of the WHIPLS program, there was uncertainty how midwifery students would perceive the teaching. At the time of attendance of WHIPLS program, most of the midwifery students had already been exposed to clinical work and were proficient in conducting births etc. There was also some anxiety around their perception of learning gynaecology examination skills and performing pap smears (as this was not directly applicable to their curriculum but encouraged as an extra skill to learn). It was interesting to observe that the midwifery students valued the program equally although it was acknowledged that the teaching of gynaecology was a little less relevant to their course compared to the obstetrics examination and management of labour. The positive feedback about the program and the high level of engagement demonstrated by the midwifery students was another key-step in achieving sustainability of the program as "interprofessional".

2.2.4 Kolb's theory of experiential learning

I have based this chapter on the Kolb's theory of experiential learning(88). The experiential learning theory informs us that learning is a process and not an outcome. Hence, student engagement and immersion in a program is a key component of their learning. In this program, both medical and midwifery students were focused on learning the skills and procedures. Although they interacted with each other and occasionally provided peer support and learning, the main focus of the activity was learning the task itself. We know from Kolb's learning cycle that the first stage of learning is an active experience through a learning activity. Both medical and midwifery students were contextualizing it, based on their prior experiences through learning skills in the WHIPLS program (see Figure 1).

This process took place at both times, during teaching session, when the medical and midwifery student interacted with each other (and the facilitator) and also during debrief (at the end of the session), where they thought about their experience. This phase is the referred to as reflective observation. The next step was, where the students were able to put a perspective on what has been learnt and were continuously linking old information with the new experience. This phase may start during the WHIPLS training session itself and continue later when they went back into clinical practice and may be referred to as abstract conceptualization. The final phase is of active experimentation where the medical and midwifery students were able to apply new learning to future practice. In this phase, they were able to try how that new learning of examination and procedural skills fitted in with their clinical practice. In the next chapter, we will discuss this further when this phase has already occurred and we get information from the participants on clinical application of their learning.

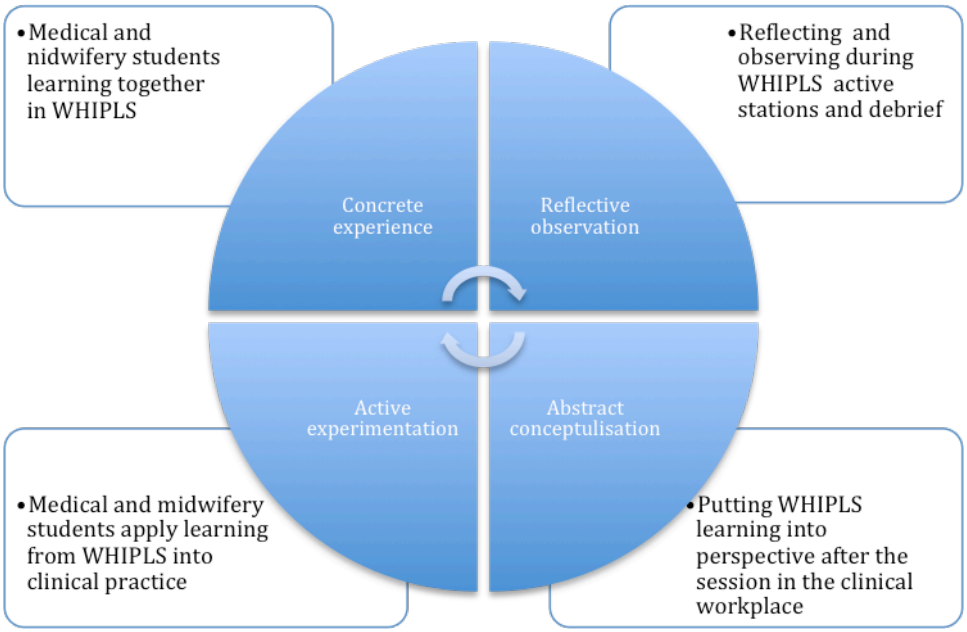


Figure 1: Kolb's learning cycle in the context of WHIPLS

2.3 Paper Publication and conference presentation

We published a paper titled "Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting?"(89) in the Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) in 2014. The readers of ANZJOG are usually from a clinical background (obstetricians, gynaecologists and midwives) and are often involved in teaching medical and midwifery students. Knowledge of WHIPLS and similar programs is relevant to their teaching practice. By publishing in one of the common journals of Australia and New Zealand, the authors aimed to encourage introduction of similar programs in other universities. This paper is attached at the end of the chapter and has been cited 9 times at the time of submission of this thesis. There was additional feedback from the reviewers about using more objective evaluation tools to assess learning that was already under investigation at the time of publication, which is reported in a latter chapter.

This research was also presented in the International Medical Simulation in Healthcare conference in Orlando, 2012 as a poster presentation. Feedback from professorial rounds was provided around further evaluation of the program using a pre-test and post-test design. This was already in the research plan for the thesis, but helped to confirm the need for the next phase of the study.

2.4 Declaration for Thesis Chapter 2 - "Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting?"

Monash University

Declaration by candidate

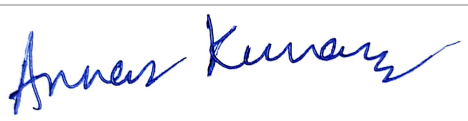
In the case of Chapter [2], paper titled "**Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting?"** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, intervention, collecting data, analysis and writing first draft	*75%*

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Carole Gilmour	concept, intervention	5%
Debra Nestel	supervision and manuscript preparation input into manuscript	5%
Robyn Aldridge	intervention	5%
Gayle McLelland	concept, intervention	5%
Euan Wallace	supervision, concept, manuscript prepa	5%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors

Australian and New Zealand Journal of Obstetrics and Gynaecology 2014; **54:** 589–592 DOI: 10.1111/ajo.12252

Short Communication

Can we teach core clinical obstetrics and gynaecology skills using low fidelity simulation in an interprofessional setting?

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Core clinical skills acquisition is an essential component of undergraduate medical and midwifery education. Although interprofessional education is an increasingly common format for learning efficient teamwork in clinical medicine, its value in undergraduate education is less clear. We present a collaborative effort from the medical and midwifery schools of Monash University, Melbourne, towards the development of an educational package centred around a core skills-based workshop using low fidelity simulation models in an interprofessional setting. Detailed feedback on the package was positive with respect to the relevance of the teaching content, whether the topic was well taught by task trainers and simulation models used, pitch of level of teaching and perception of confidence gained in performing the skill on a real patient after attending the workshop. Overall, interprofessional core skills training using low fidelity simulation models introduced at an undergraduate level in medicine and midwifery had a good acceptance.

Key words: education, gynaecology, interprofessional, obstetric, simulation.

Introduction

Undergraduate medical training (in Australia or overseas) in obstetrics and gynaecology is mostly undertaken in the clinical environment. An example is the birth suite where there is an expectation for medical students to be actively involved in patient management during labour and assist in birthing a baby, sometimes immediately after a brief introduction through a lecture or tutorial. Clinical work experience is similar for midwifery students, where the current standards are for students to be involved in the continuity of care of twenty pregnant women.[1] Both groups are confronted with the task of being involved with patient care quite early in their placements, and students may find it a threatening experience without prior training.

Basic clinical skills in obstetrics and gynaecology are difficult to acquire as they often involve intimate examination, and most students have limited time and opportunity for learning them.[2] The significant increase in the number of students creates an additional challenge in the provision of adequate clinical exposure.[3] Moreover, it has been observed that male medical students may have a decreased opportunity to learn these skills due to patient preference.[4] Teaching these skills on patients often results in a heightened anxiety and apprehension in both the patient and the student. Hence, simulation is now being introduced as a part of undergraduate teaching in medical schools, which has demonstrated not only improvement in skills and knowledge but also interest and motivation.[5]

Some clinical skills overlap with both medical and midwifery undergraduate programs such as management of labour, or performing a speculum examination to confirm the presence of ruptured membranes. Despite this commonality in task, students in these disciplines largely do not learn together. Complex rostering is an often reported challenge.[6] Other reasons may include tutors' workload and the complexity of designing a well-defined interprofessional program.[7] Besides student learning, it has been demonstrated that simulation-based education of interprofessional teams in obstetrics has resulted in improvement in teamwork,[10] especially in an emergency setting. Although there have been many studies that have studied simulation-based education within medicine and nursing specialties, it is less evident at the undergraduate level.[11,12]

This study describes the use of simple, low fidelity simulation models to teach fundamental concepts and core clinical procedures to students. It explores the medical and midwifery students' acceptance of interprofessional

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Table 1 Learning objectives for the workshop program

At the end of the workshop, students should be able to
• Perform core clinical examination skills in obstetrics and gynaecology using the correct technique.
• Rehearse the safe use of instruments for these examinations.
• Demonstrate competence of these skills on task trainers and simulation models.
• Appraise the value of learning in interprofessional settings.

learning and their perceptions of learning these skills using the simple models.

Materials and Methods

The study was conducted at Monash University, Melbourne, Australia, using an exploratory research design. The study group consisted of medical and midwifery students enrolled over a 12-month period.

Table 1 lists the learning objectives for the intervention, which consisted of blended learning with preparatory reading and a lecture-based orientation prior to a workshop. The lectures provided underpinning theoretical information for safe performance of clinical skills. The three-h workshop was conducted as a skills-station circuit where groups of 6–8 students spent one h at each station, which consisted of the following:

1 Speculum examination, bimanual examination and performing a Pap smear.
2 Vaginal examination and assessment in labour.
3 Conducting a normal vaginal birth with estimation of blood loss.

At each station, the facilitators initially demonstrated the procedure on task trainers (Fig. 1; Model Med Pty Ltd, Melbourne, Australia), and then, the students were supervised performing the procedure independently. Clinical case studies were shared and discussed.

At the time of the workshop, the fourth-year medical students (five-year program) were in the first week of their obstetrics and gynaecology rotation while the midwifery students were in their second year of training. There were eight workshops organised over the year with 40–45 students in each workshop.

We evaluated the program using a paper-based form completed by all students immediately after finishing the workshop where students used a 5-point Likert scale to rate their experience and were invited to record free text responses. Numerical data were analysed using descriptive statistics. Monash University Human Research Ethics Committee approved the study.

Results

Three hundred and sixty students (280 medical, 80 midwifery) were invited to attend the workshop. Of these, 294 students (237 medical, 57 midwifery) attended the workshop and completed the postworkshop questionnaire.

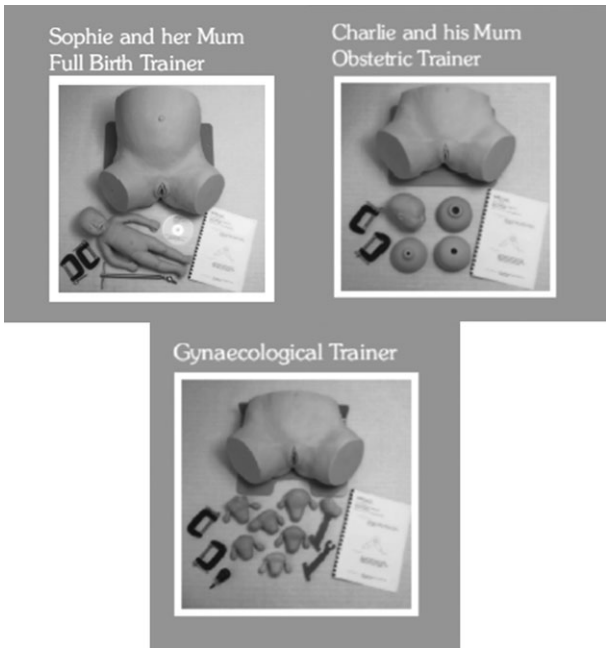

Figure 1 Simulation models used in the stations. Photo courtesy: Model-Med International Pty Ltd, Melbourne, Vic., Australia.

The questionnaire essentially assessed students' perceptions of the relevance of the skill station, where it was pitched relative to their phase of learning, whether the (low fidelity) simulation model used taught the skill well, confidence generated as a result of doing the skill station, time allocated to the skill station and whether they would like a repeat session for that particular skill station in the future. Results are expressed as percentages of positive responses (agree/strongly agree) on a 5-point Likert scale (Fig. 2). One hundred and eighty-six (78.4%) medical and 56 (98.2%) midwifery students thought that it was beneficial to attend these workshops in an interprofessional setting. Overall, across the stations, both medical and midwifery students thought that the content of workshop was relevant to their course, it was pitched at an appropriate level for their knowledge and skill, and the models taught the skill well and improved student confidence. Midwifery students perceived a lower level of relevance (74 versus 96%, $P = 0.0001$), pitch (79 versus 97%, $P = 0.0001$) and confidence (72 versus 92%, $P = 0.0001$) as compared to medical students in the gynaecology skill station (speculum examination, bimanual palpation and Pap smear).

Analysis of free text responses showed that the workshop was ideally timed just prior to starting clinical rotation. There was also a perception that this workshop worked well in small groups and needed individual supervision which gave them an opportunity to clarify their doubts. Students also thought the preparatory reading material enhanced their learning by offering

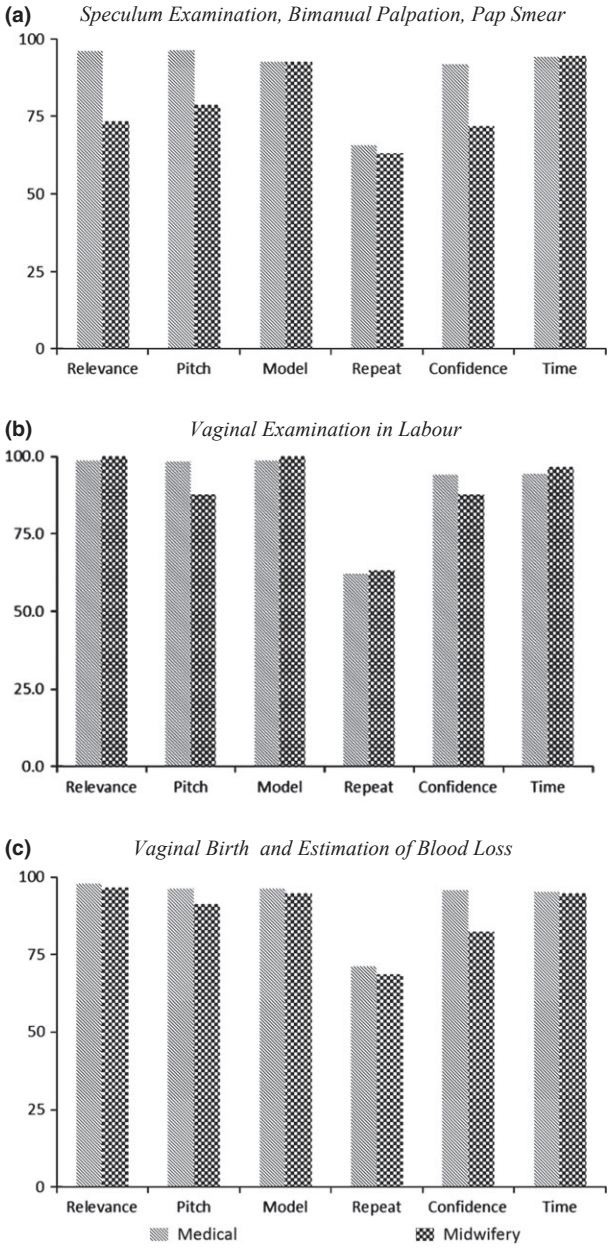

Figure 2 Consolidated feedback for various skill stations in the workshop. (a) Speculum examination, bimanual palpation and pap smear; (b) Vaginal examination in labour; (c) Vaginal birth and estimation of blood loss. Vertical axis: Data expressed as percentage of 'strongly agree/agree' answers on feedback questionnaire. Horizontal axis themes: relevance (the content was relevant to my course); pitch (teaching was pitched appropriate to my level of knowledge and skill); model (topic was explained well by the use of the model); repeat (I would like another session at a later date to practice on this model); confidence (the workshop has significantly improved my confidence in this skill); and time (time allocated for this topic was sufficient).

background knowledge. The students found the discussion relevant to clinical case scenarios helpful in relation to the skills. The experience of learning with students from another speciality was considered to offer a different perspective for students. Although this workshop aimed at achieving skills relevant to both the learning groups, there were times where one student group felt less confident about one skill compared to the other.

Discussion

Recent years have seen an increase in the use of simulation-based education for improving learning and retention of clinical skills with focus on communication and management of emergency situations as a team. However, the use of low technology simulation to achieve basic clinical skills has not been explored sufficiently.[11,12] There are very few examples of studies that have evaluated the role of low fidelity simulation in a midwifery curriculum.[13] The learning objectives generally guide the selection of simulation modality to use in a program. In our student cohort, as this was an initial exposure to obstetrics and gynaecology for both medical students and midwifery students, acquiring competence in performing these core procedures, using the correct technique was the primary intended learning outcome for both these groups.

We have attempted to demonstrate through our simple but productive intervention that a large number of students can be taught effectively with low fidelity and low maintenance task trainers. Organisation of a simulation workshop of this description is not only achievable (in spite of the variety of skills taught in a short duration), but also perceived as highly advantageous by students as they have an opportunity to repeatedly practice and achieve finesse in their examination technique, under the direct supervision of experts.

We have attempted to address the use of interprofessional education in managing routine clinical scenarios (as opposed to emergency situations),[14] and work needs to be carried out in attempting to combine curricula with disciplines where overlapping learner objectives can be identified and addressed together in a supportive clinical or educational work space.[15] In spite of the overlap in the teaching content, students perceived differences in their level of competence when medical and midwifery students were compared (eg medical students felt more confident and found it more relevant to perform speculum examinations and Pap smears compared with the midwifery students). This may stem from a cultural acceptance of roles or image perceived by doctors and midwives of themselves and of each other. As suggested by Hamilton, it is in the undergraduate years where an interdisciplinary approach to cultural competency training is best introduced. Interprofessional learning in students helps in development of tolerance and understanding of shared values.[16] The feedback received by students in our study strengthens this view point.

Obstetric and midwifery programs have shown that patient care improves with an increase in collaboration between teams in both outpatient clinics and inpatient care[17] with an emphasis that both teams should be equally

empowered to voice their concerns and opinions.[18] In a work-based setting, significant correlation has been noted between teamwork performance and clinical efficiency.[19] We hope to introduce this attitude of collaboration at an early learner's level. This may help to form a background to assess the long-term impact of a combined undergraduate midwifery and medical program.

Supplementation of simulation-based teaching has been shown to improve clinical skills and competence perceived by the students.[20] However, we believe approach to teaching skills with a large number of students is under reported in the literature and of significant interest to clinical teachers. Documenting the introduction, feasibility and student response is therefore worthy sharing.

We acknowledge the major limitation of this study in simply reporting students' reactions to the educational program and self-reported confidence. However, in the current study, we wanted to focus attention on the introduction and applicability of a simple simulation program to support the attainment of basic clinical skills as opposed to assessing learning or its retention.

We hope this study forms a basis to assess the cultural impact of learning together with the development of understanding and appreciation of each other's roles at an early level of clinical practice. Our future studies will investigate deeper levels of impact on students such as changes in knowledge, attitudes and skills; now, that feasibility and acceptance has been established.

Acknowledgements

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Chapter 3

Change in students' attitude towards learning and interprofessional teams: Level 2a of Kirkpatrick's framework

Kumar, A., Wallace, E. M., East, C., McClelland, G., Hall, H., Leech, M., & Nestel, D. (2017). Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study. Clinical Simulation in Nursing, 13(5), 217-227. doi: 10.1016/j.ecns. 2017.01.010

3.1 Introduction

In this chapter, I build further upon how the WHIPLS program was evaluated to assess the impact of the learning resulting in a change of attitude, as an evidence for level 2a of Kirkpatrick's framework. In the previous chapter, I have reported how the WHIPLS program was introduced, with students reporting acceptability to the simulation, providing evidence for the level 1 of Kirkpatrick's framework. As described, they had a positive experience by the exposure to the interprofessional group and engaged well in the simulation. They thought this experience improved their confidence and competence in performing core clinical examination and procedures. In this chapter, I address the students' attitudes towards the other interprofessional team and their approach to learning. This provides evidence representing level 2a of Kirkpatrick's framework.

3.1.1 Focus group method

Interprofessional Education (IPE) has been reported to affect change in students' attitude towards the team members belonging to other teams(62, 63). They may also experience a change in attitude towards learning itself. This change in attitude may continue later in the students' approach towards clinical practice and towards

working with interprofessional teams, when they are exposed to clinical routine in their workplace(65, 90, 91).

I evaluated the two groups of students (medical and midwifery students who attended the WHIPLS program) using focus group methods. I have used homogenous focus groups, to facilitate free communication amongst each group of students. The sharing of thoughts and ideas between the individual groups and building up of concepts was observed, justifying use of focus groups. The focus groups also helped the students' expressing their thoughts and opinions freely and exchange ideas about the other professional group.

3.1.2 Timing of focus group

I have conducted the focus groups at least three months after the attendance of the WHIPLS program, which was a challenging task. Recruitment of students was difficult, as they had completed the women's health component of their study. Studies where medium to long-term student follow up is required, are difficult to perform, as there is a high rate of drop-outs and it is difficult to retain participants in the study after the intervention has been completed. Besides, students enrolled in an undergraduate course may have completed either the course or the unit relevant to the program. Medical undergraduate curriculum requires all students to get exposed to a variety of clinical specialties in their clinical years resulting in short blocks of rotations lasting only a few weeks. In the medical student curriculum at Monash University, the students are rostered in the Women's Health rotation for 10 weeks, at the end of which they proceed to another clinical rotation with no continued contact with the previous discipline. This inhibits a follow up assessment of the students' attitudes. To add to the complexity, the midwifery course is of a different duration (lasting three years at Monash University) and teaching occurs in a different location. Finding a time to suit participants, that is remote from the interprofessional teaching is challenging.

3.1.3 Impact of this research on "IPE culture"

As shown in the published paper in the latter part of the chapter, familiarization and a change in attitude towards the other team were some of the key findings. A

change in attitude towards members of another team is an initial step towards building up an interprofessional identity(92).

Prior to the introduction of the WHIPLS program, there was a lack of exposure to other professional groups, except some incidental interaction in a birth setting (which could often be unpleasant where the two groups were competing for getting hands-on learning opportunities, while participating in a birth). Although senior midwives are usually keen to help medical students get involved in care of birthing women, they are often protective of training the midwifery students as a priority (as this is an essential skill requiring mastery learning in the midwifery course). These subtle but clear pieces of evidence indicate an initial background of hierarchical work environment, which can encourage territorial behavior in work culture.

IPE opportunities to get to know each other's teams are scant. WHIPLS was the first formal interprofessional learning exposure for either of the two professional groups. Through the WHIPLS program, medical students gained confidence in their own skill, which improved their learning opportunities on birth unit. The WHIPLS led to them having a prior exposure, and hence, more opportunities to participate in births as an assistant or even as a primary accoucher. After this initial exposure in a low-stress learning environment, the medical students were also more aware of the midwifery students' background experience, their skills and knowledge. Midwifery students on the other hand, were pleased to impress their skills upon the medical students with a view to gain more respect from the medical professional group. Exposure to various IPE opportunities may have a role in breaking these cultural barriers between professional groups.

3.1.4 Developing "professional" and "interprofessional" identities

Emergence of identities may start in the early years of training in professional groups(93). Efforts can be made to intervene through these subtle but cogent initiatives like the WHIPLS program to change perspectives. Professional identity of a group may reflect the members' roles in the profession. However, the "interprofessional" identity reflects the interface with the other professional

groups and may be affected by the quality of interactions and experiences in dealing with the other professional groups.

As described by Wenger in 1998, "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly"(94). Wenger's description fits in where interprofessional groups or communities of healthcare are considered and is applicable to the cohorts of medical and midwifery students that I refer to in this study. These communities may develop certain beliefs, ideologies, concepts and assumptions, that may further influence the individual group's clinical and professional practice. Learning in silos may encourage these assumptions, some of which may even hinder the development of an interprofessional community.

Multiple, creatively designed, meaningful interprofessional interactions can be encouraged in groups that will work together in future professional life. An example in the medical and midwifery cohort can be of working together on patient care in the clinical setting. Each of these shared learning opportunities can eventually contribute by having a cumulative effect on changing the outlook of professional groups towards each other. To that effect, I introduced the Women's Health Emergency Workshop (WHEW), a simulation-based workshop to learn emergency obstetric skills in an interprofessional environment. Currently, the workshop is being piloted with a view to be introduced in the medical and midwifery curriculum, if the evaluation showed positive results.

3.2 Paper publication and conference presentation

I published this paper titled "Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study" in the journal "Clinical Simulation in Nursing". This paper provides an insight into how differently medical and midwifery students can perceive the same learning experience and how attitudes towards each other can be different for the two professional groups. Medical student were more task-focused giving priority to learning procedural skills. They could not appreciate the midwifery students' standpoint to be "treated as an equal" as a key learning objective of the WHIPLS program. Although, it's not

documented in the paper, after attendance of the WHIPLS program, a few midwifery students volunteered to become facilitators in the program and teach medical students. They returned back the following year as facilitators and taught the interprofessional groups in the program. This change in behavior was also observed by our faculty and is representative of level-3 Kirkpatrick's framework (although not formally assessed.)

3.2.1 "Power" and "hierarchy"

Focus on issues like "power" often exhibited in a hierarchical workplace, where interest of one professional group is favoured over the other. These impressions can lead to professional groups developing underlying resentment or a perception of dominance by the other group, leaving the apparently less favoured group feeling disadvantaged. These negative attitudes can translate into negative reactions towards each other's team. These can further hinder relationships and lead to mutual disagreement in teams over patient care. Ultimately, this may even compromise patient care and safety. One way to resolve this can be to strengthen team based relationships where each member of the team has an equal stature with realisation of individual contributions by team members. This can be achieved in a team-based training in a simulation-based setting similar to ours described in this paper. The only improvisation I can suggest will be to repeatedly reinforce these feelings of "shared power" and "reciprocity"(95) leading to collaborative goal sharing and development of shared pathways to achieve these common goals.

3.2.2 Legitimate Peripheral Participation

In this context, I relate to Lave and Wenger's explanation on situated learning referred to as "Legitimate Peripheral Participation"(96), where learning is dependent on the social context where it occurs. According to them the acquisition of knowledge for learners is inseparable from their social practice. The learners will constantly undergo transformation of their own identity in relation to their community of practice based on their experiences and interactions within and outside the community. Participants in an interprofessional team relate to their own role based on their experiences, beliefs and understanding in the healthcare

setting. New learning imparted to participants takes place in their professional contexts.

3.2.3 Application of communities of practice to WHIPLS

Wenger's theory on "community of practice"(94) is particularly relevant to programs like the WHIPLS, where the two learning groups of medical and midwifery students can draw upon their previous experiences and develop an understanding of where the learning of new skills relate to their individual professional roles. If this learning (where both professional groups require to share tasks e.g in a birth setting) was to be provided in a uniprofessional environment, it is possible that students may miss the context where this learning can be applied. Although the teaching format in the WHIPLS program (like gynaecological examination and performing a normal vaginal birth) is more task-focused, the setting where these skills are used is interprofessional. This also provides an explanation of how a short interprofessional encounter in an intense simulation setting (half a day of participation in the WHIPLS) was effective for the students both in regards to skill-based learning and as an interprofessional experience. This becomes more evident through the results shown in this paper where students are asked about their attitudes after three months of returning back to their clinical environment.

3.3 Declaration for Thesis Chapter 3 - "Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study"

Monash University

Declaration by candidate

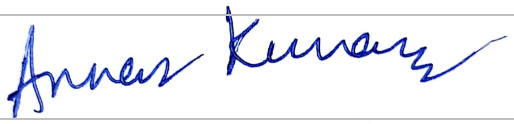
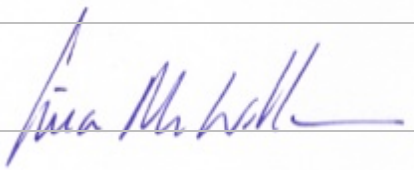
In the case of Chapter 3, paper titled **"Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study"** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, intervention, data collection, data analysis, paper-writing	75%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Euan Wallace	Concept, manuscript editing	5%
Christine East	Intervention, manuscript editing	2%
Helen Hall	Intervention	3%
Gayle McLelland	Intervention	5%
Debra Nestel	Supervision, data, data analysis, manuscript editing	10%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors

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Featured Article

Interprofessional Simulation-Based Education for Medical and Midwifery Students: A Qualitative Study

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KEYWORDS
undergraduate;
curriculum;
interprofessional;
obstetrics;
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gynaecology;
skills;
women's health

Abstract

Background: Simulation-based interprofessional education programs can have variable objectives for different participating professional teams.

Methods: In this study, through a qualitative research design, we report the medical and midwifery students' approach to their learning and attitude towards each other's team, assessed through thematic analysis of independently run focus groups three months after the attendance of the Women's Health Interprofessional Learning Through Simulation program and their respective clinical placements.

Results: Medical students reported the importance of "learning by doing" through simulation as the key theme. The feedback obtained from midwifery students was focused on "relationship of power" compared with the other discipline.

Conclusions: Interprofessional learning had a positive influence on the attitude of medical and midwifery students, in spite of the disparity in their background knowledge and experience. IPE competencies are better appreciated at a relatively mature level of clinical practice. Core skills in women's health taught through simulation were found to be helpful by both midwifery and medical students. However, the key learning was about developing respect and a supportive relationship "of equals" with each other.

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Interprofessional education (IPE) is becoming an increasingly popular and recommended feature of undergraduate health professional curricula (Halupa, 2015). Its learning outcomes are being mandated by health education regulatory bodies for example medical board of Australia, National Health Services, UK, across all disciplines. In addition to imparting content knowledge, IPE introduces the concept of teamwork and, for students, contributes to the development of professional identity and interprofessional respect (Carpenter & Dickinson, 2011; Hammick, Freeth, Koppel, Reeves, & Barr, 2007; Hood et al., 2014). The development of understanding and respect for other professional groups is considered important for effective functioning of health care teams (Dadiz et al., 2013). Simulation is a learning strategy that helps to develop team-based competencies (Sigalet, Donnon, & Grant, 2012) and can often be a component of IPE programs (Palaganas, Epps, & Raemer, 2014). The short-term benefit of improving teamwork and communication and the long-term impact on positive changes in behaviour and attitudes have been studied in working teams but with limited implementation or understanding at the undergraduate level. The challenge for studying this in the student context may be due to complexities of timetable scheduling between different courses (Al-Kadri, Al-Moamary, Roberts, & Van Der Vleuten, 2012; Tourse et al., 2008; Tucker, 2003) and different tertiary providers for different disciplinary groups resulting in students learning in professional "silos" with limited exposure to or understanding of the scope of practice of other professions.

Key points

- The key themes that appeared in the interprofessional simulation program are related to perception of "power," "scope of practice," and "relationship" to the other professional peers.
- An example of undergraduate simulation-based education demonstrated evidence of applying "learning during simulation" to clinical practice.
- Participants from different disciplines can find the interprofessional activity meaningful despite having a different focus on the "key learning messages."

Undergraduate IPE can facilitate the development of unprejudiced impressions of how interprofessional teams can interact effectively with a patient-centered approach (Bressler & Persico, 2016). Shifting the focus of IPE towards the common objective of patient care assists in bridging differences and in communicating effectively and working together on the task at hand. Pollard, Miere, Gilchrist, and Sayers (2006) argue that IPE is best introduced at a senior undergraduate level when students perceive themselves as more "clinic ready" and have started to develop their own professional identity, further reinforced by the IPE exposure. However, the timing of IPE remains contested (Tan, Bolderston, Palmer, & Millar, 2011).

Learning clinical skills in a simulated environment can drive engagement of learners by providing clinically relevant or valid tasks. For IPE simulation to be beneficial, simulation-based education must be relevant to all professions of the participating students. The simulation task can then be tailored towards the learning needs of the participants to optimise their learning.

The Barr's six categories of educational outcomes is a modification of the Kirkpatrick's framework that is often used in the evaluation of clinical simulation as described (Table 1) (Barr, Koppel, Reeves, Hammick, & Freeth, 2005; Freeth, Hammick, Koppel, Reeves, & Barr, 2002; Freeth, Hammick, Reeves, Koppel, & Barr, 2008). Using above-mentioned categories, we designed the Women's Health Interprofessional Learning Through Simulation (WHIPLS) program, which is a simulation-based training program for both medical and midwifery students. This was designed to achieve acquisition of clinical skills related to IPE and development of an understanding of other team's role and relationship, corresponding to level 2a learning outcome (a change in attitude towards interprofessional group). The components of the WHIPLS program were a simulation-based skill workshop, supplemented by prereading materials, lectures, and demonstration videos. The program was attended by both undergraduate medical and midwifery students during their training and was evaluated, using the six-level modified Kirkpatrick's framework (Barr et al., 2005; Hammick et al., 2007). The level 1 evaluation is indicative of student

Table 1 Modification of the Kirkpatrick's Framework (Adapted From Barr's Six-Level Classification)

Level 1	Participant reaction	Were they satisfied with the IPE activity?
Level 2a	Change in attitudes	Do they feel different about the interprofessional team or towards a team-based approach?
Level 2b	Change in knowledge or skills	What was the learning acquired from the IPE activity?
Level 3	Behavioural change	Was there an observable change in participant performance in the practice setting?
Level 4a	Change in organisational practice	Was there a wider change in the institutional practice as result of the IPE activity?
Level 4b	Change in clinical outcome	Was there any benefit to the patients/clients as a result of the IPE activity?

Note. IPE = interprofessional education.
Adapted from Barr et al. (2005).

experience and satisfaction (Barr, 2000) and has already been published in the context of the WHIPLS program (Kumar et al., 2014). In the early written evaluations, immediately after the WHIPLS program, medical and midwifery students reported positive benefits in regard to the relevance and pitch of the content, the time allocated to the simulation activity, and in improving their confidence in performing basic obstetric and gynaecological examination skills.

The present study explores students' perceptions of the impact of WHIPLS program and attitude regarding the other professional team three months after the intervention, which is referred to as the level 2a evaluation. The three months between the attendance of the program and the evaluation provided the participants an opportunity to reflect on their learning from the WHIPLS program and interprofessional interaction and use it in clinical practice.

The research questions were as follows:

1. How do medical and midwifery students view each other's professional relationship three months after participating in the WHIPLS program?
2. What did the medical and midwifery students consider helpful in regard to their learning three months after the WHIPLS program?
3. To what extent were medical and midwifery students able to apply their learning from the WHIPLS program in clinical practice?

Methods

The study follows a qualitative research design, utilising focus groups as a method of enquiry to encourage participant interaction. The intervention is a collaboration between medical and midwifery undergraduate schools at Monash University, Australia. This involved introduction of the WHIPLS program, an interprofessional skill training program for medical and midwifery students. The facilitators were also interdisciplinary comprising of both medical and midwifery staff. The participants were followed up after three months of clinical interaction occurring between medical and midwifery staff and students during their clinical placement.

The intervention has been described in detail in a previous publication (Kumar et al., 2014). Briefly, the WHIPLS program consisted of a three-hour clinical skill workshop, supplemented by lectures, prereading material, and videos provided a week before the workshop. Students spent one hour at each station. The skill stations consisted of the following:

1. Speculum examination, bimanual examination, and performing a pap smear,
2. Vaginal examination and assessment in labour, and
3. Conducting a normal vaginal birth with estimation of blood loss.

At each station, students learnt the procedure in groups of six to eight medical and midwifery students supervised by a facilitator. Initially, the facilitator demonstrated the procedure on pelvic trainer and manikins for birth simulation (Model-med, Australia), following which the students were supervised performing the procedure on the same simulators and also assisted each other. Occasionally, the students described to the facilitator what and how they would communicate to the patient and other times they would prefer to interact with the manikin.

Relevant clinical case studies were discussed with reference to team-based clinical management based on clinical findings. At the time of the workshop, the medical students in the fourth year (of a five-year program) were in the first week of their obstetrics and gynaecology rotation, whereas the second-year midwifery students (enrolled in a three-year course) were roistered evenly over the year. This disparity reflects a difference in course duration and meant that the students were at difference experience levels at the time of this workshop.

Recruitment

Medical and midwifery students who had completed the WHIPLS program conducted over two sessions (64 medical and 20 midwifery) were invited to participate in a focus group session. Two independent focus groups were organised for medical and midwifery students, participants who were available on the day, joined in their respective focus groups. The justification of having two separate discipline specific focus groups was to capture the thoughts and perceptions of the groups independently without being influenced by the other group. It also provided them an opportunity to communicate their thoughts freely without inhibition while referring to the other group.

Data Collection

Focus groups were thought to be valuable to address the research questions because they encourage participants to communicate openly with each other, promoting discussion and commenting on each others' experiences and perspectives (Kitzinger, 2006; Nestel et al., 2010). Focus groups were conducted three months after the WHIPLS program, following completion of medical students' rotations. As it was anticipated that the two groups might focus on different aspects of learning, focus groups were profession specific. D.N. led the medical student focus groups, whereas A.K. led the midwifery student focus groups. D.N. is an experienced qualitative researcher, has led many focus groups, and was not known to the medical students. A.K. is the supervisor of the medical students' curriculum, and students were aware she would be present

during the focus group. Students were reassured that their opinions (either positive or negative) would not influence their assessments or future clinical placements. A.K. may have been known to the midwifery students but was not directly involved in their teaching or assessments. The topic guide for the focus groups was based on literature, designed to address our research question and agreed on by the researchers prior to the session. The focus groups lasted 101 and 42 minutes for the medical and midwifery focus groups, respectively, were audio recorded and subsequently transcribed professionally. A.K. then read and listened to the recordings to verify accuracy.

Analysis

The first step in the thematic analysis was to develop a coding framework (Braun & Clarke, 2006). A.K. and D.N. inductively and independently coded the two transcripts. From these, we jointly developed a coding framework of higher order themes, which were initially developed independently and then mutually agreed on by A.K. and D.N., to closely represent what the participants themselves described. The second step of analysis was to consider each of these categories in greater depth and refine them further to reflect participants' responses. The third step was to create a summary of each code with descriptive recurrent quotes (A.K.). These summaries were reviewed and thematised (A.K. and D.N.) resulting in the six final themes.

Ethics

The study was approved by the Monash University Human Research Ethics Committee project number CF14/1554 to 2014000741.

Results

Eight medical and 18 midwifery students participated in the two (independently run) focus groups. The ''role of simulation on clinical learning'' was the key learning for the medical students, whereas ''power'' was the dominant theme for the midwifery students. Common themes are related to ''roles and relationships,'' ''team-based learning,'' ''learning methods,'' and ''patient and learner safety'' (Table 2). Below we present the themes and subthemes for each focus group.

Learning by Doing/Learning by Simulation

The first theme, *learning by doing/learning by simulation*, had five subthemes—sequential learning, hands-on practice, supplementing theoretical knowledge, safe use of instruments, and technique and orientation to unfamiliar skills. Medical students recognised the role of simulation with positive impact of ''learning by doing'' when compared with lectures. Both study groups, seen to supplement theoretical knowledge gained from lectures, valued the simulation. It provided an introductory orientation to an examination that students were not initially familiar with. Although, learning speculum examination is not a part of midwifery curriculum, the visual impact of the cervix on examination was found to be helpful in understanding the context of birthing. Students valued the provision of a stepwise learning approach (simulation prior to clinical exposure) and the opportunity for hands-on practice, in a ''safe'' environment that they could repeat as often as they needed.

Power

The most prominent theme emerging from the midwifery focus group revolved around power. References were made to different types and levels of power relating to their identity as students versus the practicing health professionals (both medical and midwifery), in the context of their knowledge, experience, or their future role compared with the medical students. The medical students acknowledged their relative lack of experience and knowledge about birth compared with their midwifery counterparts and were impressed by the extensive midwifery student experience in birth. Overall, they had a positive experience from the midwifery students teaching them.

Similarly, the midwifery students talked about their experience of learning together and related to their greater clinical experience compared with the medical students. They appeared to be aware of their identity as future midwives and doctors with some anxiety about continuation of an equitable relationship. Compared with the established clinicians in practice, the midwifery students expressed themselves to be in a relatively weaker situation (similar for their medical student counterparts). They also communicated a feeling of being at a similar level to the medical students, probably arising from task sharing.

Patient and Learner Safety and Readiness to Practice

Both teams talked about women and learner safety in regards to acquiring confidence and competence in a safe learning environment prior to clinical exposure. They reported that they felt this program was likely to positively influence both their own and the patient experience and thereby reduce the risk of patient injury. Both groups of students expressed a need for readiness to practice in clinical setting and that a baseline level—that could be facilitated though simulation—had to be achieved before encountering patients. Anxiety was expressed regarding potential ''patient injury'' that could be caused by student learning unless the necessary technique, knowledge, and skills had been acquired.

Table 2 Themes and Subthemes From the Medical and Midwifery Student Focus Groups

Medical Students	Midwifery Students
1. Learning by doing/learning by simulation	
• Sequential learning—simulation before clinical	• Orientation of unfamiliar skills
Bring up you know that all other elements involved in it, so for example using the communication skills and making sure how everything is integrated and making sure that you know just the technique itself good. Possibly that might be beneficial.	*One of the things we learnt, was about the speculum that is not covered in our studies and pap smears.*
• Hands on practice	• Hands-on practice
While it was amusing to talk to the pelvis during the examination at the time of workshop it actually helped me at least I got used to the repeated practice.	*And specially Speculum exam—more time should be given and we would have liked to be given more opportunity do it. We wanted more opportunity to practice speculum exam). Hands-on is very important.*
• Supplements theoretical knowledge/lectures	• Consolidating theoretical knowledge
It kind of supplements what we know from theory. These are the steps to perform a pap smear! We don't actually see how to do it and then when you go through a colposcopy clinic for instance you get told—ok alright take a Pap smear.	
". … because *I think we did have a week of lectures, you don't remember what you learn there …. needs to be remembered by doing it …"*	
… It makes it quite unusual to have this kind of focussed learning and then have a theory and practical side by side and to be able to measure progress.	
• Safe use of instruments and techniques	
I also remember practicing inserting the brush, not to mistake of removing the speculum out without hurting them by not closing it and that sort of thing that's valuable that whatever anatomy or situation you are in.	
• Orientation to unfamiliar skills	
… you know even as a female I thought I knew what I was walking into and I didn't …. I could see that the guys in the room thought that they had a bit of an idea and they had no idea of what's going on, so they also felt kind lot more comfortable after this.	
Its all about consolidating the skills you learn in theory and beginning to put them into practice and having the opportunity to practice them without a real patient in a safe and supported environment.	
The speculum was new for us but the visualisation (of the cervix) was really good as well.	
2. Power	
• Novice medical students aware of extensive midwifery experience	• Different type of power relating to their greater knowledge and relevant clinical experience than the medical student
There were one or two in each group and they were really happy to teach us and also answer all our questions in the birth scenarios they also have lots of births and done it all before I don't know what was in it for them. I don't know why but they seemed to really enjoy it and were also chatting with us.	*It was nice that it was interprofessional—and we did know more than the others (medical students). It was nice knowledge sharing and not all medical students were novices—It was a change of power! We knew more!!*
There was a really obvious knowledge gap that made it also very obvious that interprofession education was quite a one flow from the midwifery students to us because for us, it was our first week and it was quite new and I thought the students at least in my group were really lovely and inclusive and especially in the birthing station they really really helped us that it was a feel good experience, not sure how much it benefited them to have us in this room unless you see one teach one-do-one kind of thing but yeah I felt like they would just revising content that they already knew	*… and when we go to the workshop where we know more than the other people, whoever they are, we get to step up.*
	We have the same approach and we must be at the similar skill level because we are all together.
	We want to be appearing confident that we do know what we need to know.
	It also confirms the knowledge we have.
	• Different type of power relating to identity as students vs. practicing health professionals

(*continued on next page*)

Table 2 (*continued*)

Medical Students	Midwifery Students
while we were dealing with it for the first time, so I am not sure what the value it has to them. They were really lovely and helpful wasn't she? Really great for us.	*… we are always the observers and the second one in and the assistance is in and when we go to the workshop where we know more than the other people, whoever they are, we get to step up. I don't think it's about midwives and doctors and because we are students we are **never** in a powerful placement* *We mentioned about how we were becoming independent practitioners and they were just as nervous and feeling the anticipation as we were and it puts a real human face for us that there is no division at this point as we are all students. At that time, we felt the same as them!* *Seeing each other as equals and learning from each other and we are finding out that they were 4th years (medical students) and that they know nothing about birth till there 4th year so it was an even base that we were starting from.* • Different type of power relating to their future professional discipline *They seemed quite receptive to our knowledge because they were such novices and never been out there. While we were out there, and we could give them real life examples. Hopefully that follows through when they go out into practice out in the real world and they know that midwives **do** really know their stuff!*
3. Patient and learner safety/readiness to practice in clinical setting	
• Confidence/competence needed prior to clinical exposure *… then they knew what they would be doing because it was no longer going to be on a model it was going to be on a real patient.* *… when I got into a clinical scenario … anatomy compared to real life its quite easy to find the cervix like in the model compared to a woman but as I said the technique is still the same.* *… it makes or breaks your experience in the next eight weeks and you just feel a lot more confident going into it.* *… It was quite good and I remember the first one that I did afterwards it was quite straight forward in the technique in terms of fixation and slide preparation (while examining the patient) …* *I would say I was pretty much confident. I was able to go through the anatomy of the female reproductive system in a stepwise manner to go through in the clinical scenario and I learned a lot in the simulation with regards to how you are supposed to feel and palpate and exposure required so I was quite confident with regards to the bimanual palpation as well as the Pap smear*	• Practice skills in a safe supportive environment before patient exposure *A lot of times when you have an emergency and there are doctors that you have never seen before and will never see again, its good to have practiced with them as a student.* *Its all about consolidating the skills you learn in theory and beginning to put them into practice and having the opportunity to practice them without a real patient in a safe and supported environment.*
• Student and patient experience *… in terms of yours and the woman's experience to that examination …. We didn't really practice too much, I thought we were ok …. .but we did get taught it and it was stressed to us to practice it … which I think is a very important part doing an examination especially when woman is awake while you are doing it in a clinical setting something like that you do need to know how to act, when you do those examinations because if you don't act correctly I think its detrimental for both you and the woman.*	
• Student anxiety regarding "patient injury" *There is a person and body attached and they were quite emphatic about making the female feel quite comfortable and even that I know the registrars are going to be emphasising on things like insertion techniques and like not snapping it shut …. There was a bit part of this education even in the simulation that was this is*	

(*continued on next page*)

Table 2 (*continued*)

Medical Students	Midwifery Students
uncomfortable. This is really worrying for a lot of women. We have to try and make it comfortable and so yes I thought there was very strong emphasis made on us. *so we kind of got a baseline level of what was expected of us, I think it might very overwhelming if there was a person there as well!!. The thought that we can injure someone ….*	
4. Interprofessional learning: curriculum	
• Exposure to other discipline's curriculum *We have never been in interprofessional settings before that's all the experience we have* *Midwifery students to have a background understanding of our curriculum so the midwives can help us and we can contribute effectively in ward work.*	• Exposure to other profession's curriculum *They do not know that we have done a 3 year degree course this is same subjects as paramedics and nurses and then we start to branch out. They then have some clue as to the basics of what we do.* • Open to curricular changes *Detailed knowledge about it (what is indirectly related to our curriculum) was helpful and it's something we might not do but we could use it later. We were open to learning pap smears.* • Sharing common learning creates a feeling of being equal *Other student paramedics, nurses and especially doctors, they are not even at the same university campus as us, so the content of their course is a complete mystery to us, so that when we get sent to do a workshop and then they are here too, we are instantly on common ground*
5. Roles and relationships	
• Continuity of learning (learning from same midwife): *If there was one team that you know before and then they have seen you a few times it easy to learn* *…. and we are so lucky about getting (in a hospital) where we got to know all the midwives. The experience can be very variable.* *I am just always happy to get what I get, I just have to follow the midwife and see what I can get, you have to be really opportunistic and grab onto every opportunity a midwife gave you. If you as an individual are really opportunistic and help the midwife they will supervise you and teach you* *I don't know what there was for them … they seemed to really enjoy it and were also chatting with us.* *I found the (practising) midwife really happy and excited to have you (medical students) on. They treated you like one of the midwifery students.*	• Knowledge of own and others' roles *I think medical students need a briefing beforehand on what we do—what our role is. They do not know what midwifery is about. We kind of felt a little bit awkward, as they just don't know what we are all about!* *Any interdisciplinary learning time is fantastic for **long term** relationships out in the fields/hospitals and—seeing each other as equals and learning from each other* *I think medical students need a briefing beforehand on what we do—what are role is. They do not know what midwifery is about. We kind of felt a little bit awkward, as they just don't know what we are all about!!* *By the end of session everybody was talking among themselves and it was actually very nice. Broke down the barrier …* • Respect and appreciation for others' roles (midwifery roles to be recognised by students/clinicians) *It's a learning curve for them! They are developing the respect for midwives. We are eventually going to practice together so they might as well develop that respect.* • Define territory (normal versus abnormal relating to midwifery versus medical) *We were always on placement and learn that this is normal and this is what happens but then we learnt about what is not normal at the workshop through the medical supervisors and we went Ahhh …!! that's not normal!* *From an education point of view, we understand that a big part of our role in midwifery is about educating—educating woman, educating families and in some situations educating doctors as well. So if it is about normal birth and normal pregnancy, we see that as a part of our role and we take that on.*

(*continued on next page*)

Table 2 (*continued*)

Medical Students	Midwifery Students
	We had one lot of education and they had another lot of education with different emphasis by respecting what they know and in turn they are respecting us for what we know in our experiences. If it is about normal birth and normal pregnancy, we see that as a part of our role and we take that on. *And it was quite confronting that they were quite "airy" about themselves!!!* *About six young 20+ aged students that just oozed confidence, gone from a private school gone into to do medicine because it looks like that's what their family did. But they had no life skills.*

Interprofessional Curriculum

Both medical and midwifery students were keen to have an understanding of the other profession's curriculum. Both were open to curricular changes with a view to integrate medical and midwifery curricula, where relevant. They expressed a consideration to combine learning opportunities in a shared learning environment. Common learning objectives and overlaps in curriculum were identified by the participants through the program. These are taught in silos, and the professional groups were unaware of each others' scope of practice. Exploring interprofessional learning opportunities at the undergraduate level was emphasised on to potentially improve teamwork and clinical practice in a work-based setting.

Roles and Relationships

This included team-based learning, knowledge of the other discipline's role, an appreciation of their own role, and defining scope of practice.

Medical students expressed that team-based learning could help build better trust between the two discipline groups and that this would assist both their learning and more effective teamwork in patient management. It was suggested that tagging the two teams familiar to each other in a common workspace could encourage a continuity of learning. The medical students looked up to the midwifery staff for learning and expressed that they wanted to work with the same midwife in the birth unit repeatedly; so, a relationship of trust could be built (which was similar to the inference drawn by the midwifery students). The medical students were uncertain about whether the workshop, on such basic obstetric skills, would have been of value to the midwifery students given that they already had real-life birth experience. This positive experience of learning from the midwifery staff/students was further reinforced by the clinical work experience in birth unit after the WHIPLS program.

The midwifery students expressed anxiety that the medical students were not acquainted with the roles and scope of practice of midwives, which may affect their future relationship as doctors and midwives. It was highlighted by the midwifery students that, not only knowledge but also, respect and appreciation for other health professionals' roles are important for safe patient management.

In terms of recognising and describing their own role, an emphasis was made on defining the scope of practice of individual disciplines. However, an interest was expressed in learning about what is *beyond* their own discipline's scope of management in order to understand the role of the other professional group.

On the whole, the relationship was perceived as being on an even ground, and the professional bond was seen to be strengthened as a result of the IPE.

Discussion

This article shows how an interprofessional simulation coupled with clinical experience influenced the perspective of the two undergraduate student groups. Whereas the medical students found the acquisition of clinical skills the primary gain through the WHIPLS program, the more experienced midwifery students saw its value in developing rapport and assisting medical students with learning, as an investment in a long-term professional relationship with future doctors. This was the second research question on "what was learnt" through the IPE program. Both groups expressed that learning through simulation was beneficial in their clinical practice (medical group more than midwifery as the midwifery participants were already more experienced) that answers the third research question on "effect on clinical practice." Midwifery students were concerned about the relationship of power and working in their clinical "capacity" compared with their current medical peers (relating to the first research question on participant views of interprofessional relationships), whereas medical students were more "task driven" than "relationship focused" during their learning in an interprofessional setting. These findings are explained by

intellectualising about the course delivery and content of the two disciplines. The medical students although in year four of studies, are at the beginning of this specialty area. Their anxiety about their professional identity would be higher and more challenged, and this may lead to some of the ''airy'' behaviour, which may suggest an underlying insecurity. Midwifery students on a longer time frame with much deeper focused learning on women's health and labour are more confident in their specific knowledge and skills, more experienced in actual labour ward and in a sense are like postregistration learners. The midwifery students are much more engaged and knowledgeable about their specialty content. A similar study showed that the midwifery students had a stronger perception of their professional identity with focus on teamwork and communication compared with the medical undergraduates (Fernandes, Palombella, Salfi, & Wainman, 2015; Foronda, MacWilliams, & McArthur, 2016; Hood et al., 2014). This exemplifies that unevenly perceived background knowledge is not necessarily a barrier to learning through interprofessional education, as the benefit may vary among the individual discipline groups.

Difficult clinical skills are best introduced through simulation, but need to be followed up by the clinical work experience to provide more meaning to it and to reinforce the simulation-based teaching (Swamy et al., 2015). The prior exposure to simulation allowed students to feel ''clinic ready'' and confident to embark on clinical placements (Kumar et al., 2014; Swamy, Bloomfield, Thomas, Singh, & Searle, 2013). Students recognise the benefit of IPE beyond preparing them for clinical placement. After achieving a level of comfort performing procedures, both medical and midwifery students acknowledged the higher level of complexity and variation in patient presentations. The students also thought that they were given an opportunity to be more hands-on in the clinical workplace, if the staff supervising them in clinical work recognised that they had already received some prior training.

The access to performing more clinical procedures could be further enhanced if there was a continuity maintained in students allocated to the same supervising staff. This was specifically recognised by the medical students, who wanted to learn from the same midwifery staff members, who would let them perform births as a primary accoucher under their supervision after a few sessions. It is also interesting that midwives also enjoy being in this supervisory role to assist not only midwifery students but also medical students (Radoff et al., 2015). In some ways, they were seen to impress on their knowledge to the relatively clinically less experienced medical students to gain respect and credibility for their role.

Receiving training in teams (with both medical and midwifery students) benefitted them in understanding each other's curriculum and roles and in return was thought to maximise their learning and also their clinical performance due to a better rapport with the other interprofessional staff (Alinier et al., 2014; Gough, Hellaby, Jones, & MacKinnon, 2012; Murphy & Nimmagadda, 2015).

The key to implementing a successful IPE program is in aligning the expected learning outcomes against curricular expectations of the two learning groups (Thistlethwaite & Moran, 2010) and working towards integration of the curricula (Boet, Bould, Layat Burn, & Reeves, 2014), a step that has been taken at our educational institution, following the introduction of this intervention.

The combination of receiving IPE along with learning by doing encourages shared learning towards a common goal, with students benefitting from the pooled knowledge and developing a shared perspective, at the same time allowing reflection on their own role in the greater scheme of health care management (Brennan, Olds, Dolansky, Estrada, & Patrician, 2014). Even a single day of IPE was found to influence students' viewpoint on collaboration, teamwork, and professional identity (Murphy & Nimmagadda, 2015). The present study supports this evidence as, after a single exposure of learning together, the two teams began to develop awareness of each other's curriculum, role, and how this awareness affects their own professional identity. This was well emphasised through the results from the midwifery focus group, where they voiced how a higher level knowledge and experience empowered them with confidence to teach and supervise the less experienced medical students.

The midwifery students were also concerned about their ''future'' professional identity and hoped this training imparted by them helped the ''future doctors'' to develop respect and appreciation for their role. On the other hand, the medical students failed to identify the obstetric component of the workshop as a benefit to the midwifery students and expressed an uncertainty as to how the teaching of basic obstetric skills could benefit the clinically experienced midwifery group. They appeared not to recognise the midwifery students' keenness to establish their professional identity by being in the supervisory role for teaching basic obstetric skills to medical students. This highlights the underlying cultural differences in interprofessional groups, with student teams having little understanding of perceptions and behaviours of other teams that are likely to work together in future.

This complex interplay of roles and relationships with professional's individual identity has not been appreciated to a great extent in the available literature and needs further in-depth analysis of psychological framework governing individual disciplines. We recommend medical and midwifery IPE programs to be introduced and studied at various levels of practice (from undergraduate to practicing clinicians) and more long-term data obtained to see effect on professional understanding and relationships. The ultimate goal will be to diminish these cultural barriers, which cannot be achieved without integration of

these ''brief interprofessional learning opportunities'' into student curricula. The embedding of ''beliefs'' or ''notions'' regarding the existence of other disciplines occurs at a very early professional level, and interventions need to target all levels of educational practice to create change in future.

Limitations of the Study

A limitation in this study is sampling the students through only two focus groups. However, the discussion during the focus groups were seen to cover all premeditated themes and unmasked interesting findings regarding student interprofessional attitudes and identities that are worthy of sharing. Some of the differences of opinion of the two participant groups may have arisen simply, by them being in different groups and this is a limitation of the study. It would also have been beneficial to study the transfer of the learning to clinical practice, but this was beyond the scope of this study.

Conclusions

Three months after participating in the WHIPLS program, medical and midwifery students reported developing positive attitudes towards interprofessional simulation-based education, developed prior to and continued after their routine clinical placement. Although, development of interprofessional relationships requires some level of professional maturity to understand the depth of roles and scope of shared practice, the introduction of this teaching can be beneficial at an early career level. The effect described by the two groups of students may also have a role in development of their own professional identity as future midwives and doctors.

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Chapter 4

Evaluation of knowledge or skills: Level 2b of Kirkpatricks's framework

Kumar, A., Nestel, D., East, C., Hay, M., Lichtwark, I., McLelland, G., Wallace, E. M. (2017). Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation. Australian and New Zealand Journal of Obstetrics and Gynaecology. doi: 10.1111/ajo.12659

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4.1 Introduction

This chapter has two sections; the first section is on data collection methods available to assess learning and the second part describes how evidence on evaluation of learning contributes to the literature. In the first section, I present the evaluation of WHIPLS program, with respect to what was learnt as evidence of level 2b of Kirkpatrick's framework. I describe the various assessment tools to assess what the students learnt from the program.

In the second section, I introduce our study on home births, where midwives are involved in home birth and paramedical staff, who may become involved in case of

an emergency needing a transfer. I discuss why this form of evidence of acquired learning is important. In both the studies the key research question was "What was the learning acquired from the interprofessional simulation?" hence providing evidence for the Level 2b of Kirkpatrick's framework.

4.2 Evaluation of knowledge or skills: Level 2b of Kirkpatricks's framework (Section 1)

4.2.1 Evaluation of skills or knowledge

Level 2b of Kirkpatrick's framework refers to the evaluation of skills or knowledge acquired by participants attending an educational program. This may be an objective measure of student learning and can be assessed through either summative or formative evaluation. "What was learnt" from a program is one of the more popular domains that interest educational leaders. This question lends itself to a variety of data collection methods like questionnaires, multiple choice tests, descriptive essays, observed structured clinical examinations (OSCEs) and interviews. In the following paragraphs, we discuss the various data collection options available for this form of evaluation. I have used the "assessment" (the pre-test and the post-test) as a tool to "evaluate" the learning outcome, hence refer to both terms through the chapter. The term "assessment" is mostly used here to refer to the test used and the term "evaluation" as in program evaluation.

4.2.1.1 Objective tests like Multiple Choice Questions (MCQs) and Extended Matching Questions (EMQs)

A clearly constructed test-based questionnaire is easy to institute with use of either paper based tests or online questionnaires. Use of objective tests like Multiple Choice Questions (MCQs) or Extended Matching Questions (EMQs) are easy to standardize across the whole cohort, especially if they are designed as having only one correct answer. Most health professional courses have exams and students are mostly familiar with this form of data collection, hence it can be easier to engage them in evaluation. Students also require less time and effort with single best choice answer compared to writing detailed answers. However, this form of assessment may lack the depth of understanding of the subject, which can be

usually achieved by using open-ended questionnaires and interviews. Feedback about performance can be given by disclosing test scores, performance on learning domains, or face-to-face feedback using the question as a trigger for broader discussion (as we have done with the WHIPLS program). Use of online tests can also make it easier for data entry, analysis and interpretation.

4.2.2 Methods to test skills and knowledge

Evaluation of learning can use either quantitative or qualitative methods or both. The assessment of knowledge can use content-based tests, surveys or standardized interviews. The clinical skills can be examined either by direct observation or using videos. These can be evaluated objectively using checklists or scoring sheets. However, evaluation of skills can be very labour-intensive, and difficult to test the whole cohort. Also, it is frequently used with observation of a random sample of students. Ideally all forms of assessment should be delayed and not immediately after the teaching to get an accurate assessment of student learning and knowledge/skills retention.

4.2.3 Evaluation of WHIPLS program using pre-tests and post-tests (strengths and limitations)

In our program, we have used the same paper-based questionnaire (with 23 items) in each test for both medical and midwifery student groups. The pre-test was scheduled approximately 2-3 days before the WHIPLS program and the post-test was instituted immediately after the WHIPLS program. This study was published in the ANZJOG in 2017 titled "Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation". This form of evaluation was easy to perform and it was feasible to offer the test immediately after the session while all participants were present. However, the reviewer comments addressed the use of the same paper for both pre- and post-tests suggesting the risk of recall, specially, as the post-assessment was immediately after the intervention.

A better alternative would have been for us to use a different set of questions (but standard-set to the same difficulty level). Ideally, the assessment could be repeated,

after a few months to check for retained knowledge. By process of pursuing the PhD, I have gained better insight into assessment of programs and I am currently repeating the test six months after the session to check for retention of learning. The test was designed to assess the knowledge of the skills and also, where that skill could be applied in clinical practice. But, we did not assess the skill itself. We considered assessing direct observation of the skills being performed, but this had to be abandone. A skill-based test would have to be scheduled at a later date in a separate session and this was not considered feasible in our set up.

4.2.4 Role of tests to promote learning

The second part of our research question in this paper was "What do learners think about assessment tagged to simulation and, if the assessment process contributes to learning?" Here, we attempted to explore students' views on formative assessment of tasks taught in a learning program. We know from existing literature that "assessment drives learning"(97). Assessment may have a pre-assessment effect with student preparation in anticipation of the assessment(98, 99). Assessment `may also have a post-assessment effect where students receive feedback and follow it up with a reflective process, which further influences their learning. The best results are noted when assessment occurs often enough for students to immerse in active recall (97). The theory of "total time hypothesis" had suggested that repeated review of content" helped in the assessment rather than the "assessment" itself but later proven that assessment had an independent effect too (100).

It was interesting to observe that the assessment process was largely well received by the students. Most students viewed the formative assessment (before and after) as an extension of the learning program as opposed to feeling threatened or anxious about their performance. They perceived the test as a way to complement learning from the program. The results from this paper add on to the literature about the value of formative assessment and how it could play a role in student learning. In our opinion, summative assessment is still the main form of testing for students (both in undergraduate and postgraduate medicine). Formative

assessment, although considered to add value to learning is still underutilized and can become a regular component of student teaching programs.

4.2.5 Impact of the assessment on the WHIPLS program

As a result of this research, the pre-test and post-test tagged to the simulation has now become integrated into the program itself. Although the questions asked in the pre-test were not directly addressed in the workshop, the content was revisited through the teaching and provided the context to the skills learnt. This enabled the students to use the pre-test as a frame of reference and attempt to focus on what the assessment questions addressed, while they were in the session. In the post-test, that learning is revisited to reinforce the key concepts. The assessment has been integrated into the WHIPLS program for the last three years and forms the basis of using other formative assessments, as a way to complement other learning programs.

4.3 Evaluation of knowledge or skills: Level 2b of Kirkpatricks's framework (Section 2)

4.3.1 Introduction of home birth simulation program

This section introduces the home birth simulation where home birth midwives and paramedical teams learnt together in an in-situ workshop. Similar to the WHIPLS study evaluated in the previous section (on the comparison of the pre-test and post-test), this paper evaluates the key messages learnt from the workshop. Hence, this provides evidence of level 2b of Kirkpatrick's framework.

The home birth simulation (described later in the chapter) was organised in any of the midwives' homes to replicate a real home birth setting. During the session, when a birth emergency occurred, the midwives had to work within the limitation of the resources available at home similar to a real home birth. This is an example of an in-situ simulation. In the next few paragraphs, we discuss the role of *in-situ* simulation as opposed to simulation in an educational space/simulation center.

4.3.2 "In situ" simulation

Simulation in an in situ setting usually uses a blended approach where the simulators (with or without simulated patients) can be used in a real clinical environment. The advantage of in situ simulation relates to realism where participants can connect with the environment as if it was a real clinical space. This may help their immersion in the simulation scenario. In situ simulation is likely to benefit by improving both physical and psychological fidelity. As described by Dieckmann (101), physical fidelity resides in the simulator and the environment. The semantic fidelity depends on how well a scenario is drafted and executed to mimic the real clinical situation. The psychological fidelity relies on the participant's cognitive and emotional response that engages the participant to "believe" the situation as real for the duration of the simulation.

4.3.2.1 Benefits of in situ simulation

According to a review on in situ simulation(102), it can benefit in four ways – at an individual level (for procedural or task- based skills), at a team level (to improve non-technical skills like communication, coordination and efficiency), at a unit level (to improve learning of tasks, systems, processes, physical environment and organization) and organizational (related to functioning or processes to improve patient safety). Another recent review by Sorensen et al(103) presented the argument that the major advantage of in situ simulation is for only organizational factors, while individual and team based learning can be achieved to a similar extent using off site simulation.

4.3.2.2 In situ simulation of home births

There appears to be mixed opinion on the benefits of in situ simulation to the participants. However in the context of our research, the conditions, equipment and support are quite unique to a home setting, and are difficult to replicate in either a simulation centre or even a hospital. If we consider a woman who chooses to give birth in a bath at home, and later on has a postpartum hemorrhage, in this situation, the midwife will need preparation on how she will get the woman out of the bath using the help of another midwife and also the woman's partner. She needs to be moved to a to a more spacious room, where she can lie down flat and

her condition can be reviewed. The midwife may be confronted with the task of planning the next steps on how she would expeditiously cannulate the woman to provide intravenous hydration prior to the arrival of the emergency ambulance services. While providing emergency medical management, as a home birth midwife, she needs to explain and support the woman and partner regarding the events and how they are being managed. The midwives may also need to coordinate the transfer of the woman to a hospital setting with the paramedical staff and the birth unit midwifery lead. In this situation (which is highly unlikely to occur but may present without prior warning), it is essential that midwives have had training to manage these efficiently, as a lack of prior preparation can lead to poor outcome.

4.3.3 Evaluation of home birth simulation program

Through this research, we attempted to answer the research question on the "key features" learnt by the midwives and the paramedical staff. These results are discussed in detail in the following paper, but the main points were improving communication, understanding the roles of interprofessional teams, developing an understanding of the process and being able to plan ahead. Along with the pre-test and post-test evaluation of the WHIPLS program, this is the evidence I provide in support of level 2b Kirkpatrick's framework, to demonstrate what was the learning acquired by the participants through the activity.

4.3.4 Paper publication and book chapter

The next section in this chapter is the paper published in the journal, "Women and Birth" titled "Simulation based training in a publicly funded home birth programme in Australia: A qualitative study" that has been cited three times so far. The results from this research were also written as a chapter titled "In-situ simulation of home births" in a book titled "Simulated Patient Methodology: Theory, Evidence and Practice". This research was also presented at the International Meeting on Simulation in Healthcare in Los Angeles, 2018.

4.4 Declaration for Thesis Chapter 4 - Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation

Monash University

Declaration by candidate

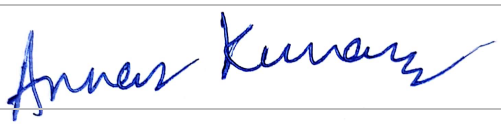
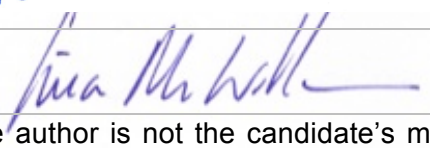
In the case of Chapter 4, paper titled, "**Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation",** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, intervention, data collection, writing first draft	65%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Debra Nestel	Concept, editing of paper	5%
Christine East	Intervention	2%
Margaret Hay	Data analysis	5%
Irene Lichtwairk	Data analysis	4%
Gayle McLelland	Intervention	2%
Deirdre Bentley	Intervention	2%
Helen Hall	Intervention	2%
Shave Fernando	Intervention	2%
Sebastian Hobson	Intervention	2%
Luke Lamour	Intervention	2%
Philip Dekoninck	Intervention	2%
Euan Wallace	Concept, supervision, editing paper	**5%**

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors.

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ANZJOG

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ORIGINAL ARTICLE

Embedding assessment in a simulation skills training program for medical and midwifery students: A pre- and post-intervention evaluation

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Background: Simulation-based programs are increasingly being used to teach obstetrics and gynaecology examinations, but it is difficult to establish student learning acquired through them. Assessment may test student learning but its role in learning itself is rarely recognised. We undertook this study to assess medical and midwifery student learning through a simulation program using a pre-test and post-test design and also to evaluate use of assessment as a method of learning.

Methods: The interprofessional simulation education program consisted of a brief pre-reading document, a lecture, a video demonstration and a hands-on workshop. Over a 24-month period, 405 medical and 104 midwifery students participated in the study and were assessed before and after the program. Numerical data were analysed using paired *t*-test and one-way analysis of variance. Students' perceptions of the role of assessment in learning were qualitatively analysed.

Results: The post-test scores were significantly higher than the pre-test ($P < 0.001$) with improvements in scores in both medical and midwifery groups. Students described the benefit of assessment on learning in preparation of the assessment, reinforcement of learning occurring during assessment and reflection on performance cementing previous learning as a post-assessment effect.

Conclusion: Both medical and midwifery students demonstrated a significant improvement in their test scores and for most students the examination process itself was a positive learning experience.

KEYWORDS

evaluation, gynaecology, interprofessional, kirkpatrick, obstetrics, outcome based, undergraduate

INTRODUCTION

Teaching intimate obstetric and gynaecological clinical examination skills to medical and midwifery students can be challenging.[1] To add to the cognitive load, and further hamper learning, clinical examination skills are sometimes taught to students simultaneously with communication skills. Simulation can address this challenge by providing an opportunity for learning through repeated practice until mastery of the skill is achieved.[2] The term 'chunking' refers to breaking up information into small procedural steps[3,4]

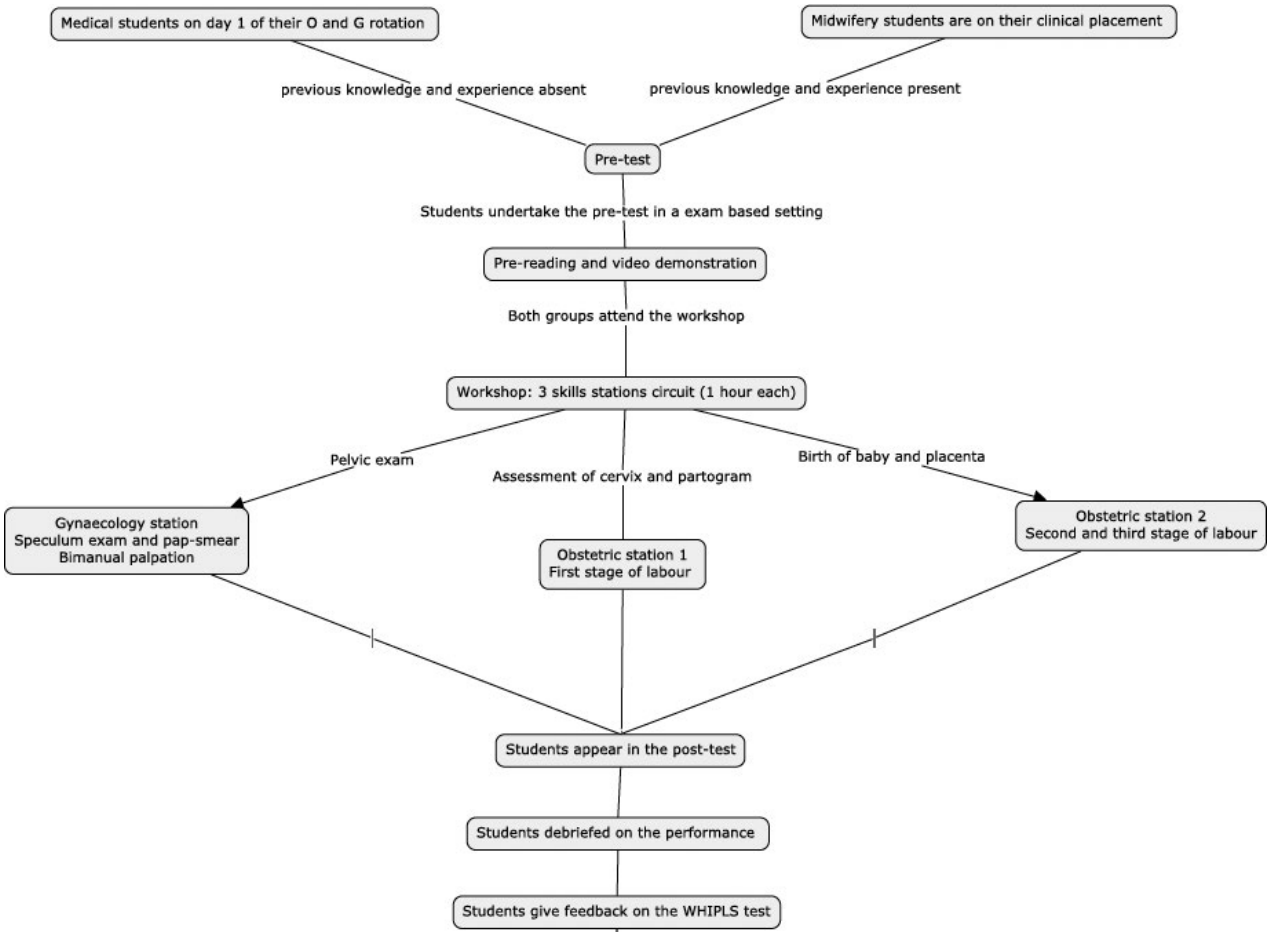

FIGURE 1 A student's journey.

that can be independently learnt. It has been shown to reduce the cognitive load perceived by the student.[5] Practice through simulation has been shown to improve the efficiency and accuracy of the task performance, hence laying the foundation for introduction to clinical practice.[6]

Simulation can be a component of 'blended learning' where two or more complementary approaches are used to teach the same material.[3] This may include educational methods such as theoretical knowledge through a lecture and demonstration of a skill by the tutor. Such learning can then be supplemented with students examining a mannequin or task trainer to learn the various procedural steps organised in a strategic sequence. Granados[7] demonstrated this with students learning digital rectal examination where rectal and prostate mobility and hardness were modelled with surface textures and spring mechanism. This also applies to the field of obstetrics and gynaecology where certain procedures are not visually evident to the learner, such as performing a Pap smear or assessing cervical dilatation in a labouring woman. These procedures can be learnt by repeatedly performing them on pelvic simulators, allowing learners to improve both their skills and comfort level with the procedure.[8] The knowledge acquired from lectures and videos can also be applied to clinical practice on mannequins. This relates to the concept of a 'flipped classroom',[9–11] where short video-lectures are viewed by the students at home and the in-class time is utilised for interactive learning projects and exercises. Compared to delivering a lecture such an approach increases the efficiency of the tutors supervising structured activities.

To date, the various areas of assessment of simulation programs have focused on student anxiety, confidence, satisfaction, skills, knowledge and interdisciplinary experience.[12] We have previously described our Women's Health Interprofessional Learning by Simulation (WHIPLS) program in regard to medical and midwifery students' interdisciplinary experiences and confidence.[13] In this study we sought to assess if there was any benefit to student learning afforded by participating in this program. The overarching research question was 'How much learning had been attained by medical and midwifery students through the WHIPLS simulation program?' Students' approaches to a test introduced before and after the simulation session and how having a test affects their learning was also studied.

We sought to demonstrate if medical and midwifery students' performances improved after the intervention (the simulation program). At the same time we question what learners think about the assessment tagged to the program and if it contributes to learning itself. The research question is relevant to both

TABLE 1 Blueprinting the assessment

Topic	Number of questions	Concept being assessed
First stage of labour	5	Clinical examination skills and assessment of progress, identification of complications
Second stage of labour	6	Examination and management of second stage of labour, identification and management of complications
Third stage of labour	4	Management of third stage of labor, identification and management of complications
Speculum/Pap smear examination	5	Speculum examination technique, cervical anatomy/histology, procedural technique of obtaining Pap smear, interpretation of cytology results
Bimanual palpation	3	Examination technique, common findings

teachers and learners to develop a better understanding of the role of an 'exam' as 'learning' rather than as an 'assessment' tool.

MATERIALS AND METHODS

We have described the WHIPLS program in detail elsewhere.[13] Briefly, these on-going workshops consist of a brief preparatory reading, a lecture, a pre-recorded video demonstration and a hands-on skills learning workshop. Each workshop is conducted with groups of six to eight medical and midwifery students using a simulation model (Model Med, Melbourne, Australia) and supervised by a clinical facilitator. The workshop involves three skill stations (two on obstetrics) focused on learning the examination of women in the first stage of labour (both latent and active phase), second and third stages of labour (which included the student conducting a normal vaginal birth and estimation and management of blood loss) and (one on gynaecology) performing a speculum, pap-smear and a bimanual palpation on a gynaecology trainer. The description of the intervention is demonstrated in a sequential step-wise flowchart (Fig. 1). The workshops are undertaken every three months.

We conducted a pre-test and post-test assessment of all medical and midwifery students attending the WHIPLS program over a two-year period, January 2013 to December 2014. Monash University Human Research Ethics Committee approved the study. Participants in the study consisted of medical students in their fourth year of undergraduate training (five-year program) and third year midwifery students (four year dual nursing/midwifery degree program), at Monash University, Melbourne, Australia. Medical students attended the WHIPLS program at the beginning of their obstetrics and gynaecology clinical placement while many of the midwifery students were already in their clinical placements. The test was conducted without any prior warning to the participants, in an examination environment 1–2 days prior to the workshop. The pre-reading material, lecture and training videos were all a part of the WHIPLS program and hence, these resources were provided only after the pre-test but before attending the workshop. The post-test was also conducted in a timed examination environment immediately after the workshop. The participants were not provided with the answers until the submission of the post-test. After the post-test, the correct responses were discussed and a group feedback provided regarding their performance.

Pre-test and post-test validity

Content validity

A panel of experts from medical and midwifery undergraduate teaching developed a 23-item multiple choice question (MCQ) assessment. Each question had four options (A–D), were equal in weighting (one mark each) and no marks were deducted for incorrect responses. The panel blueprinted the learning material covered during the workshop and all topics were sampled in the MCQ assessment in comparable numbers (Table 1). An independent panel of experts (who were not involved with the program and were blinded to the intent of the assessment) evaluated the questionnaire to assess the adequacy of response options. Both tests were marked by independent assessors, who were not involved in the study. Both the pre-test and post-test used the same MCQs, which were designed as clinical vignettes around the concepts that were taught in the program.

Internal structure evidence

Individual item statistics for all questions were obtained to assess reliability across all items. Reliability tests were conducted using Cronbach alpha and discrimination statistics were obtained to assess if there was consistency in performance of individual students across all items in the test. The overall Cronbach α for the pre-test was 0.56 (range 0.51–0.57) and 0.63 (range 0.62–0.64) for the post-test. The test for reliability was average but was considered acceptable for both the pre-test and post-test questionnaire. The narrow range of variation in the alpha scores across all 23 items (in both the tests) also qualifies that the spread of marks across all questions was even in distribution.

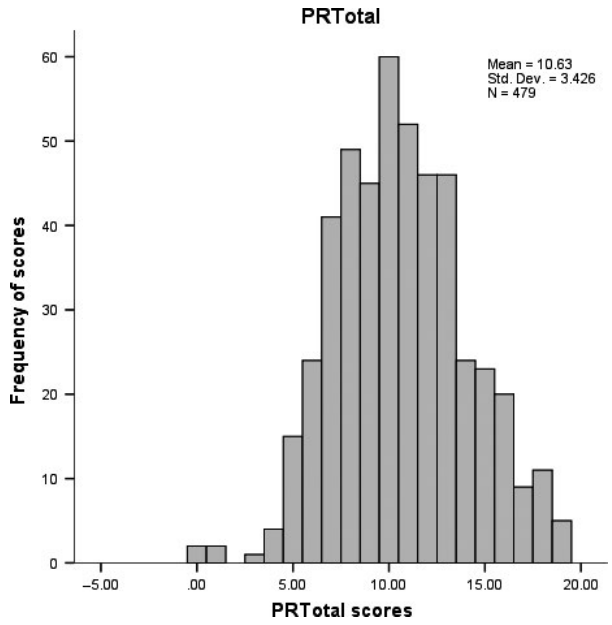

FIGURE 2 Pre-test results.

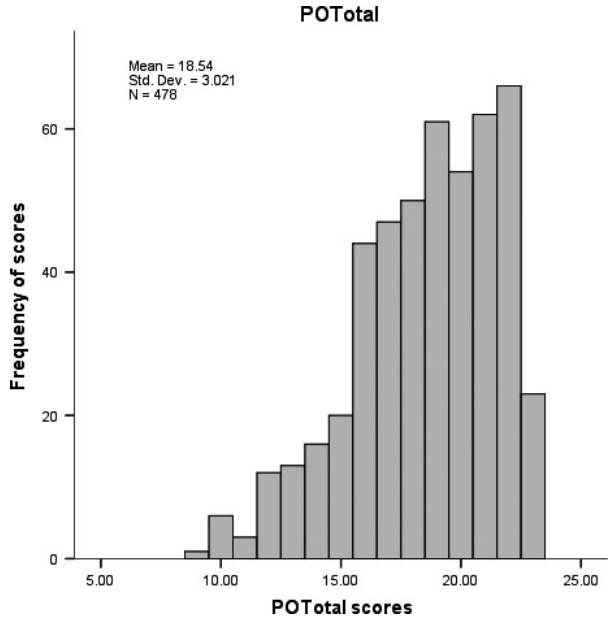

FIGURE 3 Post-test results.

Data collection and analysis

All pre-test and post-test assessment responses were entered separately for medical and midwifery students, as baseline knowledge was deemed to be generally greater in the student midwife group. Midwifery students were in the third year of their program and most had some practical experience, whereas the medical students were just entering their first rotation and had no previous exposure to this learning. Only those students who had completed both the pre-test and the post-test were included in the analysis. Frequency statistics of student performance in the two tests were reported for both medical and midwifery groups. The data were analysed with the IBM SPSS statistics program version 23 (IBM, Armonk, NY, USA). A two-tailed paired *t*-test was used to compare the difference between the mean scores in the pre- and post-test and a one-way analysis of variance (ANOVA) test was used to compare the performance of the medical and midwifery students in the pre- and post-tests.

A paper-based questionnaire was used with an open-ended question asking students about what they thought about having the test before and after the WHIPLS program. A conventional content analysis[14] was performed on the response to the open-ended question addressing the students' opinion on having the test before and after the WHIPLS program. The key categories were identified from the text. Some categories overlapped but items were counted only once. Two assessors (AK and DN) were involved in the process of assigning categories to minimise researcher bias; the key themes were then agreed upon after negotiation.

RESULTS

Over two years, 405 medical and 104 midwifery students participated in the workshop. Of these, 22 medical and nine midwifery students were excluded from analyses because they had not attempted the pre-test. Data from 383 medical and 95 midwifery students were available for analysis.

Pre-WHIPLS test and post-WHIPLS test results

Pre-WHIPLS test scores were normally distributed while the distribution of scores for the post-test showed a negative skew (Fig. 2 and

TABLE 2 Pre-and post-test scores

	Pre-test			Post-test			
Group	**Mean**	**SD**	**Range**	**Mean**	**SD**	**Range**	***P*-value†**
Medical students (*n* = 383)	9.9	3.12	0–19	18.6	3.06	9–23	<0.001
Midwifery students (*n* = 95)	13.5	3.02	0–19	18.5	2.88	10–23	<0.001
Total medical and midwifery (*n* = 478)	10.6	3.4		18.54	3.02		<0.001

†*t*-test.

TABLE 3 Themes after the content analysis on students' opinions on the pre-WHIPLS test and post-WHIPLS test

Chronological event	Theme	Number of responses
Pre-test (prior to WHIPLS)	Pre-test not useful as no prior knowledge	25
	What to learn? Directs learning	29
	Provides evidence in regard to workshop goals	21
During WHIPLS	Helps improve student engagement	13
Post-test (after WHIPLS)	Recognition of enhanced learning	103
	Reinforces what has been learnt	26
	A direct comparison provides effective feedback	57
	Improved confidence by the post-test performance	11
	Identifies gaps to help future learning	27
Both tests	Both tests not useful	16
	The test failed to match the workshop teaching	9
	The test was intimidating but still helpful	7
	The test was intimidating hence not helpful	5

3). The overall mean (SD) scores for the pre-test and post-test assessments were 10.6 (3.42) and 18.54 (3.02), respectively (Table 2). The overall post-test scores were significantly higher than the overall pre-test scores ($P < 0.001$). The respective pre- and post-test scores for the medical students were 9.91 (3.12) and 18.56 (3.05), ($P < 0.001$) and for the midwifery students 13.54 (3.02) 18.47 (2.87), ($P < 0.001$) (Table 2). The ANOVA showed significant differences between medical and midwifery students' pre-test scores ($P < 0.001$), while no significant differences were found between the scores of these two student groups in the post-test scores ($P = 0.8$).

Students' opinions of the assessment

Two hundred and fifty-four students (182 medical, 37 midwifery, 35 unidentified) provided 364 comments on the testing approach. The key themes are listed in Table 3, arranged in chronological order of occurrence.

'Pre-WHIPLS effect'

Students had mixed opinions on the usefulness of the pre-test ranging from being useful to 'direct or channel learning' ($n = 29$) and not being useful 'due to no previous clinical exposure or perceived as being intimidating' ($n = 25$) with 16 comments about the complete assessment (both pre-test and post-test) not being useful. Seven students acknowledged that they did not like the pre-test at the time but realised its importance later.

'During WHIPLS effect'

Themes that focused on the 'during intervention effect' indicated that the test was an instrument to direct the tutors' teaching in the workshop and monitor its progress ($n = 21$). The test was also seen to improve student engagement during the WHIPLS workshop.

'Post-WHIPLS effect'

The most frequently recorded theme related to 'recognition of enhanced learning' ($n = 103$). The second most prominent theme was 'benefit of feedback from testing' ($n = 57$). The test was also acknowledged to reinforce learning by revision of the content ($n = 26$). The post-test also helped to identify gaps to promote future learning ($n = 27$) in the clinical placement.

DISCUSSION

Medical and midwifery students demonstrated significantly improved test scores in the post-WHIPLS test, providing evidence for a positive knowledge gradient in each student group. Although the medical students, being new to obstetrics and gynaecology, scored relatively poorly in the pre-test, both groups scored similarly in the post-test. This suggests that the teaching content was well aligned with the assessment. Although, the midwifery student group did bring skills learnt in clinical practice, which enhanced their baseline score, interestingly, following the intervention, the medical students had caught up on the knowledge assessment. Our work with the medical and midwifery learning groups supports students' beliefs that the program helps to improve *both* their confidence in performing core clinical skills in obstetrics and gynecology[13] *and* to measure knowledge. The combination of improved confidence and evidence of acquired learning further reinforces that simulation-based education benefits both participant groups, even if they start at different levels of learning.

A review of other programs that assessed skills and knowledge in undergraduate nursing simulation[12] demonstrated an improvement in information seeking, procedural clinical skills, problem-solving which was also observed in undergraduate medicine training.[15,16] Clinical skills that can be learnt in clinical practice can

also be learnt in a simulation program.[17] Their respective assessment tools hold the potential of being utilised as a summative assessment for credentialing or assessing competence.[18] These assessment tools can examine the skill itself (informative about student learning and competence). Alternatively, knowledge based on the skill can be assessed (as we have done, as it is more generalisable, feasible and easier to score and standardise with a large group of students).

In this study, we have evaluated 'how much' learning was acquired through the workshop[19] providing a mid-level evaluation of a simulation program with an objective measure of change in learning. There are numerous studies on participation satisfaction with the simulation activity (including our previous study),[13,20] while demonstrable change in participant behaviour and clinical outcome is scantily reported and will be considered a high-level outcome-based evaluation. The evidence for acquired learning also forms phase 1 of translation research.[21] In clinical research, translation phase 1 consists of preclinical activities that assess the efficacy of care. In reference to simulation, this would assess 'what' and 'how much' the student has learnt, that can potentially be applied to a patient care setting. Further work into application of these skills with the objective of improving patient outcome then constitutes phases 2 and 3 of translational research and can impact change in future educational practice.

In our program, we have assessed baseline knowledge through the pre-test (a tool for a self-performed gap-analysis by students, hence, identifying 'what' they could learn). The post-test assists students in 'recognition' and 'cementing' of acquired learning and at the same time, identifies gaps for future learning. This may provide insight into factors that may assist/hinder learning, following which further learning programs can be aligned to address gaps in student knowledge. If assessments are routinely amalgamated into teaching programs, students are more likely to view them as an 'adjunct' to learning, rather than an 'assessment of' their learning[22,23] and may feel less threatened by the idea of being assessed. The introduction of formative assessment has been found to improve student motivation and self-esteem while also encouraging further learning.[24] Test-enhanced learning has also been demonstrated[25] with both pre-assessment effect (learning in anticipation of an assessment) and post-assessment effect (after reflection or a feedback session).[26] Assessment to promote learning (in a simulation program) has a positive impact on learning, where an increase in self-confidence was reported in preparation for a future patient contact,[27] yet has not been extensively studied. This aspect of our study was assessed using a content analysis and hence, may not get a high frequency for many of the themes identified. It suggests that the pre-test may be recognised by the students as an 'approach' to signpost the aims of the teaching activity and direct the course of their learning through the simulation and the post-test assessment, an activity to check and reinforce student learning.

We were unable to measure the students' competence in performing the skill (e.g. students could be observed performing the procedures like the speculum and bimanual examination, but did not have time to be assessed 'on-the-spot'). Second, we assessed the students immediately after the workshop and results may be affected by 'short-term memory' or 'recall'. We justify our repetition of the test at this short interval (three days) as the test comprised of core learning skills and concepts, which are necessary to acquire prior to clinical exposure. The reinforcement of learning through the repeat test is seen as an advantage here, especially because the focus of the paper is also on using test as a 'learning' tool and not just for the purpose of quantifying learning.

An outcome-based evaluation tool such as ours (with a pre- and post-test) can help to validate faculty observations in the clinical setting, guide debriefing, and identify potential areas for curriculum revision and student remediation.[28] McGaghie Issenberg, Barsuk, & Wayne (2014)[29] have identified outcome measurement, skill acquisition, curriculum integration and educational/professional context as the key components of a successful simulation program. For future studies, we recommend evaluation of simulation programs with focus on retention of skills and change in clinical performance. These can be translated into educational/clinical practice and ultimately, lead to assessment of patient outcome, which will help to fill the gap in the existing literature.

CONCLUSIONS

The pre-test and post-test evaluation of the WHIPLS program demonstrated an improvement in learning in both medical and midwifery students. Although medical students had scant prior knowledge and skills compared to their midwifery counterparts, their performance in the post-test had improved to be at a similar level as the midwifery students, signifying the effectiveness of learning acquired through the WHIPLS program.

Both groups of medical and midwifery students reacted positively to the test and acknowledged that it helped them to self-assess and observe a change in their learning. The combination of the two tests was not only useful in providing evidence of learning, but also was perceived as a motivating factor to direct learning and hence, should not be only viewed as an assessment tool but also an instrument to complement learning.

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4.5 Declaration for Thesis Chapter 4 - "Simulation based training in a publicly funded home birth programme in Australia: A qualitative study."

This declaration to be completed for each conjointly authored publication and to be placed at the start of the thesis chapter in which the publication appears.

Monash University

Declaration by candidate

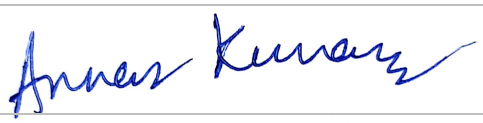
In the case of Chapter 4 paper titled, "**Simulation based training in a publicly funded home birth programme in Australia: A qualitative study"** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, intervention data collection, data analysis, first paper draft	70%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Debra Nestel	Editing paper	5%
Sally Stoyles	Intervention	5%
Christine East	Paper editing	5%
Euan Wallace	Concept, paper editing	5%
Colleen White	Intervention	10%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors.

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ORIGINAL RESEARCH – QUALITATIVE

Simulation based training in a publicly funded home birth programme in Australia: A qualitative study

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ABSTRACT

Background: Birth at home is a safe and appropriate choice for healthy women with a low risk pregnancy. However there is a small risk of emergencies requiring immediate, skilled management to optimise maternal and neonatal outcomes. We developed and implemented a simulation workshop designed to run in a home based setting to assist with emergency training for midwives and paramedical staff. The workshop was evaluated by assessing participants' satisfaction and response to key learning issues.
Methods: Midwifery and emergency paramedical staff attending home births participated in a simulation workshop where they were required to manage birth emergencies in real time with limited availability of resources to suit the setting. They completed a pre-test and post-test evaluation form exploring the content and utility of the workshops. Content analysis was performed on qualitative data regarding the most important learning from the simulation activity.
Results: A total of 73 participants attended the workshop (midwifery = 46, and paramedical = 27). There were 110 comments, made by 49 participants. The most frequently identified key learning elements were related to communication (among midwives, paramedical and hospital staff and with the woman's partner), followed by recognising the role of other health care professionals, developing an understanding of the process and the importance of planning ahead.
Conclusion: Home birth simulation workshop was found to be a useful tool by staff that provide care to women who are having a planned home birth. Developing clear communication and teamwork were found to be the key learning principles guiding their practice.

Summary of relevance

Problem

- There are limited resources available to clinicians who aim to enhance management of complications in a home birth.

What is already known

- Simulation of obstetric emergency helps to prepare staff for those rare but serious complications of birth that can be prevented or managed by efficient use of resources and effective teamwork.

What this paper adds

- The paper demonstrates the benefit of simulation-based learning and training of midwifery and paramedical staff in obstetric home birth based emergencies.

1. Introduction

Following an approximately half century trend for most healthcare systems in the Western world to encourage only hospital based births, home birth, once the norm, is again

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regaining popularity and institutional endorsement[1–3] as its safety is (re)-established. For healthy women with a healthy pregnancy, giving birth at home is a safe and appropriate choice[4] (when women are cared for by trained clinicians, and back-up systems of care are in place). This option of care is highly valued by women and their families.[5,6]

However, as with any birth, a planned birth at home has attendant risks of unpredictable and potentially life-threatening emergencies such as shoulder dystocia and post-partum haemorrhage. Timely and expert management of these and other emergencies are essential for optimal maternal and neonatal outcomes. The perceived additional risks associated with managing these emergencies in the home, rather than in hospital where there is likely to be better and more immediate access to advanced resources, such as theatre and advanced neonatal resuscitation, has led some authorities to caution against home birth[7] or to outwardly oppose home birth[8]. In contrast, based on evidence derived from large, well-described population experiences, other learned bodies support and recommend home birth for healthy multiparous women.[1]

As with any healthcare provision, a key component of a home birth programme is the safety of mother and baby. The pillars of safe home birth practice encompass appropriate selection of pregnant women, compliance with care management protocols, relevant training to recognise, anticipate and manage complications, and provision of a timely transfer to hospital, with emergency management plans triggered at very short notice. In particular, the provision of advanced and specific training to midwifery staff involved in providing home births is important.

In that regard, high quality simulated emergency training has been shown to reduce the rate of adverse events and improve outcomes in a hospital environment.[9,10] These simulations afford personnel an opportunity to update their knowledge, to practise skills and to improve communication and teamwork. The learning gained from these programmes results not only from the hands-on teaching drills but also from feedback regarding teamwork performance exhibited in the task.[11] The learning acquired may be further supplemented by the process of reflection of one's own practice in relation to the experience assimilated from the simulation activity.

Indeed, the success of such training is thought to depend on the simulations occurring in the real clinical environment and involving all the clinical team players that are involved in routine care.[10,12] To this end, for many years we have mandated that all midwifery and obstetric staff in our hospital based maternity service undergo regular emergency training using a validated third party programme – the practical obstetric multiprofessional training (PROMPT) program.[13] Accordingly, in 2011 when we established a public-funded home birth programme as part of our maternity service, we sought to develop a simulated emergency training programme in the home environment for the midwives, and paramedical staff, providing that service. Here, we describe the results of a participant evaluation of that emergency training programme.

2. Methods

2.1. Home-birth programme overview

A publicly funded home birth programme was introduced at a Level 3–4 maternity hospital[14] (Casey Hospital), located in an outer metropolitan suburb of Melbourne, Australia in 2011.

The programme provided training to a group of midwives participating in a rotating (Caseload program) roster in the birth unit, with a view to provide intrapartum care to women in their own home. A home birth steering group was established (Fig. 1) with representation from all stakeholders including senior staff members from hospital administration, senior midwives, obstetricians, anaesthetists, paediatricians, paramedical staff (who may be involved in stabilisation of women and transfer to hospital), emergency department physicians and nurses. The programme was jointly led by midwifery and medical team members. The Working Group provided guidance to the programme leads in all facets of the programme. Monash Health Human Research Ethics Committee approved the study as a quality improvement activity.

The two key components that supported the home birth programme were development of strict inclusion and exclusion criteria and a protocol to guide the practice of home birth midwives (based on Australian College of Midwives National Midwifery Guidelines). The initial protocol and the inclusion/exclusion criteria were revised six months after implementation of home birth in the community, based on the feedback from the home birth steering group and following the review of the women and births managed at home during that period (Fig. 2).

2.2. Home birth simulation workshop

The third, and probably the most important, component that was designed to encourage and support a safe home birth practice was the in situ home birth simulation workshop. At Monash Health, the Practical Obstetric Multi-Professional Training[10,13] workshop is attended annually by all midwifery and medical staff, as an "in-house" training day at the hospital. It is currently used as a training tool for obstetricians, anaesthetists, paediatricians and midwives who are trained together as a team, with focus on all facets of clinical practice (including teamwork and communication). The training has been approved and assessed by the health care service, and it was found to be beneficial for health care providers to improve their clinical skills and confidence in management of obstetric emergencies as a team with improvement of clinical practice and outcome.

Adapted from the Practical Obstetric Multi-Professional Training (PROMPT) workshop, we designed an in situ home birth workshop to up-skill midwives.

2.3. Workshop details

2.3.1. Setting and equipment

The home based PROMPT workshop was customised for training for home birth with its focus on working within the scope of practice limited by resources that can be safely provided in a home based setting.

To enhance the fidelity (or realism) of the simulation, the workshop was delivered in a community home (in situ). The equipment used for training was the home birth kit used by midwives in a real home birth. Only two midwives were active participants in each scenario, replicating real home birth practices in our programme.

2.3.2. Participants

The participants of the workshop were home birth midwives, paramedical staff from Mobile Intensive Care Ambulance (MICA) Victoria, who respond to the emergency phone call, and the obstetricians on call (available on phone) who are consulted through telephone for advice.

2.4. Simulated emergency scenarios

The workshop covered five clinical emergency scenarios, which would start with a phone call where a woman in labour (simulated) would make a telephone call to the home birth midwife. Following the initial encounter, the scenario unfolded with occurrence of intrapartum, postpartum, or neonatal complications. At the start of

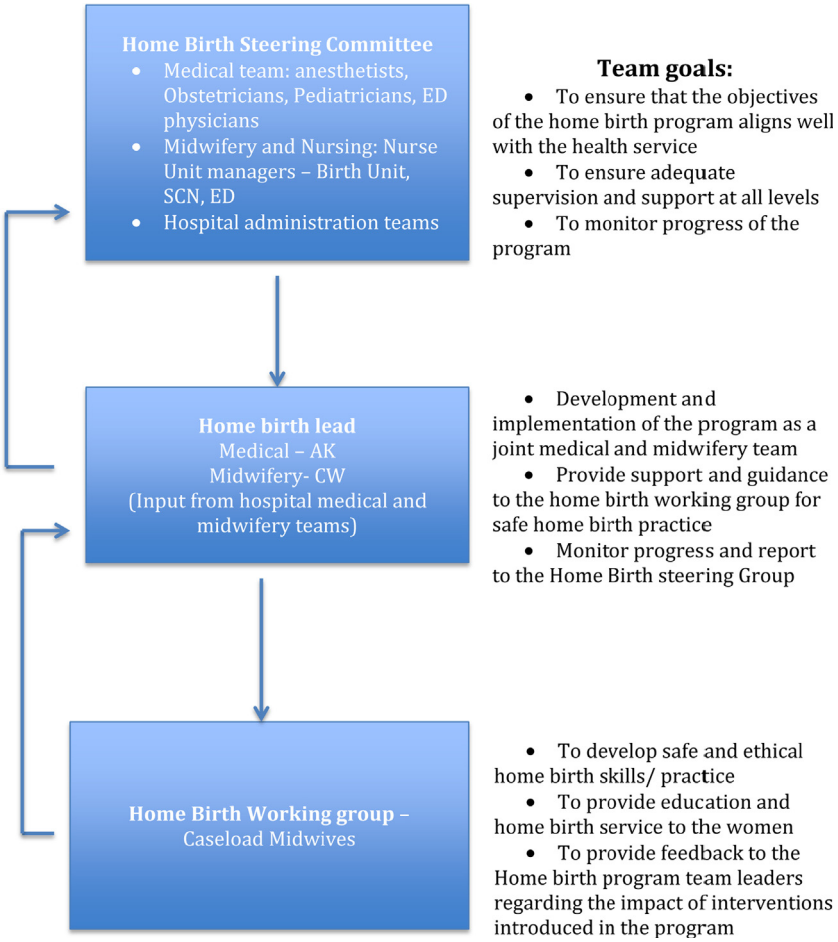

Fig. 1. Home birth structure with respective team goals.

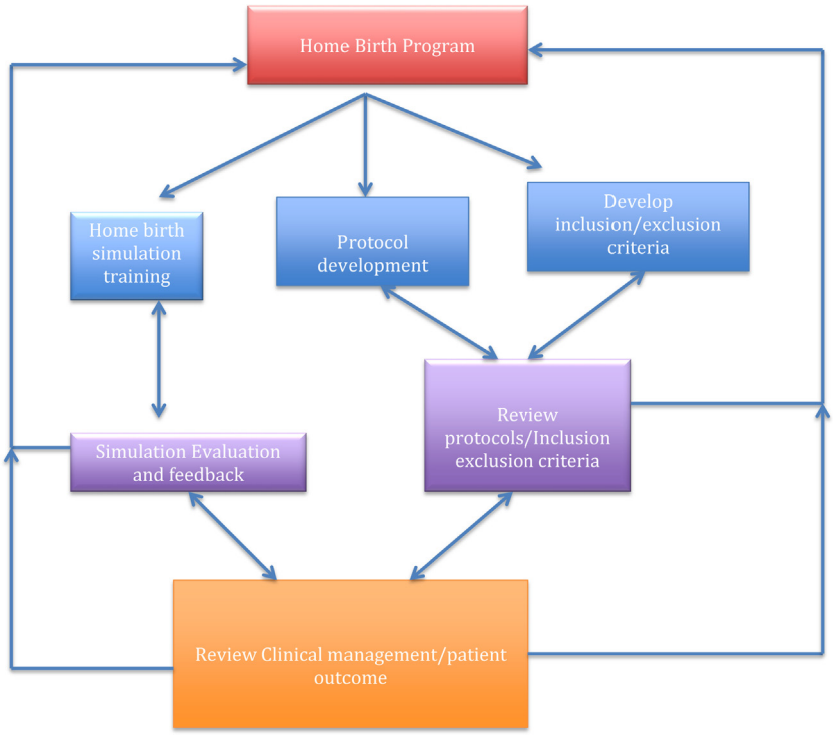

Fig. 2. Home birth programme: monitoring progress.

each scenario, a different pair of midwives and paramedics were recruited to participate without prior knowledge of the precise scenario.

The task required participants to identify and manage the emergency with stabilisation of the mother or baby in real time, using the equipment provided in the home birth kit. The simulation usually required a phone call to the birth unit, obstetricians and to Emergency Services Telecommunication Authority (ESTA by dialling as a simulated phone call arranged prior with the emergency services). The ESTA staff responded to the situation by attending the distress phone call. The scenario was then attended by the MICA paramedic staff and managed as a team along with the home birth midwives. Most scenarios culminated with the transfer of the mother and/or baby to the hospital in the ambulance.

Eight to twelve midwives and two to four paramedical staff attended each session. In most scenarios a hybrid simulation was used with the simulated "patient" aligned with a birthing model (*Model-med International Pty Ltd, Melbourne, Australia*) for pelvic examination, birth and internal manoeuvres. Scenarios involving newborn resuscitation used a *SimBaby* newborn model *(Laerdal, Melbourne, Australia).* The simulated "patient" was trained to portray a woman in labour. With a background in maternity care, she was well placed to draw on personal experiences to realistically portray her role.

2.4.1. Debriefing session

Each scenario was followed by a debriefing session (delivered by an experienced PROMPT workshop educator) involving all participants, where they were encouraged to think about their performance and how the experience of the simulation would influence their clinical practice. A blended approach to debriefing was used drawing on several models.[15,16] Debriefing included feedback given to the participants about their performance in the simulation, which took approximately 30 min for each scenario and was facilitated by the PROMPT midwifery educator.

2.4.2. Workshop evaluation

Each workshop followed a quasi-experimental research design with the use of pre-test and post-tests that explored participants' attitudes and behaviours of relevant clinical practices used to evaluate the workshop.

For the purpose of standardisation, results from the same test were also collected from the in-hospital simulation session (conducted for medical and midwifery staff members who participated in clinical obstetric management in the hospital) over the same duration (which is also reported here in the results). It is also important to note that the same home birth midwives would also have to participate in the in-hospital birth unit roster and hence, would have participated in both the workshops.

The pre-test and post-test paper-based forms had 26 items, which were rated on a 5-point Likert scale. The post-test included an open-ended question addressing learning from the workshop. Information on professional characteristics was collected to identify if participants were midwives or paramedics in the home birth evaluation and the number of times they had been involved in managing home birth or in-hospital obstetric emergencies.

The pre-test addressed the participants' perception of knowledge and confidence in managing emergency situations including maternal collapse, shoulder dystocia, neonatal resuscitation, postpartum haemorrhage, cord prolapse and breech vaginal births. At the end of the workshop the participants were asked to rate its usefulness in managing the obstetric emergencies.

Numerical data were entered into Microsoft Excel and a comparison of the two workshops (home and hospital-based) was undertaken using descriptive statistics. Text data was transcribed and a content analysis undertaken by two researchers independently (AK and DN) to identify key categories. After establishing consensus, all data was recoded. Some categories overlapped but items were counted only once. Any discrepancies were negotiated enabling final attribution of text within categories. The content was further analysed using a descriptive-interpretive analysis for an in-depth assessment of emerging themes.

3. Results

The workshop was evaluated for 3 years (2012–2014), comprising six home birth workshops, conducted at intervals of 6 months. The first two home birth workshops served as pilot studies and were not formally evaluated. Over the other four sessions, 73 participants attended the workshop with midwifery ($n = 46$) and MICA paramedical ($n = 27$) staff members.

Forty-nine participants completed the pre-test and post-test evaluation of which 42 were midwives and seven were paramedics. Incomplete evaluations ($n = 17$) were excluded. Reasons for incomplete evaluations included midwives and paramedics, who were on duty and called off to attend an emergency and were unable to complete both the questionnaires.

The median score for knowledge and confidence of management of obstetric emergency was 4 (maximum score = 5) for midwives performing both home birth and hospital births. These midwives had little experience of managing obstetric emergencies at home while their overall experience for managing hospital-based emergencies was variable and is shown in Fig. 3. The score for usefulness of both hospital and home birth simulation workshops was comparable (5 out of maximum score of 5) for both groups participating in the scenario drills and for the debriefing.

The content analysis of textual data on what participants learnt from the home birth simulation was based on 42 participants who made 110 comments. The most frequently cited learning related to communication ($n = 42$). As shown in Fig. 4, most of the communication was channelled through the home birth midwife. This included examples of general communication such as communicating in person (to the other midwife, MICA paramedic staff or the woman's partner) and also by telephone to the ESTA ($n = 4$), the obstetrician on call ($n = 5$) and the hospital midwife in-charge ($n = 3$) and always with clarity ($n = 12$). Where there were several specific items, we created an additional category such as communicating precisely and concisely during handovers to paramedics ($n = 12$), and, timely and accurate documentation ($n = 6$).

The importance of preparation was cited, mentally ($n = 11$) and with equipment ($n = 7$). The importance of identifying how home birth care environment influenced outcome was recognised, that included familiarisation with protocols, attending to the environment for safety of the baby and mother and, transport arrangements such as requesting two ambulances ($n = 11$).

Respondents identified safety as underpinning much of the learning, with explicit statements on using all available resources, including asking for the partner to help ($n = 9$). Teamwork and insight to others' roles was identified ($n = 11$) as one of the key learning objectives.

There were also statements of newly acquired or affirmed technical skills/manoeuvres ($n = 5$). Finally, the role of realism in the simulation was cited in relation to the presence of real colleagues from midwifery, paramedical staff and obstetrics, that the simulation took place in a real home, that activities were undertaken in real time, that the scenario challenges were realistic and the psychosocial fidelity believable ($n = 6$). The staff members engaged well with the activity and thought that the simulation was useful to support their practice by providing "learning in a non-threatening environment" ($n = 3$). There were no negative comments provided in the

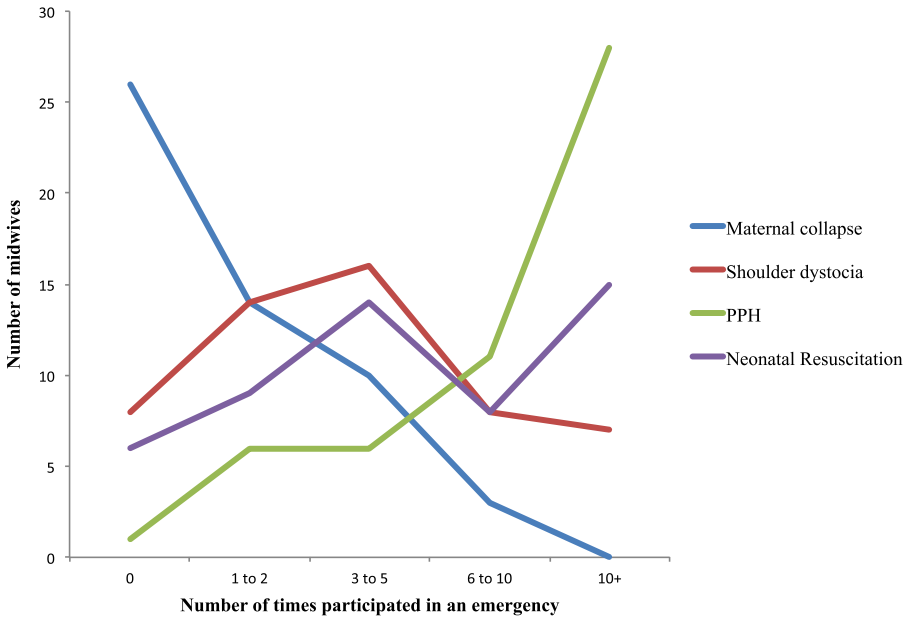

Fig. 3. Background experience of midwives in managing obstetric emergency.

open-ended section of the feedback. The debrief was perceived to provide a reflection on the team's usual practice and how their performance in the scenario will influence their attitude and behaviour in future ($n = 2$). It provided a forum for participants to discuss how they will prognosticate, prioritise and strategise their course of action in the most efficient way.

4. Discussion

In this study we have assessed the participants' perceptions of usefulness of a home birth emergency training workshop. The intervention was beneficial in enabling participants to practice and reflect on a simulated home birth, making direct links to real practice. Although technical skills were important, participants also reported value in the opportunity to communicate effectively with colleagues and with the support person at home and to be prepared with a back-up plan if complications occurred.

There are several examples of interprofessional maternity simulation training programmes that have been shown to increase the participants' confidence and improve clinical skills.[10,16,17] These programmes have been useful to teach management of rare emergencies like maternal collapse, eclampsia, cord prolapse, shoulder dystocia, postpartum haemorrhage and neonatal resuscitation to obstetric, paediatric, anaesthetic and midwifery

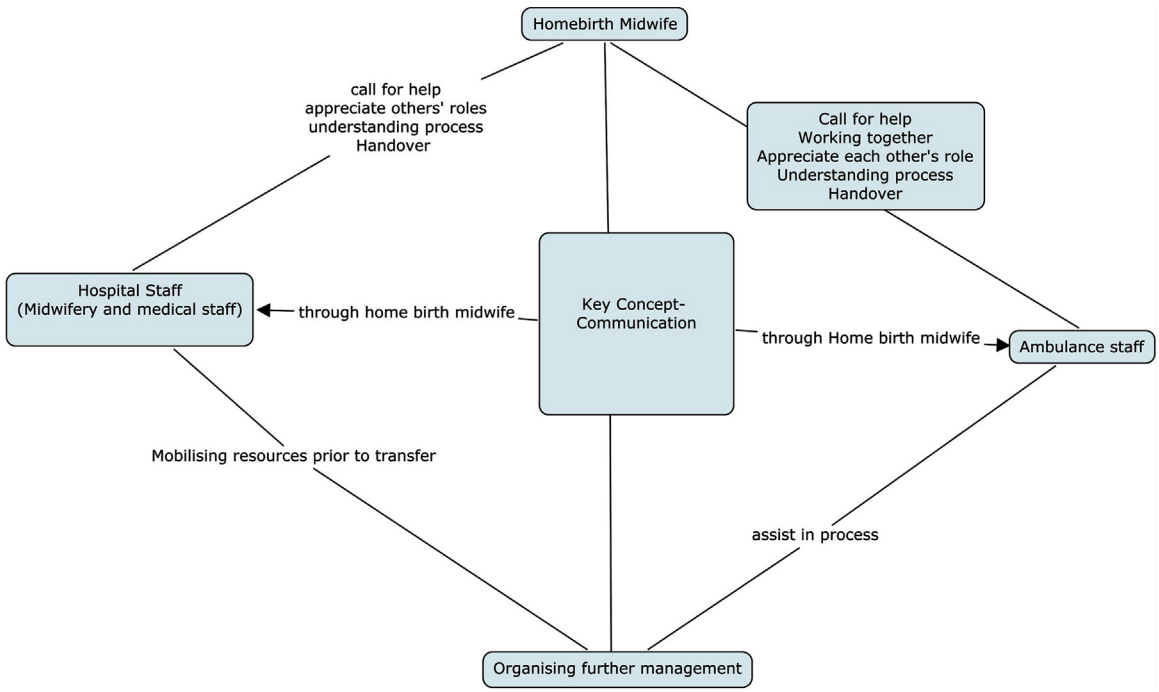

Fig. 4. Interpretive analysis of home birth results.

workforce[18] and improve team performance.[19,20] Recent reports have also shown that introduction of interprofessional team training workshops in the clinical workplace have led to a decrease in maternity claims,[21] therefore further justifying the expenses incurred in running these training programmes.

Development of a relationship to work together is an investment requiring time and effort and requires recognition of the mutual support that teams provide each other.[22] The "handover and overlap of management with the ambulance staff" provides a sharing of clinical information that underpins women safety[23] as most home birth complications would require an expeditious transfer to hospital for further observation, even after the required management plan had been enacted upon.

As far as we are aware, this is the first time a home birth emergency simulation has been described in situ with resources, equipment and personnel restricted to reflect the resources available in that setting. This is important to optimise psychological fidelity such that participants need to communicate effectively and use available resources efficiently, as would be required in real home birth practice and on the site where home birth emergencies occur. This provides an opportunity to practice both technical and team working skills in real time. The feeling of realism reported by the participants provided an external validity of the usefulness of this form of training, adapted from the PROMPT model of teaching,[10,13] to suit a home birth setting.

The success of a simulation programme partially relies on fidelity. In reference to a simulation exercise, the word "fidelity" refers to the learner's perception of "how a simulator looks, feels and acts"[24] and includes both the concepts of structural fidelity (how the simulator appears) and functional fidelity (what a simulator does).[25] An extra dimension can be added to this to enhance realism, which is "situational or contextual" fidelity (the setting or location of the simulation). The concept of fidelity can be also classified as physical and psychological (which is the key component of teamwork simulation).[26,27] "In situ simulation" has been shown to contribute to the psychological fidelity[28] and is described as "a team-based simulation strategy that occurs on the actual patient care units involving actual healthcare team members within their own working environment".[26–27] The success of the PROMPT and other similar programmes has also been attributed to the use of an "in-situ" simulation in a birth unit[28] and our work strengthens this concept.

We regularly use hybrid simulation[29] to facilitate the teaching of pelvic examination findings on mannequins (to assess cervical dilatation and presentation) and for internal manoeuvres (as in management of shoulder dystocia and postpartum haemorrhage or a breech vaginal birth) and human "patient" simulation with a simulated "patient" to enhance communication and team-working skills.[30] The latter is considered relevant as the midwives, when required to be involved in these emergencies, have a dual role of treating the woman and simultaneously providing explanation, reassurance and support to the woman and her partner/support person. "Multi-tasking" skills and "thinking ahead" are essential requirements under these circumstances.

As interprofessional training has only been introduced in obstetric training programmes in recent years, and as yet has not been developed elsewhere for home birth, there is no literature for us to compare our home birth training programme with. Instead we relate our experience to the hospital simulated interprofessional training programmes that have adopted different kinds of simulation modalities (from task trainers to simulated patients)[31] to improve clinical skills and teamwork.[9,12,16] The feedback received by the midwives who participated in both in-hospital and in situ home birth programmes was comparable in relation to the learning acquired from these workshops. As home birth is new to these hospital-based midwives, there was a significant difference in their prior experience of managing these situations at home versus the hospital. The prior lack of experience in home-based setting makes it vital for their mental preparation to attend "in-situ" home-based training, which adds significantly to the fidelity of the workshop.

A limitation of our study is that we have only obtained participants' feedback immediately after the workshop and have not assessed their performance in the simulation scenarios or in clinical practice. However, we believe sharing our experiences of the development of the workshop and these participant responses is an important step in the development of future programmes.

Even if the absolute numbers of women requesting home birth are small, an effort should be made to ensure safety of women with adequate training, education and provision of a back-up support system. Publicly funded home birth programmes have been practiced and are under study in many states across Australia.[32,33] This necessitates the need for robust training of the staff members involved and this easily applicable simulation based training programme can be evaluated in similar programmes running elsewhere. Although we have focused this paper on training and education, a home birth programme needs to focus on the multiple aspects of the development of guidelines to direct practice, having an easy access to hospital facilities and regular inter-disciplinary hospital meetings to review processes and outcomes of home birth. All of these interventions are pivotal to developing an ethical and a safe home birth practice. The evaluation of learning from other experiences will be helpful in guiding our management strategies to reinforce a safe home birth practice. Future workshops could also include the views of women who have undergone home births.

5. Conclusion

An interprofessional simulated training workshop was found to be useful in supporting home birth practice with hospital back up. The workshop was perceived to benefit midwifery and paramedical staff in enhancing their clinical skills and in training together as a team with a common objective of improving maternal and perinatal outcomes of home birth.

Further research is required to assess the long-term influence of this intervention on participant's behaviour, attitudes and impact on birthing outcome. We recommend evaluation of the role of training in other home birth programmes to identify how these programmes can be improved to support women's birth options.

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4.6 Declaration for Thesis Chapter 4 - "In-situ simulation of a home birth."

Monash University

Declaration by candidate

In the case of Chapter 4, book chapter titled **"In-situ simulation of a home birth"** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, first paper draft	80%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Debra Nestel	Paper editing	20%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date 17.05.2018**
Main Supervisor's Signature		**Date 17.05.2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors.

In-situ simulation of a home birth

Overview:

Birth at home is a safe and appropriate choice for healthy women with a low risk pregnancy, however carries a small risk of a birth emergency requiring immediate, skilled management to optimise maternal and/or neonatal outcomes. We developed a simulation workshop designed to run in a home based setting to assist with emergency training for midwives undertaking home birth care and present an evaluation of that workshop by assessing participants' satisfaction and their response regarding key learning issues. Both midwifery and paramedical staff were invited to participate in an in-situ simulation (in a community home) workshop, where the teams were presented with simulated emergency clinical scenarios, which needed to be managed in real time. This was found to be a useful tool by staff who participate in home birth or intrapartum patient transfer. Developing clear communication and teamwork were found to be the most important learning messages from the activity.

What was the need?

Birth at either a hospital or at home may rarely present with sudden and unforeseen complications that require the attending health care providers to manage these situations in a timely manner and with effective teamwork.

Teaching these skills to health care professionals is a challenge as some of these emergencies like shoulder dystocia, postpartum hemorrhage and neonatal respiratory distress are uncommon, hence resulting in a poor clinical exposure for the attending staff members, especially in a low risk setting. Simulation workshops have been integrated in hospital based credentialing programs to up- skill the staff members with these procedures and equip them with team working skills to enable them to safely manage these situations.

Although simulation programs provide training for hospital-based emergencies, similar programs have so far, not been introduced to manage complications of a home birth. However, with improvement in health care facilities, and availability of more birth choices for women, there appears to have been a recent increase in interest in home births, hence, unmasking the need for development of simulation programs that can support the learning requirements of the staff attending births at home.

Birth simulation programs have focused on teaching clinical or procedural skills and/or on teamwork. An example of such a training model is the Practical Obstetric Multi-Professional Training (PROMPT)[1] model, where multi- disciplinary teams involved in maternity care learn together to manage a simulated emergency on birth unit as a team. The PROMPT model of teaching was developed in the UK and has successfully demonstrated to improve teamwork and patient management

leading to better clinical outcomes[2]. In a hospital based setting, it involves midwives, obstetric, anaesthetic and paediatric clinical staff to work together through an obstetric simulated emergency in real time. Based on the concept of the PROMPT model, we have introduced a home birth based model with an *in-situ* simulation conducted in a home-based setting. The workshop was introduced to improve participants' (midwifery or paramedical staff) performance in managing these complications safely and efficiently. The participants' response to the home birth simulation workshop was evaluated to explore what was the key learning achieved through this activity.

Method:

As a part of accreditation, the Practical Obstetric Multi-Professional Training workshop is attended annually by all staff working in the maternity unit, as an "in-house" training session at the hospital for obstetricians, anaesthetists, pediatricians and midwives who are trained together as a team, with focus on all facets of clinical practice (including teamwork and communication). Adapted from the Practical Obstetric Multi-Professional Training (PROMPT) workshop, we designed an in situ home birth workshop to up-skill midwives involved in running the service.

Workshop details

Setting:

The home-based PROMPT workshop was designed for training for home birth with its focus on working within the scope of practice of the home birth staff and limited by resources that can be safely provided in a home based setting.

To enhance the fidelity (or realism) of the simulation, the workshop was delivered in a community home (*in situ*). The equipment used for training was the home birth

kit used by midwives in a real home birth. Only two midwives (occasionally accompanied by the paramedical staff) were active participants in each scenario, replicating real home birth practice in our program.

Simulated emergency scenarios:

The workshop covered five clinical emergency scenarios, which would start with a phone call where a woman in labour (simulated) would make a telephone call to the home birth midwife. Following the initial encounter, the scenario unfolded with occurrence of intrapartum, postpartum, or neonatal complications. At the start of each scenario, a different pair of midwives and paramedics were recruited to participate without prior knowledge of the precise scenario.

The task required participants to identify and manage the emergency with stabilisation of the mother or baby in real time, using the equipment provided in the home birth kit. The simulation usually required a phone call to the birth unit, obstetricians and to Emergency Services Telecommunication Authority (ESTA by dialing as a simulated phone call arranged prior with the emergency services).
The ESTA staff responded to the situation by attending the distress phone call. The scenario was then attended by the MICA paramedic staff and managed as a team along with the home birth midwives. Most scenarios culminated with the transfer of the mother and/or baby to the hospital in the ambulance.

Eight to twelve midwives and two to four paramedical staff attended each session. In most scenarios, hybrid simulation was used, where the simulated "patient" was aligned with a birthing model (*Model-med International Pty Ltd, Melbourne, Australia*) for pelvic examination, birth and internal maneuvers. The role of the simulated patient was played by one of the trained home birth midwives, with

detailed instructions provided to her by the PROMPT educator to portray a woman in labour. Scenarios involving newborn resuscitation used a *SimBaby* newborn model *(Laerdal, Melbourne, Australia)*.

Each scenario was followed by a debriefing session involving all participants, where they were encouraged to reflect on their performance and discuss their challenges and views with the other participants regarding how the experience of the simulation would influence their clinical practice. Debriefing included feedback given to the participants about their performance in the simulation, which took approximately 30 minutes for each scenario and was facilitated by an experienced PROMPT midwifery educator. There was an opportunity for participants to relate to their clinical experiences and obtain peer feedback on ways to improve their clinical performance.

What was the impact?

Both midwifery and paramedical staff found the simulation scenarios and the debriefing helpful. The most frequently cited learning was related to communication with the home-birth midwife such as face-to-face communication (to the other midwife, MICA paramedic staff or the woman's partner) and by telephone to the ESTA, the obstetrician on call and the hospital midwife in-charge. The focus was on clarity, such as communicating precisely and concisely during handovers to paramedics and, timely and accurate documentation.

The second most important learning was related to " being prepared" which included both anticipation of the problem and preparation with equipment required to manage the situation. The importance of identifying how home birth care environment influenced outcome was recognised, that included

familiarisation with protocols, attending to the environment for safety of the baby and mother and, transport arrangements such as requesting two ambulances.

Participants identified safety as underpinning much of the learning, e.g on using all available resources, including asking for the partner to help. Teamwork and insight to others' roles was identified as one of the key learning objectives.

Finally, the role of realism in the simulation was recognised in relation to the presence of real colleagues from midwifery, paramedical staff and obstetrics, that the simulation took place in a real home, that activities were undertaken in real time, that the scenario challenges were realistic and the psychosocial fidelity believable. The staff members engaged well with the activity and thought that the simulation was useful to support their practice by providing "learning in a non-threatening environment". The debrief was perceived to provide a reflection on the team's performance in the scenario with a view to influence their attitude and behavior in future. It provided a forum for participants to discuss how they will prognosticate, prioritise and strategise their course of action in the most efficient way.

The positive impact of this activity on participants' learning encouraged the health service to amalgamate this exercise as part of an annual credentialing requirement for all home birth midwives working within the health service. This simulation-based teaching, complemented by the annual attendance of the hospital-based PROMPT workshop has assisted the home birth midwives to maintain their up-skilling required to face those rare clinical emergency situations.

What lessons were learnt?

The intervention was beneficial in enabling participants to practice and reflect on simulated home birth situations, which were similar to real clinical challenges. The participants could compare and self-assess their technical skills, but more importantly, recognized the value in the opportunity to communicate effectively with colleagues and with the support person at home and to be prepared with a back-up plan if complications occurred.

Development of a relationship to work together is an investment requiring time and effort and activities such as these help to improve a teambuilding approach towards facing common challenges. The exchange of information under relatively stressful simulated situations, helped in identifying and acknowledging the mutual support that teams provide each other. The "handover and overlap of management with the ambulance staff" provided a sharing of clinical information with focus on patient safety at all times. This was considered important as most home birth complications require an expeditious transfer to hospital for further observation, even after the required management plan had been enacted upon.

Both structural fidelity (how the simulator appears) and functional fidelity (what a simulator does) contribute to the success of a simulation program. The value of using a functional and instructional design that resembles the clinical tasks cannot be undermined and this workshop strengthen this viewpoint. Of note, is the concept of *In-situ simulation* (that is the salient feature of this workshop) and has been shown to contribute to both physical (due to the context and the location) and psychological fidelity (due to realism perceived by the participants). Hence, *in-situ* simulation is described as "a team-based simulation strategy that occurs on the

actual patient care units involving actual healthcare team members within their own working environment" [3].

The learning acquired through the simulation has since then, also been put to test when home birth teams have encountered challenging clinical situations similar to the simulated scenarios and were able to directly relate to the simulation experience. The impact on change in clinical practice and outcome is under study at the time of this publication and remains to be reported. \\

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Chapter 5

Evaluation of participant behavior: Level 3 of Kirkpatrick's framework

Kumar, A., Wallace, E. M., Smith, C., & Nestel, D. (2018). Effect of an in-situ simulation workshop on home birth practice in Australia. Women and Birth. doi: 10.1016/j.wombi.2018.08.172

5.1 Introduction

This chapter addresses the level 3 of Kirkpatrick's framework, which refers to changes in individuals' behaviour that occur following attendance of a simulation program (76). Here, I describe the second paper on home birth simulation, where home birth midwives were asked about changes they made to clinical practice after participating in the home birth simulation. This paper also describes the facilitator's perspective on what changes were observed in participants' behaviors over six years of the home birth program.

One of the key consequences of a training program should be to address the transfer of learning to educational or clinical practice. Kraiger et al (1993) characterizes training evaluation as answering what students have learnt from a training program while training effectiveness addresses if, and why the intended learning outcomes were achieved. One way of capturing this effectiveness data is to assess if learning resulted in a changed practice(104). This outcome-oriented approach is analogous to translational research in education(105).

In this paper, "Effect of in-situ simulation on home birth practice in Australia", we describe how learning from the home birth simulation workshop is applied to clinical practice of caring for women in a publicly funded home-based program in Victoria, Australia.

5.2 Applying learning theories and concepts

Evidence of changed practice by a demonstrable retention of skills was described by Goldstein (1991) using a *transfer training model*(106). Kraiger et al (1993) proposed three domains of learning outcomes - cognitive, skill-based and affective outcome(104). In the cognitive domain, knowledge gained from the program is not static. The learning experiences add to the knowledge till the "new" knowledge becomes embedded in clinical practice. We already know this from the experiential learning theory described by Kolb through the learning cycle(107). As described by Kolb, learning is an ongoing experience and not an outcome measured at a fixed point in time. Learning requires the student to draw on their background knowledge, question their ideas and beliefs, add new learning by interacting with their surroundings and reflect on their situation leading to reorientation of their thoughts and feelings(108). It can be likened to renegotiating a contract with one's own self and adapting to the new learning with a constant continuation of this cycle.

Experiential learning theory also introduces the concept of "learning spaces" where learning is a result of interactions with the environment(108). This concept overlaps with *situated* learning theory (described by Lave and Wenger, 1979) suggesting that learning is situated within activity, context and culture(96). Both of these theories are inspired by Vygotsky's *socio-cultural* theory suggesting that all learning arises in the context of social and cultural process(109). In describing *complexity* theory, Davis and Sumara (2006) also explain how learners and environment interact to facilitate learning(110). In our context, we refer to Fenwick's *socio-material* theory, explained from a healthcare perspective(111). The concept describes how both material (objects all around that form a part of the work-life) and social factors (feelings and cultural discourses), contribute to learning. People and objects interact with each other to find plausible solutions and a constant relationship exists between material and social factors in a work place situation, that influences actions and eventually, results.

5.3 Applying learning theories and concepts to home birth simulation

5.3.1 Application of experiential learning theory

The midwifery participants reported how knowledge can be built through participation in the program. The knowledge that was gained through the program, was implemented into practice, when they worked in the clinical setting. In reverse, their clinical experience, further affected, what they learnt through the program. This was becauase, during simulation, they shared their problems and found solutions together as a team. This led to completing the cycle of learning, leading to transfer of knowledge, further leading to a change in practice, which again affected learning. Embedding of that knowledge into clinical practice is the key theme in the results. When participants learnt new concepts, they went through a process of reflection, where they were able to differentiate what aspects of the learning was relevant to their practice and how that that could bring about change in their ongoing practice. This has been described above using experiential learning theory. An example from the paper is learning the process of making a call to the ambulance staff to arrange a transfer to hospital of a birthing woman. Prior to the home birth simulation, the midwives were unable to explain the emergency to the staff in a brief and succinct manner. During simulation, the home birth midwives were expected to liaise with the ambulance staff, while they were managing the emergency in real time. They learnt to put the phone on speaker to improve their efficiency, use the help of the partner to make the phone call, put the number of ambulance services on speed dial and these practices were later embedded in their routine work.

5.3.2 Application of socio-material theory to home birth simulation

We can also explain these events using the socio-material theory, where the participants interact with the environment, where social interactions with the peer group and exchanges of ideas with the paramedical staff contributed to learning. Use of equipment in the home birth context was optimized, and learning from multiple sources accepted and later contextualized for application to clinical practice. The practice also changed for the ambulance services, where midwives only had to say, “This is a home birth emergency” and the midwives were directly connected to the staff for advice rather than

explain the nature of the emergency and other routine questions that follow after an emergency service number is dialed.

5.3.3 Direct observation of changed practice

Change in participant behavior was also noted by the facilitator/educator of the home birth workshop, who expressed that she noted a change in their clinical practice not just in the home birth but also in hospital practice.

> *...it really glues them I think that is the real thing and to also see the impact in real situations you know not just in home birth, but even in hospital when they are looking after woman in the hospital. You can see what they have learnt in home birth drills be played out again in a real life situation and that just gives me a big buzz... because not only have they learned it which you actually can physically show being replayed in a real situation, you know you can say 'who is in-charge', 'who is documenting', you know you can see them do things that need to be done and also note things that have not been done.*

5.4 Multiple levels of Kirkpatrick's framework in home birth simulation

This paper illustrates the higher levels of the Kirkpatrick's framework. Changes in routine clinical practice were observed and new procedures and protocols were developed after the workshop. In the first home birth paper, we demonstrated that midwifery and paramedical participants thought that the home birth simulation workshop was relevant to their educational practice. They also described key learning concepts as communication, prior preparation, patient safety and importance of learning technical maneuvers. These provided evidence of the lower levels of the framework regarding satisfaction with simulation (Level 1) and learning (Level 2b). Here, we demonstrate how the workshop led to changes in learners' attitudes towards home birth practice (Level 2a) and also demonstrable change in participant practice (Level 3). The workshop has also become a component of credentialing midwives for home births, and participation is an annual requirement for all practicing home birth midwives (Level 4a), showing how it has changed the organizational practice. These workshops are now conducted twice a

year in one of the midwives' homes with regular attendance of home birth midwifery team along with a different team of paramedical staff.

The next section of the chapter has the paper titled **"Effect of an in-situ simulation workshop on home birth practice in Australia"** that provides evidence for change in home birth practice and management protocols as our evidence to support of level 3 of Kirkpatrick's framework.

5.5 Declaration of Thesis Chapter 5 - Effect of an in-situ simulation program changing home birth practice in Australia

Monash University

Declaration by candidate

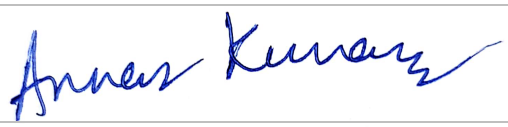
In the case of Chapter 5, paper titled, **"Effect of an in-situ simulation program changing home birth practice in Australia"**, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, intervention data collection, data analysis, first paper draft	80%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Euan Wallace	Concept	5%
Cathy Smith	Data analysis	5%
Debra Nestel	concept, Data collection and analysis	10%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors

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Effect of an in-situ simulation workshop on home birth practice in Australia

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ABSTRACT

Problem: Interprofessional training programs for obstetric emergencies have been introduced for up-skilling birth unit staff in hospitals but not frequently used in training midwives and paramedicine staff for home birth emergency.
Background: Practical Obstetric Multiprofessional Training (PROMPT) has previously been described in the home birth setting using in-situ simulation training of home births for midwifery and paramedicine staff.
Aim: The aim of this study was to evaluate the benefit of the home birth simulation in clinical practice and to explore how the simulation program prepared the midwives for a birth-related emergency in a publicly funded home birth program.
Methods: Midwives conducting home births, the midwifery educator and the simulated woman in labour (n = 9) attended an interview that explored how the midwives' learning through simulation affected their home birth clinical practice. The simulated woman and the facilitator who conducted the simulation for more than six years were also interviewed to comment on the observed change in performance in simulation. The interview transcripts were thematically analysed.
Findings: The themes that were identified and agreed upon, were applying learning to clinical practice, learning in teams, valuing realism, facilitating simulation based education and managing variation.
Discussion: In-situ nature of simulation with home birth midwives and paramedical staff facilitated learning transfer and team-based approach to practice. The careful simulation design provided a breadth of experience in emergencies.
Conclusion: Applying learning to prepare for clinical emergency situations changed the midwives' approach in managing home births. This provided evidence for a change in behaviour (Level 3 Kirkpatrick's framework) and transfer of learning, leading to changed protocols (Level 4a Kirkpatrick's framework).

Statement of significance

Problem or issue

Most home birth practices are not supported by interprofessional simulation training programs. Such programs are scant and those that exist are rarely evaluated.

What is already known

Home birth practice will benefit from being supported by effective simulation/interprofessional training programs that have had a robust evaluation.

What this paper adds

This paper describes a sustainable home birth simulation program and its impact on clinical practice. Learning together and managing varied clinical scenarios in teams supports the midwives' home birth practice.

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1. Introduction

Multidisciplinary simulation programs have influenced birth practice in the developed world[1,2] as they offer hands-on training experience in managing emergency situations. These programs usually work on principles of mastery learning and deliberate practice[3,4] with simulation of various obstetric emergency scenarios in a team-based setting. They have been reported to improve clinical technical skills,[5] teamwork, leadership and communication.[1,6,7] Recently these initiatives have demonstrated improvements in client-reported quality of care.[8]

Whilst these simulations have formed the main-stay of clinical up-skilling for obstetric emergency in hospitals, this approach has had little application for low risk births at home.[9] One reason may be due to fewer numbers of women having access to a safe birthing service in a home environment or their choice of not opting for birth at home, even where facilities are available. As a result, in Australia, only 0.5% of pregnant women had a planned home birth in 2010.[10] However, even in other high-resourced countries where home births are relatively more prevalent, like the United Kingdom or Netherlands, this type of interprofessional simulation is rarely reported as a means to encourage safer home birth practices.

In situ simulation refers to "a team based simulation that occurs in the actual health care units involving actual team members within their own working environment".[11] We have previously described an in situ simulated home birth training workshop using a modification of the Practical Obstetric Multi-Professional Training program.[5,9,12] The interprofessional team commences with the presence of the attending midwife accompanied by another support midwife.[13] After diagnosing an emergency, she would call for the ambulance staff, with attendance of the paramedic. The paramedical staff attending the session, were undertaking this in their working hours and were on call for duty at the time. The scenarios mimicked the way an emergency could present at home and were conducted in an actual home-based setting. Our previously published study has already established the participants' responses regarding the major learning acquired from the workshop. This was found to be useful by both midwifery and paramedicine participants and the key learning messages were based on teamwork, communication, prioritization, sharing of tasks and optimum utilization of available resources.[9]

The current study aims to explore how the learning acquired through this workshop influenced the participants' subsequent clinical practice. We based our research on the theoretical framework of experiential learning.[14] According to Kolb's theory of experiential learning,[15] new learning is created by addition of new experiences. Learning is created by acquisition of abstract concepts that can be applied to a variety of real life situations. Simulation based learning can also be explained using Kolb's learning cycle.[16] The different phases of learning, from the initial step of participation in the simulation activity and debrief, is followed by the next step of reflection on the learning acquired. A connection is drawn between the theoretical learning concepts learnt in simulation. The retained concepts can eventually be applied to clinical practice, which can contribute further to concrete experience.

We evaluated the effect of an in-situ simulation workshop on the clinical practice of home birth midwifery staff and how that experience further influenced their learning. A secondary outcome was to assess how this training workshop was perceived in relation to their attitude towards managing rare, but challenging life-threatening obstetric emergencies at home. The research questions were "What did the midwives learn in the home birth simulation that could be applied to their home birth practice?" and "What was the role of the home birth simulation in relation to preparing for obstetric emergencies in a home birth situation?"

2. Methods

Monash University and Monash Health, Victoria, Australia conducted the study jointly. Given the nature of the question, we adopted a qualitative research paradigm. This enabled us to explore in depth how the learning affected participant's attitude and practice of managing home births. The study was approved as a quality assurance project by the Monash Health Human Research Ethics framework.

2.1. Description of home birth simulation

A publicly funded birth program was introduced at Monash Health in 2011 to provide a safe birthing option to low risk pregnant women. Caseload midwives at the participating hospital had a model of care, where a small group of midwives looked after pregnant women and were also involved in their birth, hence offering continuity of care under the program. The team of caseload midwives were trained for both hospital and home births, hence, worked in both settings. They provided antenatal care to women who chose to have home births and met the hospital criteria to be safely enrolled in the program. The midwives cared for women during labour and birth in the women's homes. In liaison with the hospital teams, the midwives were also responsible for managing home birth emergencies along with paramedical staff in a team effort to stabilise women prior to transfer to hospital.

To support staff training, an in-situ simulation workshop was introduced, where the midwives and paramedicine staff were asked to manage the clinical emergencies in real time using the home birth kit, equipment and personnel available in a real home birth emergency (Figs. 1 and 2). The workshop is described in detail in a previous publication.[9] The home birth simulation sessions were conducted every six months in any of the midwives' own homes. This enabled variation in the setting and was likely representative of the women who chose home birth. The 4-h sessions were offered to all midwives participating in home births and to paramedical staff working in the area and might be called upon for a home birth transfer. Each session had three different scenarios, each lasting around 20 min followed by a 30–45 min debrief. The scenario usually commenced with a woman being in labour and attended by two home birth midwives. At some point during labour or birth, an emergency would arise requiring the midwives to optimise their time and efforts in safely managing the emergency using the home birth kit. The roles of the birthing woman and her partner, were played by simulated clients (experienced midwives trained to play the role). The participants were required to promptly assess the situation, communicate with the woman and examine a pelvic task trainer attached to her to

Fig. 1. Home birth simulation using blended learning.

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Fig. 2. Following a home birth.

make a clinical management decision (blended learning). They were required to call the emergency ambulance services, who attended the emergency and assisted the midwives, eventually leading to transfer of the woman either before or after birth of the baby. All midwives and paramedical staff attending the session took turns being active participants in the scenarios, while the others observed. Neither the participants, nor the observers were previously aware of how the scenario would unfold. The whole group participated in the debrief sessions led by a midwifery educator who was trained in simulation and debriefing.

2.2. Workshop evaluation

2.2.1. Participant group

The participant group consisted of home birth midwives, who attended the home birth emergency workshop at least once. The midwifery educator conducting the simulation workshop and the midwife who acted as the simulated woman were also interviewed.

2.2.2. Interview process

The study involved conducting semi-structured interviews of the participant group regarding their learning from the home birth experience and clinical practice. The topic guide was based on the feedback obtained from the participants regarding the workshop. In preparation for the interviews, the investigators piloted the guide. DN and CS, who have extensive experience in simulation-based research, conducted the interviews. DN and CS were not known to the participants, neither were they involved in the organisation or delivery of the home birth simulation workshops. AK had the lead role in planning and management of the workshop, although was present in some of the interviews, but refrained from interacting with the participants. An interview was offered to all home birth midwives (n = 23), the simulation facilitator and also the simulated woman. Each interview took 30–40 min, was recorded and then transcribed verbatim.

2.2.3. Data analysis

AK listened to all the recorded interviews and corrected the professionally transcribed verbatim transcripts to ensure accuracy of the written data. The transcripts were thematically analysed inductively and independently (DN, CS and AK) using methods described by Braun and Clarke[17] to identify prominent themes and subthemes. Some categories overlapped but they were counted only once. AK, DN and CS discussed the results to negotiate the discrepancies and agree upon the themes. This process took several rounds of analysis and was undertaken in person and by email each time AK returning to the data to seek presence (or absence) of themes.

3. Results

Nine interviews were conducted, including the home birth midwives, the simulated woman and the midwifery facilitator. We identified five key themes (Table 1). The overarching theme was "applying learning to clinical practice". Learning in teams, realism offered, facilitation of the simulation and managing variation were the other common themes.

3.1. Applying learning to clinical practice

3.1.1. Thinking about learning

Simulation helped the participants take responsibility for their own learning by reflecting on how that learning affected their practice. The reflection process further assisted in breaking clinical procedures into smaller steps aiming to make the clinical practice more systematic. Practicing procedures with management of clinical emergency during simulation sessions, triggered implementation of strategies in real home birth situations to improve efficiency are enlisted separately (Table 2). These practical learning points were not always necessarily required to be implemented, but often considered as a preparation, in case an emergency arose.

I do think you do things automatically which are part of the simulation during a labour and you don't actually focus somewhat on what you are doing, but the simulations actually make it focused. (K)

3.1.2. Valuing peer discussion

The debrief following the simulation scenarios led to discussion of clinical presentations encountered by the home birth midwives. An exchange of experiences and clinical opinions was reported to be of benefit to the midwives with handover process and communication with the hospital staff.

Just talking to each other and in a way that's not complex and so we understood easily . . . (C)

3.1.3. Reciprocity between hospital and home care

Midwives compared their experience from the hospital births with home births (focusing on advantages like offering continuity of care and disadvantages like limited resources availability) and how that learning impacted their home birth practice to form their management plans. Technical procedures were learnt in hospital but applied differently at home. The home birth experience was in return helpful when they care about the women transferred from home to hospital.

"The homebirth scenarios actually show you how to adopt those emergency measures into the home, so everything you do in the ward if you have got shoulder dystocia, it's how to do it in house and it's minimal difference really. I mean you have two midwives that the difference that you have one midwife, but the actual backup getting them ready to transferring the woman to hospital what we do it's all just saying how can you adapt that into the home at that time and not to panic, we know what to do, but get the help there and just do what you do at hospital and keep going because I think that's something you think they emphasize to keep going, you just keep going until someone arrives."(A)

3.1.4. Observing change

It was acknowledged that participating in the simulation workshop was likely to make midwifery practice safer and hence provided more confidence and expertise. Ambulance members with prior understanding of midwifery training were found to be more

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Table 1
Themes obtained from analysis of home birth interview transcripts.

Theme	Subtheme	Concepts represented in the subtheme	Participant comments
1. Applying learning to clinical practice	*1.1 Thinking about learning*	◦ Thinking about the procedure that becomes mechanical in practice ◦ Developing automaticity ◦ Reflecting on clinical practice ◦ Reflecting on learning and how that practice was changed as a result	"Fine tune your strategy so in a real emergency it all runs smoothly." (L) "Feel better prepared that I have gone through this before."(L)
	1.2 Valuing peer discussion	◦ Closely knit group and discussion of practice is important so individual practice is influenced — value peer suggestions and debrief ◦ Exchange of information regarding practice, change in handover has become smooth and improved communication with the home birth and hospital staff	"I think there is an opportunity for sharing stories because I think we learn a lot from, oh, we did this home birth and this happened and this is what we did and reflection I think that's to so important to able to do that."(S)
	1.3 Reciprocity between hospital and home care	◦ Comparison of hospital birth with homebirth practice ◦ Learning from hospital to home births and home to hospital births	" . . . because you have got limited people and you cant just push a buzzer and 10 midwives are going to come, having your equipment set out as quickly as possible when you turn up setting all equipment out so and good communication between you and second midwife and being prepared."(C) "I think we all midwives should know their (our) emergency procedures, but in terms of circumstances at home it is not so much about the actual response to the emergency, it is about making that connection with that support that you need . . . ." (L) " . . . to also see them impacts in real situations you know not in home birth, but even in hospital when they are looking after woman in the hospital."(T)
	1.4 Observing change in clinical practice	◦ Ambulance member with understanding have been supportive towards the midwives in the real emergency ◦ "Small change in practice can have a major change in consequences for the women and baby, as clinical situation can change very quickly even in a low risk home birth" ◦ For midwifery broadens scope of practice ◦ Change in both participant and actor practice after attending sim ◦ Improved leadership noted by educator over the duration of sim training (>5 years)	"I think when I go to a homebirth, I just need to survey what's being prepared, I need to look at where things are, I need to get an overall picture what's happening for the woman and then I think yeah I am right to go now, so there is a sense of having done the simulation and it's reinforced the importance of those things and "so emotionally I feel safe". (L) "I have not had any horrible scenarios in real life you know I have had neonatal resus recently and then neonatal resus scenario it wasn't as bad as the scenario, it didn't reach the level of simulation." (S) " . . . as far as looking over the years that we are doing it watching the and still where they were from day one to still they now how much more they have grown and how much they take that role on and how much so take that control you know the leadership role in an emergency situation to make things work better" (T)
2. Valuing realism	*2.1 Suspending disbelief*	◦ Using spare time both in sim and in home birth to prepare for what is anticipated next ◦ Timely sequenced, realistic so you can manage same way in real situation ◦ Mentor based learning where experienced guide newer midwives — even in sim the experienced takes the lead ◦ Documentation — similar in both situations	"Just about the logistics of documenting . . . .as you had wet hands you know how do you document when you got wet hands. These are the various other things that stay with you."(L)
	2.2 Perceiving stress	◦ Interaction with midwife colleague as if she is a real birthing woman ◦ Preparation for clinical practice ◦ Stress perceived specially with unfamiliar situations ◦ Can be initially more stressful because of observers being present later observers forgotten as immersed in clinical situation ◦ Can be more stressful if context not clear (that it's planning for a rare event) Being in low risk clinical situation is supporting ◦ Simulation can be a negative experience for participants if not carefully prepared	"Feeling it for real prepares to have a familiar reaction in a real emergency." (K) **"**It is bit overwhelming because I was just new to caseload and hadn't been to any home birth, so I learned a lot, but it was a bit scary as well. I did the whole scenario and it actually put me off a little bit from home birth because of all those emergency situations that were put in place . . . I witnessed a couple of home births and that turned it around. This is very rare that there are emergencies, yes, and I did so that to one of the new girls that went to the last home birth PROMPT [workshop] and I said, no, this can be a bit overwhelming and they are unlikely to happen in the home births it is very rare, that was reassuring for her . . . " (C) "It feels like it lasted hours, I don't know probably 15 minutes maybe you know till it comes to the conclusion or told and then it's stopped then, you know, you don't need to go any further if you have done what you need to do."(S) "Observer makes you nervous but perform better."(K) "You forget about them [observers] then. when you were in the role play we have a job to do they are just quietly in the background." (Z) "[Being observed] . . . does put a bit a pressure on you really it's like someone looking over your shoulder and thinking what I have missed what should I have done . . . ."(M)
	2.3 Cueing for realism	◦ Visual cues by actor like fake blood (accurate quantity), actor in water for birth. Sudden change of visual trigger to expect a change in participant response ◦ Ability to perform procedures on the actor like take blood (from	"We actually ring the ward in real time." (K) " . . . because we have the models bleeding, we have the models you know actually bleeding. We did a water birth while running the water in the pool and had a person collapsed in the pool and how we physically get somebody out of the birth pool so that was

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Table 1 (*Continued*)

Theme	Subtheme	Concepts represented in the subtheme	Participant comments
		a sleeve over fore-arm), insert i.v. line on the sleeve ○ Performing real actions in real time and space with real teams	the one we did last time."(T) "I could really get in because I had real life devices on me, they could put a drip in my arm or they could you know they remember to put my legs in the position that they needed to do the manoeuvres because it was so real . . . "(I)
	2.4 Playing the woman's role	○ Understanding of women's perspectives — hence predicting women's responses ○ More empathic towards women by learning from simulation ○ Can predict participant response due to experience — pattern recognition ○ Interaction with different participant personalities ○ Prompts standardized and scripted with some flexibility ○ Graded prompts based on participant experience ○ Variable participant performances to standardised cues ○ Motivation of actor needed to provide visual and verbal cues ○ Draw upon personal experience of birth	"People would be doing things to me and I will be thinking — next time this happened, I will do this instead of this because even that might make the difference — or even as the way I am treated as that, I have treated as many of my patients, as the client, as the patient, I think to myself — I would not do that and I will do such and such because they may feel frightened."(I) "I am a quiet person so now as an adult I can scream and yell and be a like a labouring woman." (I) "And because I have looked after so many labouring woman over the years you know you take on what sort of you know what they are going to do at a certain point in time . . . "(I)
	2.5 "Empowering" participants	○ Feeling confident after sim experience ○ *"An achievement"* to go through manage the situation — also these suggest realism ○ Learning curve: observing and participating in sim and then being assist midwife ○ Situational awareness through sim — Trouble shooting through problems ○ Working closely with paramedics — systematic and supportive	"It's just backing a bit going through it all again in the home situation. I think we are pretty confident with our emergency procedures, you are not there to be learning, it's backing up what your knowledge to make it safe." (K) " . . . that we can be confident that if we need to call a paramedic service that the process is in place that they know that we exist and that they are on board with us." "I have heard if paramedics being surprised when they attended a call and they found that the woman is already cannulated, she has got a urinary catheter in, you know that the bleeding is now under control and what we need to do is to support her transfer . . . you know that not realizing that the midwives would have the skills to do that . . . "(L)
3. Learning in teams	*3.1 Learning with paramedical staff*	○ Informal debrief in the team — when they face the same situations together ○ Less opportunity to interact outside sim with paramedics ○ Both teams value training in relaxed environment ○ Rare opportunity for the midwives to learn from paramedics ○ Midwives and paramedics making each others job easier as they know about each other's scope of practice	" . . . the training with the paramedics, it just made me much more alert to what they would have to face you know and what the issues that they are dealing with in terms of being able to give care".(L) "[Paramedics] they can move on from where we leave the part so that they can take it little bit further, so we got a stable mother or stable baby before we move and we don't do this often, [in simulation] we go over things . . . " (S) "I think a lot of ambos actually think it should be part of their teaching you know they could do that as part of their training come to these simulations as well which would be great." (S) " . . . that we can be confident that if we need to call a paramedic service that the process is in place that they know that we exist and that they are on board with us"(K)
	3.3 Learning with hospital staff	○ Simulated clients – the woman and partner – who are known but not one of the home birth staff ○ Valuable to have hospital staff participating/attending like specialists and hospital lead midwives — Build bridges with hospital colleague	" . . . it will be helpful for hospital doctors and midwives to attend, to understand homebirths better." (M)
	3.3 Being observers	○ Taking turns makes you respect other participants ○ Observing contributing to learning	"A great load of learning from it and participating in the same and observing the others in the emergency situation and it's keep refreshing your knowledge and picking up extra new things as well to assist with home births, if there is emergency."(C)
	3.4 Learning with other midwives	○ Playing role of either the attending or supporting midwife is valuable ○ May be paired by a junior staff and may take the lead ○ Develop similar working styles by midwives ○ Ability to work in interchangeable pairs of midwives ○ Knowledge of each others' strengths and weaknesses ○ Sim "glues them" and make them "feel connected" like a team	"In terms of working with the other person because we are doing it together that people who are actually going to be there, we are doing as a group so that's you know that's the good part and you are not doing it with a stranger it helped to for just to flow, yeah, you just have to flow we did not have to – shall we do this shall we do that – you know – what next? – it just happens . . . "(S) "Because it's from being an observer as well its valuable just to see how people do things like oh, that's really interesting you know how she did that, you know, just picking up little tips from everybody."(M) "And just being together with the team you know I find that really powerful" (M)
4. Facilitating simulation	*4.1 Designing scenarios*	○ Challenges participant to think about next step ○ Video suggested to refresh memory and reflect on practice — Due to stress difficult to recall details ○ Constantly evolving modified based on learner requirements ○ Variable learning objectives: for novice may be technical skills, for expert Non-technical skills more important	" . . . but if something is panning out the educator will actually let it run just to see how we cope just change things slightly see how we cope with that . . . " (I)
	4.2 Keeping participant and actor safe	○ Low risk cues by touch of hand, eye contact, or verbal ○ Participant need reassurance regarding their behavior is safe for actor ○ High risk codes — to stop the sim ○ Prior communication to participant	"you have to improvise a fair bit because if the staff you know do things that it could hurt you or potentially could be dangerous, then you have to sort of respond, so then I have to still stay in character instead of respond appropriately like sometimes I put a blood pressure cuff on or sometimes I put a tourniquet on your

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Table 1 (*Continued*)

Theme	Subtheme	Concepts represented in the subtheme	Participant comments
		◦ Usually colleagues and hence respectful in the actor role ◦ Realism balanced with actor safety	arm and if it's tight, and that's because they are panicky and I am the real person unlike the manikin, it hurts you . . . " I never really got into the position where I was really being hurt, but if someone say did 'leave it on too long they just thought I was being very difficult, and I would actually touch their hand and let them know and actually say "that's really hurting", so that's all through eye contact. (I) " . . . at some stage they have to rub my stomach and obviously you know real life patient you are really rubbing their stomach and it would hurt them in real life, but because they do it and it can actually hurt. So you have to be sort of like "you need to be gentle", I know that you were in acting, but you have to be gentle, so more just touch them. That's how I would communicate with them" (I)
5. Managing variation	*5.1 Variation in scenarios*	◦ Unpredictable course of the scenario ◦ Variety of simulation scenarios ◦ Resemblance to clinical problems	"[in simulation] we have to go on and do the whole intubate and whole works, you know, where it's the actual real life one you know we just do the inflation breaths and the baby came around, you know we knew the steps" (S)
	5.2 Variation in clinical practice	◦ Difference in background experience ◦ Difference in practice styles	" . . . I think seeing how different people lay out the kit you know some people want everything laid down, other people just want you to be aware of what is in the kit and you get used to different midwifes approach with that." (L)
	5.3 Variation in locations	◦ Using a different midwife's house for in-situ simulation ◦ Varied locations in the house — like a birth pool, bathroom, bedroom ◦ Location of managing maternal and neonatal emergency	"To be close to where the mother births when you in a room apart, it is very hard to yell at to the other midwife because of the distance, so you should have be a resuscitation equipment where you going to resuscitate the baby close to it, not too close, but close enough that you could communicate with the other midwife as you have the need to yell . . . . because we have got two emergencies going on at the same time which is what happened with the drill." (C) "How we would do this, how would we get around the pool, you know where we are going to put you when we get you out of the pool, you know, and how difficult it would be you know if you are in the toilet, usually there in the smallest place in the whole house and how we are going to get you out of here to where it safe to look after you or you know how quickly can we get the baby from here to where we set the resus area up." (S)
	5.4 Variation in teams	◦ Variation in midwifery teams in simulation and homebirth ◦ Variation in paramedical teams	"I think you always do learn skills from other midwives you work with you know we never stop learning." (Z) "I have get a log of whose done what, so they might have physically done the PPH scenario last time, so this time I will make them do the shoulder dystocia."(T)

Table 2
Practical measures for transfer of learning: implementation of strategies to improve efficiency.

- Clear driveway access for ambulance
  - Having the direct access phone line to the midwife and obstetrician in charge and putting it on speed dial
  - Telephone call to ambulance, process of conversation, who to correspond with and what to talk about
  - Direct access to ambulance services under "Home birth emergency"
  - Communication — verbalizing each step and not presume any information
  - Maintain records in a wet environment with water birth
  - Direct conversation with specialists
  - Familiarity with equipment so it can be set up prior, different ways of set up watching others' practice in sim
  - Using the partner as scribe
  - Keeping the phone on loud speaker so midwife can multi-task
  - Keeping the curtains drawn off and directing the ambulance to turn towards the house.
  - Clearing up the area where neonatal resuscitation is planned
  - Setting up the resuscitation equipment at an adequate distance from the mother

supportive in a real home birth emergency. The midwifery facilitator also found improved leadership skills in the home birth midwives over six years of attendance of the workshop. The midwives described using their real life experiences to guide their performance in simulation. In the words of the midwifery facilitator,

" . . . I think is a real thing and to also see them perform in real situations you know not in home birth, but even in hospital when they are looking after woman in the hospital. You see what they learned in home birth drills be fed out again in a real life situation and that just gives me a big buzz_ . . . because not only have they learned it which you actually can physically see being replayed in a real situation you know you can say, who is in charge, who is documenting, you know you can see what needs to be done and what was done and has not been done".(T)

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3.2. Valuing realism

3.2.1. Suspension of disbelief

The home birth midwives interacted with the simulated woman, (midwife playing the role of the woman in labour) and managed the emergencies in real sequence and time. Where opportunities arose in simulation, they used their time to prepare for the anticipated emergency. Unless it was specified before, the relatively more senior midwife usually led the scenario and documentation was done similar to a real clinical emergency.

> "Just checking the equipment as quick as you can so we get to make sure it's all working . . . it is really important when someone is setting up as later they haven't got time to set up checking the things and getting the drugs ready, checking the oxygen suction and the bag of mask for the baby . . . if you really didn't have enough time because things were happening really quickly . . . "(C)

3.2.2. Perceiving stress

Almost all midwives acknowledged the stress felt during simulation, especially if the emergency was rare. The stress might initially have been related to being observed but due to the immersive nature of the scenarios, the observers' presence was forgotten and perception of anxiety due to being involved in the emergency became the dominant factor.

> *You get in the moment and that yeah you feel the heart racing and feel the anxiety! (C)*

3.2.3. Cueing

A sudden change in visual or auditory cues was suggested to change the participant's response. Physical appearance of the simulated woman with the surroundings (e.g. being in water), presence of mock blood and hybrid simulation, where blood could be extracted and intravenous cannulation possible, helped in creating realism and orientation of real time and risk.

> "You want to convince the audience as well [that] this is happening and I mean they hook up fake blood and everything. It's really good. The girls that are chosen as the woman to give birth are really good. They are not cooperative sometimes you know . . . so that's the same with people and you just have to work out how you are going to do that and I think we all throw ourselves into the acting part."(T)

3.2.4. Playing the woman's role

Participants thought that the simulated woman was successful in guiding the simulation as she was experienced in clinical practice and also understood the woman's perspective. The simulated woman acknowledged using pattern recognition in performance of the midwives. Although her prompts were standardized, she was allowed the flexibility to provide graded responses based on the participant midwife and paramedicine staff background experience. She described a wide variation in participants' responses in her interactions, even though her prompts were consistently standardized.

> "I think it is really powerful to have someone who is the person who you know in the zone . . . is very accurate and how woman react to labour like that as well, so I think it makes the big different and they do things in timely manner as well because you know it's more sequenced and more realistic to you to actually do it you know as you would know, when you do it in a real situation."(S)

3.2.5. "Empowering" participants

Participants described "a sense of achievement" and described the experience as "empowering" after managing the scenario and an improvement in situational awareness due to troubleshooting through birth related complications. Attendance in simulation was seen to be an initial step in training prior to being an observer at birth followed by being the support midwife at home birth.

> "You got the background support, you have the background resources, you have got you know, that you are not on your own, you are not alone. So, emotionally that makes you feel calm and in control. I think the best work that I know that once I have done those things you know I know that's organised, I have got a good view what's happening with the woman, then I just settle." (L)

3.3. Learning in teams

3.3.1. Learning with paramedicine staff

Contrasting a stressful scenario followed by an informal debrief (in a relaxed environment) along with paramedicine staff was seen to strengthen interprofessional relationships. This was highly valued since there were few opportunities for interacting as an interprofessional team at any other time. The midwives thought that learning from paramedics was useful as some skills overlapped while others were mutually exclusive. They were also appreciative of their respective clinical roles and acknowledged minor variations in clinical practice. The simulation workshop helped to create a relationship of trust between the midwives and paramedicine staff.

> *What was good about the debrief was hearing from the paramedics about what would be happening on their end you know like once they get the call what the process is, what we expect from them. (L)*

3.3.2. Learning with hospital staff

Midwives were of the opinion that the hospital staff (midwives and doctors) would benefit from attendance of the home birth simulation as this would facilitate their understanding of home birth practice and also bridge relationships with the home birth staff. This was expressed within the background of slight tension in the relationships of home birth and hospital staff. Working with the simulated clients (midwives playing the role of woman in labour and the partner), who were not part of the home birth team was helpful to create realism.

3.3.3. Being observers

Observation of simulation scenarios was found to improve learning by familiarizing staff with new techniques and also facilitate revision of their own learning. It also improved respect towards other participants.

> *I learned a lot from observing and it is interesting how other staff members react in emergency situations. (Z)*

3.3.4. Being with other midwives

Simulation was seen to connect participants who may not get other opportunities to meet or view each other's practice. Learning together facilitated their developing "similar styles of clinical practice" and provided an opportunity of having interchangeable pairs of midwives at a real home birth. Being involved as a support midwife in a simulation assisted learning and was similar to a real situation where the senior midwife usually took the lead. However, reversing that role in simulation was seen as scaffolding learning for the junior midwife.

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"In real life, when we [have] done the simulation we kind of know process, so when in a real life situation we can just say to the other person okay I will do this, if you do that we just so, you know, figure out where everything is where all the equipment is and if this happens, this is what we are going to do . . . " (S)

3.4. Facilitating simulation based training

3.4.1. Scenario design

A successful scenario design was seen to encourage participants to think ahead, promote questioning, and knowledge sharing and, was usually modified to best suit the learner's needs. As learners can be at different levels of experience, the learning acquired was varied for participants. The stressful scenario needed to be followed up by a clear and skilful debrief, engaging all participants and observers to promote reflection of their experiences that contributed to the learning from the workshop. As described by the facilitator.

I tried to do at least one different scenario each year because I don't want them to know what they are coming into. (T)

3.4.2. Keeping participant and actor safe

Low risk cues by the simulated woman (touch of hand/body language) and high-risk cues (codes set up to stop the simulation) were found necessary for participant and actor safety. Participants valued feedback from the simulated woman during and after the scenario to ensure that their behaviour was professional. Due to the intimate nature of obstetric simulation (requiring internal examination of the pelvic task trainer attached to the simulated woman providing the responses), some realistic scenarios were found to be potentially intrusive but managed well by prior communication to participants to ensure safety of the simulated woman (see Fig. 1). In the words of the simulated woman,

"I will just normally touch their hand . . . .that's how I would communicate with them by touch and then say "no that's not really hurting me . . . "(I)

3.5. Managing variation in clinical practice

3.5.1. Variation in scenarios

A variety of unpredictable clinical scenarios, which slowly unfolded, created a sense of stress but also developed confidence in managing these clinical events.

They are all different scenarios and I think it's difficult for the first ones [participants] (K)

3.5.2. Variation in clinical practice

Midwives had minor variations in their clinical practice, which was shared with others during simulation.

. . . put it these in the real life practice and being able to use it, so people can take a little tip from the simulation. (I)

3.5.3. Variation in locations

The real time and space was engaging and participants expressed feeling affirmed by the debrief that acknowledged and developed their skills and practice, in spite of the variety and unpredictability of clinical events encountered.

" . . . you said to the woman "where do you think you will be giving birth? And sometimes it surprises you whether I think it is appropriate and if we have to get you out of that bath you know there is no room here, if we have to resuscitate the baby where we are going to put the baby you know so home raises those issues you know so it's about that preparation beforehand and how you negotiate that and that's why I think being in a home situation makes it more real" (L)

3.5.4. Variation in teams

The change in midwives' paired together brought variation to learning from the session. As described by the facilitator,

"They have been in a different role or with the different person because they are not buddied them up with the same person all the time because again with roster of situation, they are in teams or in pairs, but depends on what the roster is, they might not be with that same person"(T)

4. Discussion

The findings, illustrated through five key themes identified in this study, show positive impacts of simulation on home birth practices and how midwives perceived greater confidence in home birth emergency management after attending the simulation workshop. The participants' perception of working in real clinical teams with management of variety of emergency situations in real time and space, using real equipment, seemed to facilitate application of learning from simulation to routine clinical practice. The program has sustained since the introduction of home births at the institution in 2011 and the facilitator's observation of participants' improved practice in simulation over six years was recorded through the interview.

The key theme, "applying learning to clinical practice" was an expected outcome as midwives frequently cited examples of practical measures learnt in the workshop (Table 2), which they implemented in a real-life clinical setting. This provides evidence for translational educational research analogous to "bench-side to bed-side" research model.[18,19] Yamada et al. explain this process of "knowledge translation" where "synthesis, dissemination and application of knowledge" is used to improve health care practices and outcomes.[19] Home birth in-situ simulation has been recently investigated by Komorwski et al.[20] describing the experience of twelve midwifery participants with varied levels of experience. The difference in the pre-test and post-test self-assessment scores improved after teaching of shoulder dystocia (15% increase) and postpartum haemorrhage management (18% increase). Our previous study also demonstrated a high level of participant satisfaction and description of both technical and non-technical skills learnt from the simulation.[9] However, as far as we are aware, no study on home birth simulation has assessed a change in clinical practice. The described change in participant competence and behaviour observed by the facilitator over the six-year exposure to the simulation workshop confirms that repeated practice in simulation improves participants' response in dealing with emergencies. The change in learning was also perceived by the home birth midwives in their team-based behaviour.

The theme on creating realism may be related to the in-situ nature of the workshop. The conditions that are conducive for birth, shape midwifery practice and influence midwives' perceptions of work.[21] Midwives create the required ambience in the home environment with an aim to minimize stress to the woman. However, they also need to factor in their preparation of a possible home birth emergency. Being in a workshop that provides a realistic experience of managing these rare clinical emergency situations, helps to equip them with the skills for necessary preparedness while maintaining calm and composure to support the birthing woman. Their description of *"feeling empowered"* (as quoted by a midwifery participant), after successfully managing an emergency reveals their need to learn to make potentially challenging practice-based decisions. The simulation workshop

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is one of the few in-situ home birth learning experiences described in the literature, designed to equip home birth midwives with these essential life-saving skills. Similar design uniprofessional/multiprofessional training workshops are being encouraged in the United Kingdom[22] and the Netherlands[23,24] where home birth is prevalent.

The theme on learning in teams was based on the interprofessional relationship of home birth midwives with hospital staff and paramedics. It underlines the "team-based" approach to healthcare even in a primary birth setting. Literature is conflicting on midwifery experience of working in liaison with obstetric based units, with some studies showing a lack of professional satisfaction or a feeling of lack of "control" on managing births.[21] The evidence provided here suggests midwives' willingness to be a part of a healthcare team, with a shared responsibility towards women that they are caring for. They demonstrated keenness for the hospital staff to attend home birth simulation, with the intention of improving professional relationships and communication with hospital teams. The observation that after attendance at the workshop, paramedicine staff demonstrated a better understanding of capabilities and scope of practice of home birth midwives marks the need and value of interprofessional simulation workshops. Similarly, midwives' understanding of work done by paramedical teams improved with such initiatives. The midwifery teams were interchangeable in simulation and also in real births and this was viewed positively promoting better teamwork.

The theme on facilitating simulation uncovers the exhaustive process required for set up of these workshops, needing a motivated leader to drive learning and carefully design the scenarios to suit learners' needs. The key components to make simulation effective are gaining an understanding of learner requirements, drafting scenarios based on learning outcome, build up performance assessment and debrief into the simulation design, guide the learning and focus on psychological and physical realism.[25] The debrief that took place after each scenario requires time and skill by the facilitator. Debriefing has to be clear and impactful to result in changed clinical practice.[26] Reflective thinking and learning from experiences can be encouraged by an experienced facilitator providing debrief.[27]

The theme on managing variation was cited as the participants were exposed to different scenarios and often perceived to be more difficult than what had been experienced in their daily practice. This degree of difficulty seemed to instil confidence. The learning was helpful in being prepared for and managing a variety of clinical situations encountered in the home birth practice, also noted in other simulation workshops.[28] The exposure to different working styles, while observing other midwives in the simulation, assisted in extending the repertoire of practice.

A limitation of our study is the lack of directly observed change in clinical practice. Human research ethics and related privacy and confidentiality issues, make this extremely difficult to obtain. A change in clinical outcome over a period of time (level 4b Kirkpatrick's framework) can be reported but it is still quite difficult to obtain this data and many other variables can influence birthing outcome. We are currently collecting data on birthing outcome and rates of transfer to hospital that has occurred since the introduction of the home birth simulation to demonstrate our evidence of improved clinical outcome (Level 4b Kirkpatrick's framework).

5. Conclusion

This study addressed two research questions on how the learning from home birth simulation could be applied to midwifery home birth practice and how it prepared them for obstetric emergencies at home. The themes that were agreed upon provide the following findings. Home birth simulation resulted in midwives making practical adjustments to their birth practice that they learned and retained from this in situ simulation workshop. Midwives reported being better equipped to prepare for a home birth emergency after attending the workshop. Realism and careful simulation design were cited as important contributing factors in their learning. Learning in teams with the paramedicine staff further facilitated their preparedness to manage an emergency as a team leading to a smooth transfer of care to hospital if required.

The transfer of learning to clinical practice articulated by the participants provides evidence of higher level of Kirkpatrick's evaluation,[29] where a sustainable change in learners' behaviours (level 3) and routine practices (level 4a) in Barr's 6-level framework can be identified. The program, itself, has sustained and supported the home birth practice since 2011. Evidence at this level has scant reporting in educational literature, but will be beneficial, if reported in future studies.

As described above, home births present a challenge to midwives due to the unpredictable nature of emergencies, often leading to questioning of its safety.[30] As described by a participant, "*the emergency back up is rarely required but necessary to be planned for*". This in situ simulation workshop was designed to enable practice related to this planning and enactment.

Ethical statement

The study complies with Monash Health Quality Assurance framework. Participants gave informed and free consent to participate in the study. They were verbally consented (as per guidelines from Monash Health Ethics Review Committee) for the interview and reassured about confidentiality.

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Chapter 6

Sustainability of a program using change management principles: Level 4a of Kirkpatrick's framework

Kumar, A., Kent, F., Wallace, E. M., McLelland, G., Bentley, D., Koutsoukos, A., & Nestel, D. (2018). Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles. J Interprof Care, 1-8. doi: 10.1080/13561820.2018.1511525

6.1 Introduction

This chapter focuses on an organizational change that was driven at our educational institution to embed the WHIPLS program into the medical and midwifery curriculum. This is my evidence in support of level 4a of the Kirkpatrick's framework. I demonstrate how the WHIPLS program was initially piloted with voluntary attendance of medical and midwifery students and eventually led to it being embedded in the curriculum and routine teaching practice.

6.2 Explanation of level 4 Kirkpatrick's evaluation

As per Kirkpatrick's original framework, level 4 change represented "evaluating results" with reference to quality improvement, change in productivity, improvement in human relations, financial benefits and an increase in sales and investment (76). These were broad outcomes and acknowledged to be difficult to evaluate. A second challenge was finding a cause-effect relationship between the program and the outcome.

In the six-level modification these outcome measures were clearly separated out into achieving an "organizational change" as Level 4a and achieving "change in patient

outcome" as Level 4b. "Managing change" was documented by Kirkpatrick to be a necessary action. What change is required should to be decided at the outset itself and then effort and strategy will be required to have it accepted in the organization (77).

6.2.1 Kirkpatrick's statements about introducing change

Ten statements were made by Kirkpatrick that are relevant for consideration when introducing change(76) (For the purpose of simplicity, I have referred to "managers" as those who can impact change and "participants" as those who will be affected by it.)

1. Resistance to change arises from an anxiety about the negative effect it may have on the people involved.
2. Even if change is suggested by "experts" people may resist it.
3. For change to be acceptable by participants, they need to be given ownership for it. More the involvement by the participants, more the likelihood of acceptance.
4. Participants will welcome change if they see it benefits them, regardless of whether they understand it or not.
5. Empathy towards participants is helpful in managing change(112).
6. The managers can "influence" change even when they don't think they have a "control" over it.
7. Managers should involve their teams and accept their suggestions while taking decisions.
8. Resistance to change may decrease over time, so a slow change may be more acceptable.
9. Effective communication is one of the key principles for managing change(113).
10. Managers should encourage and facilitate learning and its application by the participants(114).

6.3 Change Management models

6.3.1 Kurt Lewin's 3 stage process

There are various frameworks that describe how change can be introduced in a more effective manner to make it more acceptable to those who will be affected by it.

In our study evaluating the PROMPT program (PRactical Obstetric Multi-Professional Training) at Monash Health for all medical and midwifery staff, we have used the Lewin's 3 stage process (115) to explain how the change was introduced. This has been explained in detail in paper titled **"Evaluation of learning from Practical Obstetrical Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: A mixed methods study"** in the next chapter. In this paper, we have described the process of change to be introduced and embedded in a program that was already in place. For this to occur, the first step was to 'unfreeze" the existing practice and focusing on the reasons for it failure. In the case of medical and midwifery staff managing obstetric emergencies, there was a significant delay and lack of communication leading to ineffective management. The second step was to introduce "change", which was the PROMPT program. The final step is embedding the change, referred to as "refreeze". Once the benefits of the PROMPT program were visible, efforts were directed to making it part of the routine practice. Enabling its use as a credentialing tool and making it a mandatory requirement assisted further in setting up the program for routine staff training. It has been described as a linear model but we view it as a cycle as change is a constant process and the practice that has been embedded after change has been impacted needs to be reviewed to assess its benefit and if the validity still continues leading to further change if required.

6.3.2 Kotter's 8-step change management model

The other framework we have described in the PhD thesis is the Kotter's 8-step process of managing change(116). Kotter's change management framework was described to sustain businesses and succeeded in transforming 100 companies. We have adapted this framework to demonstrate how educational programs can be introduced and change the culture of teaching in the context of interprofessional education. The paper titled **"Interprofessional education and practice guide: Sustaining interprofessional simulation using change management principles"** describes the step-by-step process of how sustainability was achieved. We have written it as a guide to demonstrate the process of how the WHIPLS (Women's Health Interprofessional learning by simulation) program was introduced as a pilot project. Due to its benefits noted by student and educators, it was decided to be continued, eventually forming a component of the curriculum for medical and midwifery students at Monash University.

6.3.3 How to overcome barriers to change

Barriers to continuing IPE as a curriculum, thereby hampering sustainability, may include funding issues, time-tabling and variable number of students enrolled in each course. These were some of the challenges that have been described in the literature(117) and also described in our paper. Other issues may be a lack of teaching resources or even awareness of the role of other professions in healthcare(118). Until institutions develop actively planned strategies to promote IPE, only continuing on a voluntary basis will not succeed in making these activities sustainable(119). These challenges prevent IPE programs in developing as a component of core curriculum.

6.4 Evaluation of programs for curriculum integration

Programs that are introduced using a theory-based approach to curriculum can evaluate if and what aspects of IPE are beneficial(16). There is plethora of literature on interprofessional initiatives introduced for the purpose of research (most of them assessing lower levels of Kirkpatrick's framework). However, very few studies address interprofessional programs that are evaluated as a part of the core curriculum.

Large scale IPE requires a careful choice of IPE activities with focus on individual learning goals in small groups(120). Mapping IPE competency with clear learning objectives and engaging leaders are necessary for sustainability (121). As an example, a best practice model (published by Bridges in 2011 from three universities) described a range of programs with each program demonstrating its own benefit. These were firstly, a didactic program to enhance knowledge about professional, team-based care and cultural impact, the second was a community-based program with focus on collaborative and patient-centered care in the community, and the third was a simulation-based program to teach clinical team-based skills including communication and leadership. All programs helped to develop participants' own professional identity and of other professions. These could only be achieved with support from institutions and colleges, by allocating dedicated staff and technological resources, curricular mapping and faculty training and support(122).

6.4.1 Curriculum integration of WHIPLS

In this paper we have modeled a systematic approach to achieving curricular integration. Our experience from inception of WHIPLS to its implementation, evaluation and embedding in curriculum can help other educators who want to advance their scope of IPE initiatives. The paper described in the following section is written in the form of a guideline on request of the editor in chief (currently under review). As far as we are aware, only a few studies have implemented the Kotter's 8-step in medical educational research; an example is "Anchoring interprofessional education in undergraduate curricula: The Heidelberg story" (65). We have been inspired by the recent use of this framework adapting the business model into healthcare education.

According to Kotter, the general learning is that most changes take time and go through the series of phases, all of which leads to slow transformation in affecting change. Kotter also warns the program developers and implementers that pitfalls at any step can result in significantly slowing down program success. We find the lessons from the Kotter's paper worthy of sharing and hope the readers of the paper will find it valuable for their practice.

The following section presents the guideline using the Kotter's 8-step process, with focus on the lessons that were learnt in process of embedding the WHIPLS program in the medical and midwifery curriculum at Monash University.

6.5 Declaration of Thesis Chapter 6 - Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles

Monash University

Declaration by candidate

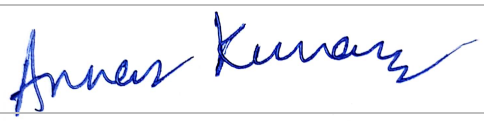
In the case of Chapter 6, paper titled, **"**Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles**"** the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
concept, paper draft, revision	70%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Fiona Kent	Editing paper	10%
Euan Wallace	Editing paper	4%
Gail Mclelland	Editing final draft	2%
Deirdre Bentley	Editing final draft	2%
Angela Koutsoukos	Editing final draft	2%
Debra Nestel	Supervision	10%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors.

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ORIGINAL ARTICLE

Interprofessional education and practice guide No. 9: Sustaining interprofessional simulation using change management principles

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ABSTRACT

Collaboration between teams is an essential component of patient safety in the complex ever-changing environment of healthcare. Collaborative practice requires training, which needs to start prior to registration for it to be established in the clinical workforce by graduation. Despite the perceived value and motivation of course coordinators, interprofessional training programs often struggle to sustain, due to various reasons related to logistics of timetabling, staff availability and/or absence of institutional support. We present a guide, outlining the lessons learned from implementing a sustainable change from our 6-year experience of the Women's Health Interprofessional Learning through Simulation (WHIPLS) program. The WHIPLS program was initially piloted to teach clinical skills in an interprofessional environment for pre-registration medical and midwifery students and has become a core component of the clinical curriculum. We describe the steps that were required to attain this outcome using the Kotter's 8-step plan for management change. The key lessons learned were *identifying overlaps in course curriculum, planning for leadership and implementation, creating institutional "buy-in", aligning with national goals, focusing on the learner, translating into routine clinical practice, keeping the program simple, accepting innovation and considering a strategic evaluation.*

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Curriculum; Kotter; medical; midwifery; obstetric; undergraduate

Background

The importance and value of interprofessional education (IPE) in healthcare is being increasingly recognised. In particular, interprofessional simulation programs are gaining popularity to increase learners' knowledge, skills, and attitudes and to concurrently facilitate working with other professions (Palaganas, Epps, & Raemer, 2014). In profession-specific contexts, simulation has been used to teach complex clinical skills and knowledge (Arias et al., 2016; Dabson, Magin, Heading, & Pond, 2014; Deering, Auguste, & Lockrow, 2013), with retention of skills reported up to a year after training (Crofts et al., 2013). Simulation also introduces learners to the collaborative skills required for effective interprofessional teams in the context of complex health care provision (Brock et al., 2013; Carpenter & Dickinson, 2011). Awareness of the roles and scope of practice of their own and others' professions, an understanding of communication styles and structural hierarchy provides a basis from which effective team practice can be developed (Foronda, MacWilliams, & McArthur, 2016; MacDonald et al., 2010). Hence, a culture of learning and working in a team environment is increasingly encouraged in clinical settings with the ultimate aim of improving patient care (Andreatta, Frankel, Smith, Bullough, & Marzano, 2011).

The majority of simulation-based IPE initiatives have been created for post-registration learners with less uptake or poor engagement in pre-registration courses (Rosenfield, Oandasan, & Reeves, 2011). However, IPE prior to qualification is also desirable, particularly in high stakes areas of practice with more studies needed in the pre-registration student group (Palaganas, Brunette, & Winslow, 2016). For example, conflicting perspectives among medical and midwifery staff regarding patient management have been described (Reiger & Lane, 2009). Many of these differences of opinion and distrust towards members of the other professional group are thought to be related to individual profession's perception of professional identities (Khalili, Orchard, Laschinger, & Farah, 2013). As the foundation of profession-specific beliefs starts at the pre-registration level, targeting attitudes and beliefs about professional identities should also start at this level (Sharpless et al., 2015). However, the introduction of IPE at the pre-registration level presents its own challenges (Lawlis, Anson, & Greenfield, 2014). Common hurdles include difficulty in alignment of curricula, learner-level compatibility, funding, scheduling, lack of institutional and administration support (Oandasan & Reeves, 2005) and lack of faculty preparedness for interprofessional teaching roles (Abu-Rish et al., 2012; Gilbert, 2005). In the workplace, clinical placements hold the potential for IPE but large student cohorts pose rostering challenges. Besides, each speciality has a different role in patient care (which may be exclusive to their profession) and the importance of understanding other professional roles at the pre-registration level may be

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undermined (Carlisle, Cooper, & Watkins, 2004). This may lead to reluctance in exploring opportunities to have joint teaching sessions with other professions.

Pilot studies of IPE for volunteer medical, nursing, and allied health students have been created for running in a classroom or in clinical workspaces, with the majority in operation for 5 years or less (Abu-Rish et al., 2012; Gough, Hellaby, Jones, & MacKinnon, 2012; Kent & Keating, 2015). Many of these programs that were originally initiated for research purposes (engaging only a small subset of a student cohort) are now increasingly being encouraged into routine educational practice (Cerra & Brandt, 2015). The challenge of sustainability is frequently cited (Berger et al., 2017). This can be addressed through mapping of educational curriculum (Nagelkerk, Coggan, Pawl, & Thompson, 2017) and embedding of interprofessional competencies (Goldman, Kitto, & Reeves, 2017). Studies describing long-term sustainable programs need to report more frequently (Anderson & Lennox, 2009; Lawlis et al., 2014), as many of these programs would either not be reported or fail to continue (Kumar et al., 2017). This raises the need for identifying clear pathways of embedding these learning programs into curricula (Wilhelmsson et al., 2009).

The focus of this guide is on the key messages learned from driving an organisational change. The change was to embed a simulation-based IPE program into a curriculum using Kotter's 8-step model (Kotter, 2007). We present a simulation-based IPE program in undergraduate medical and midwifery curriculum on core clinical skills in obstetrics and gynaecology - the Women's Health Interprofessional Learning by Simulation (WHIPLS) (Kumar et al., 2014). Although initial participation by students was voluntary, due to the success of the program it has been integrated into medical and midwifery curricula. Previous publications have demonstrated participants' perceptions of learning (improved confidence in performing these clinical skills) (Kumar et al., 2014), their change in attitude towards the other professional group three months after attending the program (Kumar et al., 2017) and knowledge attained through the program using pre-tests and post-tests (Kumar et al., 2017).

Overview of the WHIPLS program

The WHIPLS program was a joint initiative by the Department of Obstetrics and Gynaecology, Faculty of MBBS and School of Midwifery at Monash University and has been described in detail elsewhere (Kumar et al., 2014; Kumar, Nestel et al., 2017; Kumar, Wallace et al., 2017). Briefly, half-day workshops consisted of preparatory reading, a lecture, a pre-recorded video demonstration of the skills that were provided to the students for prior preparation followed by an experiential interprofessional skills workshop. The workshops provided hands-on experience in managing a woman in labour and conducting a normal birth as an interprofessional team and performing a gynaecology examination. Each workshop was conducted with groups of 6–8 medical and midwifery students using a simulation model (*Model Med, Melbourne, Australia)* and supervised by a medical and/or a midwifery facilitator. A pre-test (using multiple choice questions) was instituted prior to any intervention and a post-test was offered at the end of the program to capture the acquisition of knowledge and skills. A post-program survey with the use of a Likert scale and also open-ended responses was used to collect student feedback. A focus group was offered at three months (during which the medical and midwifery students had exposure to both clinical teams working in the birth unit) to assess a change in attitudes towards the interprofessional groups. A repetition of the test used earlier was carried out at the end of 6–9 months to assess retention of knowledge and skills.

Using Kotter's 8-step change model, we describe our experiences of embedding the WHIPLS program in medical and midwifery curricula over six years between 2012 and 2017. Kotter's change management model describes a step-wise approach to how a change can be initiated and eventually anchored in the existing curriculum. The justification for using the Kotter's model is based on the easy, intuitive step-wise application of the model, specifically designed for stakeholders (Steven, Sally, Jean-Luc, & Hisham, 2012). The process of embedding WHIPLS has resulted in increased interest in IPE learning by medical and midwifery students, in addition to facilitating faculty development for the program. During this period, 1579 medical and 331 midwifery students have been trained through the program. Sixty-eight tutors from the medical and 88 tutors from the midwifery faculty have facilitated the program. Through developing the WHIPLS program and achieving its sustainability in curriculum using the Kotter's 8-step process, we have identified key lessons (described below in italics along with Kotter's 8-steps) that are worthy of sharing with others who may benefit from the messages learned in this process. Figure 1 explains the relationship of these key-learning points in the context of the WHIPLS program.

Lessons learned

Approach to implementing the WHIPLS program using Kotter's 8-step change model to initiate change

Create a sense of urgency

Prior to the initiation of WHIPLS, medical and midwifery students were taught clinical skills directly on patients and without simulation. Learning on patients often created anxiety in students, which translated into students lacking confidence and heightened patient anxiety. Students were expected to communicate and reassure the patient, while they were learning a procedural skill and handling instruments. Traditionally, medical and midwifery students had some difficulties working together because they competed for the same learning opportunities on the same patients, often with increasingly limited opportunities. Not surprisingly, this led, at times, to conflict between them and faculty members with each advocating for their own students. Such dynamics undermined the need for the two professions to work together in this high stakes clinical space. These concerns were also voiced through faculty meetings/incident reporting, hence, putting pressure on course leaders to replace traditional teaching with more innovative techniques.

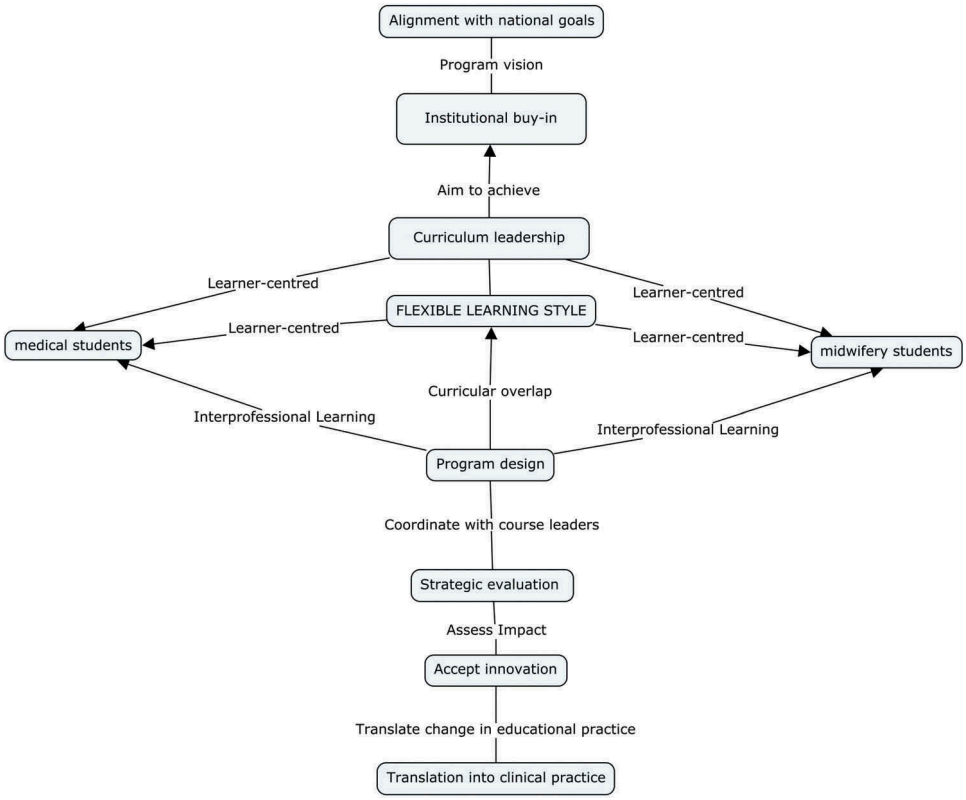

Figure 1. Organisational change- Key points.

Create a guided coalition

The medical and midwifery leaders considered the benefit of working together to teach clinical skills to students and to improve communication and understanding of interprofessional roles. These were thought to be effectively taught using a joint "workshop-style" session. Each profession's curriculum, variation in the course duration and content was assessed. Through various interprofessional meetings, appropriate timing of the delivery of the program in the courses was identified, based on course leaders' recommendations of when students needed to acquire these skills. A joint force-field analysis was undertaken to identify factors supporting and inhibiting the introduction of the initiative.

Lesson learned no. 1 - identify overlap in the course curriculum. The medical and midwifery course leaders identified common problems in student learning and formed an alliance to teach overlapping clinical skills together. A fundamental step was to match the core curricular content for the professions involved (Shrader et al., 2016). Identifying core curricular overlap and developing shared learning opportunities (creating coalition and sharing a vision) can be challenging. This is due to barriers like variable course calendars and unwillingness of faculty to work across sites and professional groups. Other additional challenges can be the presence of socio-cultural inhibitions, e.g. medical and midwifery students may not be comfortable to speak up in presence of members of the other profession (Luebbers, Dolansky, Vehovec, & Petty, 2017). An open-minded approach to understand other curricula and adapt to alter learning approaches is required for embedding such programs.

Create a vision for change

Once the gaps in the program for each profession had been identified, a steering committee with stakeholders representing the course leaders, faculty, clinicians, administrators, and student representatives was formed. The curriculum was blueprinted and learning objectives identified. The committee created a clear vision for what would become the WHIPLS program and a work plan with implementation timelines were created. The plan was described under the following categories:

a. Learning objectives
b. Timing of workshops in each curriculum
c. Frequency and duration of workshops
d. Faculty and administrative staff required to conduct the workshop
e. Budgeting the sessions – (equipment and consumables)
f. Evaluation strategy
g. Changes required to "embed" the program in curriculum

Lesson learned no. 2 - plan for leadership and implementation. As cited in Kotter's work, for change to occur, the course leaders need to be motivated and involved in taking ownership of the program delivery (Kotter, 2007; Rees & Johnson, 2007). The course leaders play a pivotal role in motivating their respective teams. A capable leader needs to support the faculty's capacity to

deliver teaching efficiently and manage conflict at an early stage (Ayres-De-Campos, Deering, & Siassakos, 2011).

Communicate the vision

The detailed plan of the WHIPLS program was discussed and piloted with small profession-specific student groups. Feedback from the student groups and faculty was used to guide further the educational design in the combined IPE workshop. The detailed plans, requirements, and expected gains were communicated to the leaders of the organisation (heads of departments of obstetrics and gynaecology and midwifery), clinicians in the health care network and to the students who would benefit from the initiative. Funding was acquired (for a limited time) through a small learning grant to promote interprofessional sharing of knowledge and skills.

Lesson learned no. 3 - create institutional "buy-in". For attaining institutional advocacy, the program needs approval from the senior faculty and executive members who continue to endorse and fund the ongoing program. As concluded in a large review, government and institutional support "outside the professional curriculum/boundaries" is minimal (Lawlis et al., 2014). This necessitates the programs to become an integral part of the core curriculum to ensure sustainability. WHIPLS is one of many programs introduced in Australia through an interprofessional learning grant in 2012, and one of the few to continue in operation. At an institution level, a Collaborative Care Curriculum has recently been established, with agreement reached on shared learning outcomes for collaborative practice across all health professional programs. Our evaluation to assess learning and sustained impact on participants' attitudes, facilitated the endorsement of our program by creating "short term wins" not just for the program coordinators but also for the institution (Hood, Cant, Leech, Baulch, & Gilbee, 2014).

Lesson learned no. 4 - align with national goals. In Australia, some health professional programs now require evidence of interprofessional learning activities within the curricula (Australian Medical Council, 2012; Australian Nursing and Midwifery Accreditation Council (ANMAC), 2012). In a recently published review, governance and centrality (strategic role of the central organisation) were cited to be some of the crucial components of promoting integrative care (Chung, Ma, Hong, & Griffiths, 2012). Our program (along with other programs in the Collaborative Care Curriculum at our institution) is aligned with guidelines provided by the Australian Medical and Nursing Council (Australian Medical Council, 2012; ANMAC, 2012).

Remove obstacles

The initial plan was revised after input from faculty and a wider group of stakeholders (clinicians, course administrators and students). The challenges were identified in the implementation of the workshop and actions taken to resolve them (Table 1).

Create short-term wins

The program was evaluated at multiple levels using the modified Kirkpatrick's 6-level framework (Freeth, Hammick, Reeves, Koppel, & Barr, 2008; Barr, Koppel, Reeves, Hammick, & Freeth, 2008). The lower levels of Kirkpatrick's framework refer to participant perception of the benefit of the program (Level 1) by obtaining student feedback. The short-term benefits were evaluated by collecting relevant information immediately before and after the program. Participants were asked about the program's relevance to their respective courses. The value of the skills learned in clinical practice was collected using a pre-test and post-test assessment of knowledge (Level 2b) (Kumar et al., 2017). The medium-term benefits were a change in students' attitudes towards teams (Level 2a) (Kumar et al., 2017) and retention of skills (Level 3) assessed 3–9 months after program attendance. These reports were shared with the leaders of the organisation, the WHIPLS faculty and the students through presentation in education conferences, department and executive faculty meetings, media reports and papers for publication. This was a key step in achieving "buy-in" to embed the program as a long-term gain. The institutional support led to a sustained change in educational practice, that we are now reporting as our evidence for Level 4a of Kirkpatrick's framework through this publication. The other long-term benefit is to patients resulting through the IPE training (Level 4b), which is more suited to IPE in clinical practice but was beyond the scope of our evaluation.

Lesson learned no. 5 - consider strategic evaluation. Programs that are either newly introduced or those seeking to be embedded in curricula benefit from strategic evaluation. The objective measure of a program's growth provides evidence for its success. Identifying "what works" and "why" is useful to provide direction to the evolving nature of the interprofessional program (Kent, Hayes, Glass, & Rees, 2017). Gaining insight into program objectives and if these are met is valuable for both student learning and faculty development. This information further assists in achieving institutional support and policy change. Using an evaluation framework (as we have demonstrated using the Kirkpatrick's framework) strengthens the study model and facilitates its generalisability to other programs. An underlying theory-based approach is also suggested to strengthen the evaluation of IPE. In our program, we have used Kolb's theory of experiential learning (Kolb & Kolb, 2005) and socio-material theory (Fenwick, 2014).

Consolidate improvements

The data collected through the evaluation and informal feedback from faculty and students were used to guide further changes in the program. Guidelines were revised to provide clearer guidance to the faculty. Changes to the teaching format were made based on faculty members' and students' suggestions. For example, frontloading the whole group attending a workshop with theoretical concepts and demonstration of skill (modelling for expert practice), while reserving small group teaching only for supervising students on manikins and for group discussions of clinical cases. This

Table 1. Description of issues, challenges, and solutions in relation to introduction of the WHIPLS program.

Issue	Challenges	Solutions
Learner-level compatibility	• Midwifery students were in the third year of the 3-year course and later a 4-year course • Medical students had just started their obstetrics and gynaecology placement in year 4 of the 5-year undergraduate medicine • Midwifery students were far more advanced in their learning on labour and birth than the medical students	• Learning about labour and birth was familiar to midwifery students but it was proposed to help in revision of the skill and learn relevant but new procedures like performing speculum examination. • Taking pap smears was new for medical and midwifery students and hence, considered beneficial for both groups. • Provision of readings and online videos prior to attendance at the workshop assisted in aligning students with different levels of knowledge.
Scheduling	• Due to the variation in course length and content, the timing of the program in the course was a challenge.	• WHIPLS program was scheduled at the commencement of the 9-week medical student rotation while midwifery students were rostered over eight sessions across the year. • Attendance was built into clinical placement rosters.
Extra facilitator time required from both professions	• Each session required extra time rostered for the facilitators	• The teaching load was shared across the professions. • A combination of medical and midwifery faculty maintained the interprofessional nature of teaching and both complemented each others' teaching content and style. • The roles of faculty were revised to include WHIPLS as a component of regular teaching and not viewed as an extra responsibility.
Maintain student engagement	Both groups of students needed to: • find the learning relevant • connect the workshop with their individual course content • engage in the learning style of the program	• The course content was aligned by the process of blueprinting the curricula. • The pre-reading material and watching online videos assisted the students to engage better with the manikins. • WHIPLS program content was tailored to address some of the assessment tasks that are required in their respective courses. • Interprofessional faculty helped to maintain attention and interest in both professional groups throughout the session.

helped to retain individualised supervision for students in spite of a large number of students attending the program.

Lesson learned no. 6 - focus on the learner. In a learner-centered program, students play an essential role in its acceptance and assessing relevance to their curriculum and/or assessment. The application of the acquired learning to clinical practice needs to be visible to participants at the time of attendance of the program to ensure engagement in learning (Brashers et al., 2016; Reeves, Perrier, Goldman, Freeth, & Zwarenstein, 2013). The learning objectives need to be clearly laid out for faculty and students' benefit. Modifications to the program are guided through faculty reflection, student feedback and through assessment of student learning.

Lesson learned no. 7 - keep the program simple: simplicity promotes sustainability. Initial introduction of an interprofessional program involves educational teams (that may or may not be familiar with each other) to develop a conjoint strategy that applies to members (students and faculty) of both teams. Moreover, clinical work environment is complex and discrete learning messages related to interprofessional learning may be lost due to various clinical distractions (Golec-Harper & Clifford, 2013). This uncovers the need to have simple, clearly defined learning objectives and expected outcomes outlined at the initiation of the program; even more relevant at the pre-registration level where students have had limited exposure to other professional groups. In our program, both groups of learners concentrate on "skills" and "tasks" together. As this was their first formal exposure to interprofessional practice, the learning outcome was limited to information sharing, providing peer support and learning about each other's practice. As the program develops further, increased complexity (preferably in small increments) may be considered.

Anchor the changes

The changes introduced were used to evolve the program accordingly. Once no further significant modifications were considered necessary, the course was integrated in the curricula for both disciplines, with consensus reached over a two-year period. This helped to enforce mandatory attendance of the program attained as a final step in its development. The "embedding" of the program in the curriculum has led to it running seamlessly with tutor roles "built in" their job profile to facilitate the workshops.

Lesson learned no. 8 - accept innovation. The course and institutional leaders, faculty and students need to be open to accepting change for achieving excellence in a program. The program itself may undergo repeated revision based on learner or faculty feedback, outcome of student/faculty assessment or following a program evaluation. Hence, an attitude of constantly improving teaching practice, based on the lessons learned, needs to be encouraged. According to Kotter, the cultural change occurs towards the end, and only after the value of embracing the innovation has been recognised (Kotter, 2007). Until acceptance to change has occurred, there remains the risk of reverting to previous practice. Hence, modification of the program and "consolidating

improvements" with an acceptance for things to change again, (if required), will make it easier to sustain teaching programs.

Lesson learned no. 9 - translate into routine clinical practice.
For long-term integration of the program, the students should be able to link the interprofessional learning with their clinical experience (Kumar et al., 2017; MacRae & Skinner, 2011). The systematic design of the program is likely to increase the chances of learning being applied by the students and this requirement needs to be met for all interprofessional groups. The link between learning and clinical practice is crucial for anchoring the clinical translational practice. In our program, we have introduced the program just prior to medical students starting clinical placements and when midwifery students were already undergoing clinical placements. Hence, both student groups had the learning opportunity to practice their newly developed clinical and interprofessional team-working skills.

Discussion

The integration of an IPE program into routine clinical placements has been described using the example of the WHIPLS program. The Kotter's 8-step strategy (Kotter, 2007) was found useful to inform and direct the organisational change required. Although the steps were initially used to describe a business model, they are equally useful to leaders in healthcare who wish to effect change. The learning from Kotter is that change will take time (Campbell, 2008) and often appears so daunting that it hampers the change process itself. Breaking the change process into small carefully planned and manageable steps facilitates and supports change, delivering outcomes faster (Tsuyuki & Schindel, 2008). Change also needs a driver; hence, creating a guided coalition to facilitate planning for leadership and implementation is a key step. Weiner's theory of organisational readiness also supports the two necessary ingredients for change. The first component is the resolve of the organisational members to implement change and the other is change efficacy, as to how the resources are mobilised and situational factors are altered/negotiated, to drive change (Weiner, 2009). Another interesting insight is introducing the change in small increments, so the benefit (or the lack of it) can be observed (Lewin, 1947). In relation to Kotter's 8-step model, we describe the "consolidation of improvements" by accepting repeated change guided through a learner-centered approach. In our program, the fluidity of the program was retained until it was finally acceptable and beneficial for faculty and students alike, following which the "anchoring of the changes" occurred.

The success of the WHIPLS program lies in it being "sustainable" leading to modification of educational practice. For this to occur, at the outset, it is important to identify learning deficits in uniprofessional programs that identify the need for the program to become interprofessional. In our case, it was the need to improve medical and midwifery teams' relationship, which created the urgency (Kumar et al., 2017). Recently, Berger and colleagues described the process of integration of interprofessional seminars in teaching Bachelor of Science and medical students (Berger et al., 2017). They described challenges similar to those we encountered, such as resistance to change by existing workforce, logistic problems of scheduling seminars and acquiring dedicated teaching space. These challenges were overcome by enablers, like securing state-level support. We also found that achieving "institutional buy-in" from the educational authorities assisted greatly in the process of embedding the program as has been documented before (Oandasan & Reeves, 2005). Using various measures to draw support, such as aligning with institutional and national guidelines and also undertaking a strategic evaluation helps to overcome organisational barriers and drive positive change (Cahn, 2014; Murphy & Keck, 2015). Evaluation also helps to guide which innovation to accept or reject in the program and creates concrete evidence to facilitate transfer of learning into educational/clinical practice.

Current progress and future directions

In this guide we use the example of WHIPLS (Kumar et al., 2014; Kumar, Nestel et al., 2017; Kumar, Wallace et al., 2017); a change was reported in students' attitudes towards the other professional team even after the students from the two professional groups had stopped interacting with each other. In another case based IPE program reported recently, 70% of students thought they would manage situations differently after attending the program (Nasir, Goldie, Little, Banerjee, & Reeves, 2017). Although the strain in professional relationships surfaces mostly when these graduates are functioning in clinical practice, building connections and improving interaction at a pre-registration level has been suggested to shape the future roles and professional identities (Hood et al., 2014; Thistlethwaite & Moran, 2010). The combination of these brief interprofessional encounters along with exposure to interprofessional teams in clinical placement may impact long-term change in attitudes and demonstrable behaviour of these students.

Through our guide, we offer practical suggestions that can be generalised for other IPE research programs and can be considered to form a component of IPE curricula (see additional key resources in the Appendix). Our easily adaptable model using Kotter's 8-step approach can be considered for guiding IPE programs elsewhere. The program has now run successfully for six years. The learning attained by the course providers through this initiative has informed the development of more IPE workshops between medical, nursing and pharmacy, physiotherapy, occupational therapy learners. An example of this is the introduction of an obstetric emergency workshop designed as an advanced learning skill for both medical and midwifery learners, a falls prevention workshop for a range of learners and a medication safety workshop for medical, nursing and pharmacy learners. We believe that integrating these programs in student curricula, combining clinical placement and the opportunity of informal interaction are the three key steps towards accepting interprofessional learning as a standard practice in the healthcare industry. We suggest further research in each of these areas to inform how IPE affects health care outcomes.

Declaration of interest

The authors report no conflict of interest.

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Appendix: Key resources

Below is a small selection of resources that were found helpful to evaluate and achieve sustainability of the WHIPLS program.

Kotter, J. (2006). Leading change. Boston, MA: Harvard Business School Press

Kotter, J. P. (2007). Leading change: Why transformation efforts fail. Harvard Business Review, 85(1), 96–103

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Lewin, K. (1947). Frontiers in Group Dynamics: Concept, Method and Reality in Social Science; Social Equilibria and Social Change. Human Relations, 1(1), 5–41. doi: 10.1177/001872674700100103

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Monash University WHIPLS resources available on request from the corresponding author (AK).

Chapter 7

Impact on clinical outcome: Level 4b of Kirkpatrick's framework

Kumar, A., Sturrock, S., Wallace, E. M., Nestel, D., Lucey, D., Stoyles, S., . . . Dekoninck, P. (2018). Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study. BMJ Open, 8(2), e017451. doi: 10.1136/bmjopen-2017-017451

7.1 Introduction

In this chapter, I present our work on the Practical Obstetric Multiprofessional Training (PROMPT) program. This program was introduced at our health service to improve medical and midwifery staff performance in managing obstetric emergency situations with intent to improve patient outcome. In the first section, I present my perspective on why clinical outcomes are not often reported. I also discuss the use of Kirkpatrick's model at multiple levels with a consideration of sequential use of the various levels. In the latter section, I present our paper published to evaluate the PROMPT program that used multiple levels of Kirkpatrick's framework with focus on reporting a change in clinical outcome.

7.2 Studies reporting clinical outcome

Studies on use of simulation showing effect on clinical outcome are scarce. Team training with simulation has been the mainstay of up-skilling health professionals involved in birth emergency for almost two decades. However, program evaluations have frequently concentrated on learner satisfaction and team-attitudes and occasionally on

knowledge/skills acquisition and to a small extent on retention of clinical skills. But, very few programs describe a change in patient outcome.

7.2.1 Reasons why clinical outcomes are not often reported

Some reasons explaining why this gap exists in evaluation are due to:

- Lack of planning resources assessing patient outcome before and after "implementation of training"
- Dilution of the effect of simulation training by other risk management processes
- Duration of running training programs before clinical patterns in patient outcome can be observed
- Inability to establish a cause-effect relationship between training and clinical outcome

7.3 Reporting multiple levels of evaluation of Kirkpatrick's framework

Due to the above listed limitations, many studies fail to report a change in clinical outcome. Even when clinical outcome is reported, it is difficult to establish "if" the change in outcome occurred due to the simulation-based training. In order to assess if the learning program was effective in improving the outcome, we attempted the use of multiple levels of Kirkpatrick's framework to produce evidence at various levels that may show a contribution of improved learning and performance resulting in an improved clinical outcome. On observing the benefit at various levels of Kirkpatrick's framework, we hypothesise that the improved clinical outcome was likely due to participant perception of self-confidence and the learning acquired from the program, although it was difficult to establish a sequential association.

7.4 Sequential Kirkpatrick's model

Hughes et al proposed a sequential Kirkpatrick's model to demonstrate this association. Their meta-analysis showed that there was improvement at all levels of the Kirkpatrick's framework(87) that included participant reaction, learning, transfer and results. Alliger et al had suggested a sequential role that if participants reacted positively to the training,

it is likely to result in learning, leading to transfer of that learning to performance, and hence better outcomes can be achieved(123). Further work by Hughes et al proposed a progressive model, where a direct relationship of healthcare training exists with each of the variables independently, that are participant reaction, learning transfer and results. The sequential chain that suggests reaction affects learning and learning further affects transfer complements this relationship. This transfer of learning eventually leads to improved results.

7.4.1 Association between student reaction and learning

Positive participant reactions (demonstrated by satisfaction with the learning program, perception of confidence and acquired knowledge or skills) are likely to improve engagement in the activity with evidence of declarative knowledge and affective learning. Sitzmann proposes a Training Engagement theory (124) that explains a temporal association of creating learning goals, prioritising them and persisting during goal striving as evidence for training effectiveness. They suggest using multi-level predictors to assess the success of training using within person, between-persons and a macro-level assessment to get insight into training effectiveness.

7.4.2 Association between learning and change in practice

The association between learning and transfer may be linked to repeated practice. If learning is used as a regular process of up-skilling e.g. learning surgical procedure that is practiced in simulation, it is likely that these procedures will also be translated in a clinical environment(125). As per the paper published by Hughes(87), the pathway from training to patient outcome (in the sequential team training model in healthcare) was seen to be mediated by learning and transfer. In the paper, this sequential chain was observed to begin from learning rather than reaction. However, when the traditional training model was assessed in the same study, the mediation went from reaction, learning, transfer and results.

These findings provide justification for us to use the Kirkpatrick's model to demonstrate the effectiveness of our program. In all three programs, (WHIPLS, home birth study and the PROMPT), we have demonstrated a positive gradient in participant satisfaction and

learning. In the home birth program, we have demonstrated a change in practice and performance (behavior) and in the PROMPT study, a minor but noticeable improvement in the management of major postpartum hemorrhage.

In the following section, we present the paper on evaluation of the PROMPT program titled **"Evaluation of learning from Practical Obstetrical Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: A mixed methods study"** which was published in BMJ Open in 2018.

7.5 Declaration for Thesis Chapter 7 - Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study

Monash University

Declaration by candidate

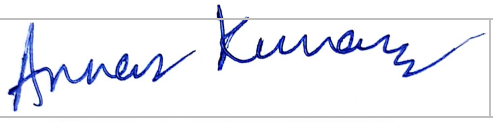
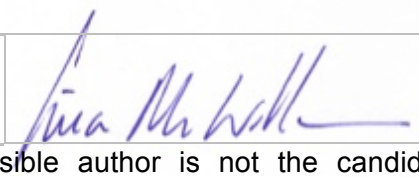
In the case of Chapter 7, **"Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study"**, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Concept, data collection, data evaluation, writing first paper draft	70%

The following co-authors contributed to the work. If co-authors are students at Monash University, the extent of their contribution in percentage terms must be stated:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Sam Sturrock	Data collection, analysis	4%
Euan Wallace	Concept, editing paper	4%
Debra Nestel	Editing final draft	2%
Donna Lucey	Intervention	2%
Jenny Morgan	Intervention	2%
Sally Stoyles	Intervention	2%
Peter Neil	Intervention	2%
Michelle Schlipalius	Intervention	2%
Philip Dekoninck	Data analysis	10%

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work*.

Candidate's Signature		**Date: 16/05/2018**
Main Supervisor's Signature		**Date: 15/05/2018**

*Note: Where the responsible author is not the candidate's main supervisor, the main supervisor should consult with the responsible author to agree on the respective contributions of the authors.

BMJ Open

Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study

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ABSTRACT

Objectives The aim of this study was to evaluate the implementation of the Practical Obstetric Multi-Professional Training (PROMPT) simulation using the Kirkpatrick's framework. We explored participants' acquisition of knowledge and skills, its impact on clinical outcomes and organisational change to integrate the PROMPT programme as a credentialing tool. We also aimed to assess participants' perception of usefulness of PROMPT in their clinical practice.

Study design Mixed methods approach with a pre-test/post-test design.

Setting Healthcare network providing obstetric care in Victoria, Australia.

Participants Medical and midwifery staff attending PROMPT between 2013 and 2015 (n=508); clinical outcomes were evaluated in two cohorts: 2011–2012 (n=15 361 births) and 2014–2015 (n=12 388 births).

Intervention Attendance of the PROMPT programme, a simulation programme taught in multidisciplinary teams to facilitate teaching emergency obstetric skills.

Main outcome measure Clinical outcomes compared before and after embedding PROMPT in educational practice.

Secondary outcome measure Assessment of knowledge gained by participants through a qualitative analysis and description of process of embedding PROMPT in educational practice.

Results There was a change in the management of postpartum haemorrhage by early recognition and intervention. The key learning themes described by participants were being prepared with a prior understanding of procedures and equipment, communication, leadership and learning in a safe, supportive environment. Participants reported a positive learning experience and increase in confidence in managing emergency obstetric situations through the PROMPT programme, which was perceived as a realistic demonstration of the emergencies.

Conclusion Participants reported an improvement of both clinical and non-technical skills highlighting principles of teamwork, communication, leadership and prioritisation in an emergency situation. An improvement was observed in management of postpartum haemorrhage, but no significant change was noted in clinical outcomes over a 2-year period after PROMPT. However, the skills acquired by medical and midwifery staff justify embedding PROMPT in educational programmes.

Strengths and limitations of this study

- ► This is one of the few mixed methods studies on evaluation of training programmes using multiple levels of Kirkpatrick's assessment capturing participant reaction, knowledge acquisition, organisational change and patient outcome.
- ► This is an outcome-based evaluation using the high levels of the Kirkpatrick's framework (evaluating impact on the health service and patient outcome) providing evidence of training effectiveness.
- ► The participants' behaviour (under direct observation or by using videos) could not be studied in either simulation or a clinical setting.

INTRODUCTION

Interprofessional team-based, simulated training programmes are becoming increasingly popular to improve the performance of clinical workforce in emergency responses and its resultant clinical outcomes. The provision of high-quality birth suite care is no exception. Staff training in technical clinical skills is put to test in complex obstetric situations that require time critical management. Team members must be instantly engaged to achieve synergism in managing acute obstetric emergencies. Hence, acquisition of non-technical skills (NTS), such as effective communication and teamwork, are as important as mastering 'hands-on' clinical skills.[1]

Table 1 Modified Kirkpatrick's framework (adapted from Barr's six-level classification)

Level 1	Participant reaction	Learners' views on the learning experience and its interprofessional nature
Level 2a	Change in attitudes	Changes in attitudes towards team members of the interprofessional groups
Level 2b	Change in knowledge or skills	Including knowledge and skills related to the interprofessional activity
Level 3	Behavioural change	Identify individual transfer of interprofessional learning
Level 4a	Change in organisational practice	Wider change in organisational practice and delivery of care
Level 4b	Change in clinical outcome	Improvement in change in patient care

*Adapted with permission from Barr *et al*.[2]

Interprofessional education (IPE) focuses on 'staff members working together to learn *with*, *from* and *about* each other'.[2] IPE programmes help individuals to develop an understanding of other professional roles within the multidisciplinary team. Such an understanding is thought important for safe and effective clinical practice as a team.[3] In order to maintain a level of confidence in managing these difficult clinical emergencies, regular up-skilling sessions are necessary.

PRactical Obstetric Multi-Professional Training (PROMPT) is a multiprofessional training package designed to expose participants (obstetricians, midwives, paediatricians and anaesthetists) to obstetric emergencies in a real-time environment.[4–8] This simulation-based programme aims to recreate clinical problems either 'in-situ' in a birth unit or in a simulation centre and presents them to participants as realistically as possible. The scenarios can be designed specifically for the level of the participants and the available facilities. Evaluation of these programmes is necessary to assess if their objectives are met. Programmes can be evaluated using various frameworks, one of them being the six-level modification of Kirkpatrick's framework.[2 9 10] The various levels assess participant's satisfaction, change in attitude or identification of what was learnt, if these skills changed participant behaviour in a clinical setting or ultimately affected clinical organisational change and patient outcomes (see table 1).

We introduced the Victorian state version of the PROMPT programme to our maternity service in 2013.[11] In this study, we aimed to evaluate the impact of PROMPT in our health service by assessing the various levels in the six-level framework. Specifically, we wished to identify the 'key learning points' acquired, 'how' useful this workshop style teaching was rated and whether there was any evidence of change in patient outcomes. We also describe the process of 'embedding' this programme in educational up-skilling of staff.

METHODS

Study design

The study follows a mixed methods design with quantitative analysis of patient outcome data and for participant rating of the intervention. The data regarding the key learning messages was extracted using qualitative content analysis identifying key themes.

Setting and participants

Monash Health maternity service provides birthing care for over 9000 women annually at three separate hospital sites, each with different levels of acuity, all within metropolitan Melbourne, Victoria. The three sites share common clinical practice guidelines, policies and procedures. Monash Health implemented the PROMPT programme in its current format across all its sites since 2013. Midwifery educators and dedicated senior obstetric medical staff run the programme. The PROMPT sessions are conducted 10 times per year at each site at monthly intervals. Midwifery and medical staff (junior and senior) are required to participate at least every 2 years. All medical and midwifery staff who had attended the PROMPT session at least once between 2013 and 2015 were invited to participate in the study.

PROMPT programme scenarios

The half-day programme consists of short, interactive lectures and scenario-based drills. Each drill is followed by a debrief covering clinical skills and NTS. The clinical scenarios include eclampsia, shoulder dystocia, neonatal resuscitation and postpartum haemorrhage (PPH). These are topics that were already covered in the prereading material provided to the participants.

Questionnaires

The evaluation of the PROMPT workshop followed a pretest and a post-test research design using paper-based questionnaires. The questionnaires were drafted, revised and agreed on by the PROMPT committee (represented by both medical and midwifery educators) to establish content validity. The questionnaires had been pilot tested in a home birth-based simulation programme (in a different participant group that included home birth midwives) at Monash Health, and results were published in a peer-reviewed journal.[12] Each questionnaire had 26 items where participants' responses are recorded using a 5-point Likert scale. The pretest evaluated levels of knowledge and confidence managing the obstetric emergencies covered. They are also asked about participants' professional background and experience in these clinical emergencies. At the end

of the workshop, the post-test evaluated the satisfaction and learning acquired from the programme. Participants were also asked to reflect on the essential learning points attained that were thought to be transferable to their (individual or team based) clinical practice using free text.

Textual data were analysed independently and inductively using content analysis undertaken by two researchers independently (AK and SamS) to produce key themes.[13] The results were discussed, and after establishing consensus, all data were recoded. Some categories overlapped. but items were counted only once. Discrepancies were negotiated enabling final attribution of text within categories.

Clinical outcome measures

A retrospective cohort study examined all documented cases of the three major obstetric emergencies covered during the drills (eclampsia, shoulder dystocia combined with neonatal resuscitation and PPH). Clinical outcomes were evaluated in two cohorts: before the implementation of PROMPT in 2011–2012 (n=15 361 births) and after the implementation of PROMPT in 2014–2015 (n=12 388 births). Patient outcomes were evaluated using the following measures. For shoulder dystocia, we measured the use of external and internal manoeuvres, time between delivery of the head and the body, completion of documentation, major maternal perineal trauma (third and fourth degree tears) and neonatal outcomes including brachial plexus injury, clavicle or humerus fracture, Apgar score <7 at 5 min, umbilical cord lactates >8 mg/dL, admission to newborn services and perinatal death. For PPH, we classified women into two groups according to the estimated volume of blood loss (1000–1499 mL or ≥1500 mL) reporting rates of blood transfusion, transfer to the operating theatre, intravenous fluid resuscitation and use of a (Bakri) balloon tamponade.

Data were extracted from an electronic database of birthing outcomes, the Birthing Outcomes System (BOS), which records outcomes for all births ≥20 weeks of gestation and is routinely entered by midwifery staff.[14] Where necessary, BOS data were supplemented by individual case record review.

Statistical analysis

Data were analysed with Prism for Mac V.7.0a (GraphPad software, San Diego, California, USA). Continuous data were expressed as medians and IQR because of skewed distributions. To compare the two cohorts, we used a Mann-Whitney U test for quantitative data and a Fisher's exact test for contingency testing. A P value <0.05 was considered statistically significant.

RESULTS

Participation

Since 2013, we have run 70 PROMPT sessions across our three sites with a total of 508 participants. Approximately one-third (n=178, 35%) of participants were medical staff (junior and senior). The remaining were midwifery staff (n=287, 56%), medical or midwifery students (n=34, 7%) or special care nursery staff (n=9, 2%). By 2015, 76% midwives and 90% senior medical staff had participated at least once in PROMPT.

Satisfaction with the simulation activity (level 1 Kirkpatrick's framework)

Figure 1 summarises the participant knowledge, confidence and prior experience in managing obstetric emergencies. Staff confidence in management of eclampsia was lower than that for the other obstetric emergencies. The confidence and knowledge concerning neonatal resuscitation was higher for midwives than the medical staff (figure 1). In general, the workshops were rated highly by both medical and midwifery participants (median Likert score of 5 (maximum) for both groups) in regards to clinical usefulness of material covered and debriefing experience.

Knowledge acquired from the workshop (level 2b Kirkpatrick's framework)

Four hundred and thirty comments made by 237 participants were available for content analysis (table 2). The key themes related to improved communication between staff members (n=87), developing knowledge of equipment and procedures (78 responses), learning leadership and followership (73 responses), being in a supportive learning environment (63 responses), the realism of the simulation (48 responses), understanding the roles of staff from another profession (46 responses) and prioritisation of tasks (33 responses).

Communication

Clear communication established directly with the members of the team (by using the individual's name) and with others who assist in the process, for example, with switchboard calling an emergency code. Where appropriate, specific terminology should be used. The loop of communication should be closed by obtaining a response from the recipient to ensure accountability of the individual undertaking the task. The communication was seen to be even more crucial at certain times like the handover of a task to another member of the team.

Situational awareness

Identification and knowledge of equipment, its location in the birth unit, organisation of the equipment and knowing if it was in working order was recognised as relevant for the staff using it in an emergency with time constraints. A prior familiarity of content and a practice of using the postpartum and eclampsia kit were found to be essential. Necessary gear found missing at the time of workshop or kept in the wrong location, delayed the management and caused stress to the team.

Similarly staff members were keen to have a prior awareness of protocols and procedures, more so in complex situations like eclampsia and neonatal resuscitation and where clinical manoeuvres were needed like shoulder dystocia. The organisational pathways needed like calling an emergency code and methods

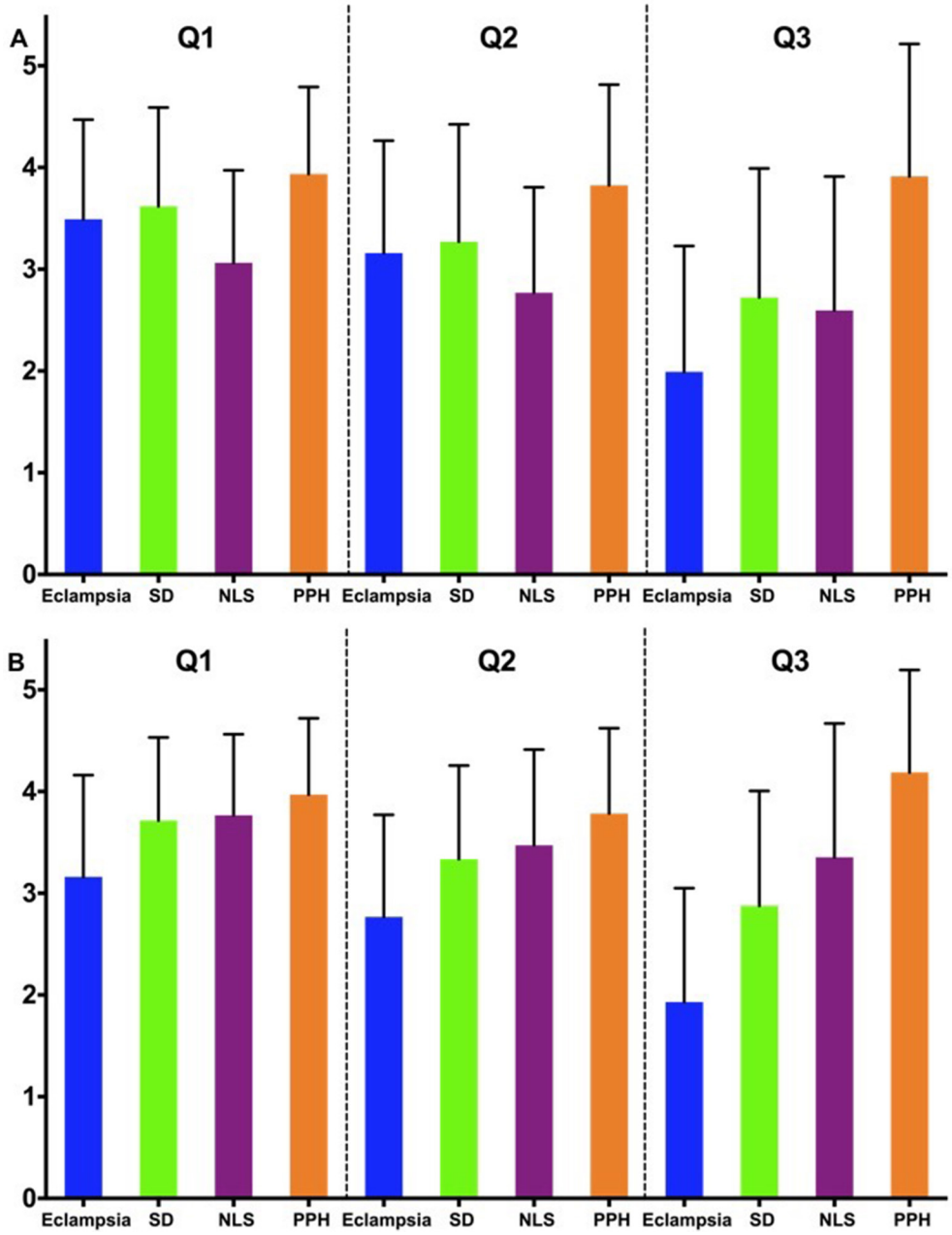

Figure 1 Bar diagrams showing level of knowledge (Q1), confidence (Q2) or prior experience (Q3) of medical staff (top panel) and midwifery staff (bottom panel) in dealing with eclampsia, shoulder dystocia, neonatal resuscitation (NLS) and postpartum haemorrhage (PPH). Numbers 1–5 on the y-axis denotes Likert scale rating, where 5 is the highest rating.

to access operating theatres in an emergency were also emphasised.

Learning leadership and followership

The importance of leading an emergency team presented as an unexpectedly prominent theme. The key characteristics of a leader were to maintain a 'helicopter view' at all times and be clear and assertive with instructions to participants. it was considered important to establish and announce who the leader of the team was (either by the leader or another participant) and appoint one if already not designated. The leader could change during the emergency scenario depending on individual capability and who was available. Handover from one leader to another needed clear communication. In such situations, the new leader should initially 'step back' and assimilate the situation prior to taking over.

The rest of the team should patiently wait for instructions, offer to help (based on their individual scope of practice) and contribute to the team management by playing their designated role. If the instructions were unclear or participants were unable to perform the allocated task, they should speak up and close the communication loop.

Supportive learning environment

The PROMPT workshop was acknowledged to improve participants' confidence and learning of clinical knowledge and skills through individual opportunity to practice

Table 2 Learning acquired from the PROMPT programme

Theme	Responses	Comments
Communication	87	'*Allocating task to a certain individual and not to someone!*' '*Use closed loop communication*' '*Use team members' names*' '*Use specific terminology*' '*Effective communication between team members leads to effective management*' '*Communication becomes even more important in an emergency situation*' '*Asking who is in charge (of the situation)*' '*To ask what's happening for documentation, to tell when observations/anything is to be done*'
Knowledge of equipment and procedure	78	'*I learnt where things are kept so they can be accessed immediately in an emergency*' '*Familiarity with the ward and procedures to initiate emergency responses*' '*Need to spend time learning to hook up the resuscitation cot to the gases in birth rooms*' '*Using the resuscitaire, turning it on*' '*Familiarise yourself with the content of the emergency boxes*' '*It was difficult to find the equipment like the IV pump for the simulation. I understand we need to know where these things are*'.
Learning leadership and followership	73	'*Put hand up if free when already completed a task in an emergency situation*' '*It's ok to not have a job and wait*' '*Learned to identify the importance of clarifying leadership role in every scenario*' '*Step in with a helicopter leader role*' '*Ask who is the leader/what is going on/what can I do?*' '*I needed to be more assertive as team leader*' '*Clear instructions and explicitly determining who the emergency leader is*'
Supportive learning environment	68	'*Useful to practise these things in team prior to the real deal*' '*It consolidated training/knowledge that I have come across in pieces*' '*It identifies my weaknesses so I can work on them*' '*Learning about eclampsia and PPH in a relaxed environment*'
Realism in simulation	48	'*Having a serious actress helped to keep it real*' '*Stay calm in a stressful emergency*' '*Practical experience of emergencies we don't normally get to manage*'
Interprofessional roles and teamwork	46	'*Teamwork improves working together*' '*My specific role as a RMO (junior doctor) in an emergency situation….*' '*….taking on roles/tasks that I can do instead of RMO*' '*That you could have a small role that makes up effective care*'
Prioritisation	33	'*(checking) Fetal heart rate during eclamptic fit is not a priority*' '*Think of first line of management in a maternity emergency*' '*IV fluids very important in PPH, possibly more than drugs*' '*The importance of airway and fluid resuscitation*' '*The first steps in managing an eclamptic woman*'

PROMPT, Practical Obstetric Multi-Professional Training.

and team feedback. In a simulated setting, the technical skills and procedures could be 'unpacked' into small steps during the feedback session. The combination of learning emergency skills in a simulated environment was seen as a step towards improving women safety.

Realism in simulation

The participants perceived the workshop to be similar to a real emergency through the role of an actor, scenario design, experiencing stress, working within timelines and location in a birth unit. The scenarios were based on rare emergencies and followed an unpredictable course resulting in participants feeling anxious and voiced the need to 'stay calm'.

Role of interprofessional staff

Participants displayed a preference to revert to their natural/usual clinical roles when managing a clinical emergency as this was based on their strengths and scope of practice. The participants wanted to have a clear, well-defined role allocation that was 'task specific'. Both medical and midwifery staff members were keen to share learning in the interprofessional setting and wanted to understand roles of the other discipline in the team. Both teams referred to learning teamwork and task sharing.

Prioritisation

Participants demonstrated a need to organise the tasks systematically and to get help early. They emphasised on

timely escalation of tasks due to their awareness of their limitations in managing emergency situations and their scope of practice.

Organisational change to 'embed' the PROMPT programme (level 4a Kirkpatrick's framework)

We describe the process of embedding the PROMPT programme using Kurt Lewin's three-phase model.[15]

Step 1: unfreeze

The key issue of poor communication (occasionally leading to conflict) among medical and midwifery staff was recognised through incident reporting as a component of a risk management process. This was seen to delay mobilising resources required in an emergency setting, hence compromising optimum patient safety. In a time critical situation, where effective teamwork is the key, a need to create change was recognised by medical and midwifery leaders at the institution. The need to change was communicated both to the healthcare network executive group and to the clinical staff delivering patient care. This coincided with introduction of the PROMPT programme in the state of Victoria resulting in strategic inclusion of the team-training programme for medical and midwifery staff.

Step 2: change

The change described here is embedding the PROMPT programme as a component of routine educational practice. The principles learnt through the programme focused on communication, leadership and situational awareness, similar to the vision shared by the institution. The benefits of attending the programme were communicated to the staff and feedback encouraged from participants. Problems that hindered attendance (like rostering issues and managing patient workload on teaching days) were dealt with promptly. Funding was obtained from the institution by reporting benefits of change in attitude of interprofessional staff and observed improvement in performance, although this was not formally evaluated. This funding further facilitated the operational management of the programme, as dedicated clinical staff members could be employed to sustain the quality of teaching.

Step 3: refreeze

The observed improvement in attitudes of the interprofessional staff and effort to meet higher standards of clinical practice was encouraged. Leadership and operational support required to run the programme was improved (by increasing the numbers of faculty members facilitating the programme), and ongoing training support was provided to them. A process of providing team-based feedback was developed (using the PROMPT guidelines), and the role of learning through PROMPT was formalised, which lent itself to its use as credentialing tool. A mandatory requirement of 2 yearly attendance was set up for all medical and midwifery staff.

Table 3 Shoulder dystocia

	2011–2012	2014–2015	P value
Cases, n (%)	268 (1.7)	290 (2.3)	0.001
Live born, n (%)	268 (100)	290 (100)	1.00
Internal manoeuvres, n (%)	51 (19)	54 (19)	0.91
Interval between head and body	2.0 (IQR 1–3)	2.0 (IQR 1–2)	0.04
Brachial plexus injury, n (%)	17 (6)	10 (3)	0.12
Fracture*, n (%)	14 (5)	7 (2)	0.12
Apgar <7 at 5 min, n (%)	21 (8)	15 (5)	0.31
Lactate >8 mg/dL, n (%)	12 (4)	22 (8)	0.16
Admission SCN/NICU, n (%)	87 (32)	74 (26)	0.08
Major perineal trauma, n (%)	31 (12)	27 (9)	0.41
Third degree tear, n (%)	28 (10)	26 (9)	0.48
Fourth degree tear, n (%)	3 (1)	1 (0.3)	0.36
Management sheet completed, n (%)	63 (24)	48 (17)	0.04

*Humerus or clavicle.
NICU, neonatal intensive care unit; SCN, special care nursery.

Clinical outcomes (level 4b Kirkpatrick's framework)

In 2011–2012, there were 15 361 births, and in 2014–2015, there were 12 388 births at Monash Health.

Eclampsia

Across the 4 years, four women had an eclamptic seizure, two in 2011–2012 (0.13/1000) and two in 2014–2015 (0.16/1000). All four women were managed as per local protocol.

Shoulder dystocia

Table 3 summarises the incidence and outcomes related to shoulder dystocia. The rate of shoulder dystocia in 2011–2012 (n=268; 1.7%) was significantly lower than in 2014–2015 (n=290; 2.3%, P=0.001). No neonatal deaths were recorded in either group. The interval between delivery of head and body was shorter in the recent cohort (2.0 min (IQR 1–2) vs 2.0 min (IQR 1–3), P=0.04). In the cohort after implementation of PROMPT, we observed lower incidences of brachial plexus injury, humerus or clavicle fractures, low Apgar scores and nursery admissions, although these differences were not statistically significant (table 3). There was a significant decrease in the completion of the required shoulder dystocia emergency 'management sheet' (24% vs 17%; P=0.04).

Table 4 Postpartum haemorrhage 1000–1499 mL

	2011–2012	2014–2015	P value
Cases, n (%)	561 (3.7)	511 (4.1)	0.09
CS, n (%)	196 (35)	176 (34)	0.90
Transfer to theatre after vaginal birth, n (%)	65 (12)	76 (15)	0.12
Intravenous access before theatre, n (%)	260 (99.6)	252 (100)	1.00
Bakri balloon, n (%)	2 (0.4)	6 (1)	0.16
ICU admission, n (%)	0	3 (0.6)	0.12
RBC transfusion, n (%)	65 (12)	75 (15)	0.15

CS, caesarean section; ICU, intensive care unit; RBC, red blood cells.

Postpartum haemorrhage

For women with a PPH of 1000–1499 mL, there was no significant change in the number of cases between cohorts (n=561 (3.7%) vs n=511 (4.1%)), and no significant differences were observed in maternal outcomes or management strategies. For women with a PPH of >1500 mL, a significant difference was seen in the number of patients transferred to theatre after vaginal birth (30% vs 38%; P=0.049) and the use of Bakri balloons (6% vs 12%; P=0.02), which were introduced in 2011 (tables 4 and 5).

DISCUSSION

Main findings

Through a formal evaluation of PROMPT and a review of clinical outcomes, we have observed that this multidisciplinary training has a positive effect on managing of obstetric emergencies within our service. Consistent with mandatory workforce training requirements, participation of both medical and midwifery staff was excellent across all of our sites such that PROMPT has become an embedded component of ongoing professional development. In this paper, we have evaluated our PROMPT programme using the various levels of Kirkpatrick's framework, observing encouraging results. All levels examined showed positive effects after implementation of this structured training. In addition, the evaluation allowed us to identify areas for future improvement such as record keeping of therapeutic measures.

Table 5 Postpartum haemorrhage >1500 mL

	2011–2012	2014–2015	P value
Cases, n (%)	329 (2.2)	287 (2.3)	0.48
CS, n (%)	101 (31)	64 (22)	0.03
Transfer to theatre after vaginal birth, n (%)	99 (30)	108 (38)	0.049
Intravenous access before theatre, n (%)	199 (99.5)	171 (99.4)	1.00
Bakri balloon, n (%)	21 (6)	34 (12)	0.02
ICU admission, n (%)	23 (7)	24 (8.3)	0.55
RBC transfusion, n (%)	156 (47)	149 (52)	0.29

CS, caesarean section; ICU, intensive care unit; RBC, red blood cells.

Participants found PROMPT an effective approach for the acquisition of new skills and knowledge. Medical and midwifery staff members reported an increase in confidence and had high satisfaction scores on learning as a team (level 1 Kirkpatrick's framework).

Our next level of assessment focused on key 'take-home' learnings acquired by the participants (level 2 Kirkpatrick's framework). Communication and situational awareness were considered important NTS learnings by the majority of participants and is a finding consistent with other studies.[5 6] The themes on 'leadership' and 'following the leader' are thought critical for safe team-based management, both in simulated and real emergencies.[6 16] Poor performance in leadership despite good communication can also occur, hence, making leadership an independent learning goal of the workshop.[17] Developing improved 'situational awareness' with knowledge of equipment use and efficient use of team members is an often-reported learning outcome of the PROMPT programme.[5]

Our final analysis reviewed the birthing outcome and safety data (Kirkpatrick's level 4b). In the recent cohort, we observed a significantly increased incidence of shoulder dystocia. This could be related to an increased awareness of this condition but could also reflect the increasing numbers of obese pregnant women delivering at our centres. We observed a small but statistically significant difference in the interval between the delivery of head and body, the clinical relevance of which is debatable. These could be assessed individually using case reviews and learning gaps addressed through clinical case review meetings. The significant increase in the number of patients transferred to theatre for control of massive postpartum bleeding (PPH >1500 mL), and the increase in the use of (Bakri) balloon tamponade may reflect a greater awareness of the benefits of early and aggressive control of excessive bleeding following our PROMPT implementation. This was also noted in a recent randomised control trial where the units that participated in simulation based team training had a higher incidence of blood transfusion and surgical treatment of PPH.[8]

Strengths and limitations

The current study is one of few mixed methods studies attempting to draw a link between perceived learning, clinical practice and outcomes by using various levels of Kirkpatrick's framework. As far as we are aware, only a few studies have evaluated simulation-based intervention through multiple 'lenses' of assessment, as reported in a

recent review on obstetric emergencies.[18] Most researchers have limited evaluations to either level 1 or 2 with some studies demonstrating a change in team behaviour and retention of skills.[19] Studies looking at clinical outcome are scant.[8 11 18 20] Our evaluation includes participant satisfaction with the scenario and debrief (level 1), and learning skills and knowledge acquired by the two major interprofessional groups (level 2). We demonstrate the process from introduction of the intervention and its 'embedding' in curricular training and 'credentialing' (level 4a). The PROMPT programme has been successfully integrated with teaching programmes globally; however, the description of the programme with change management principles is worthy of sharing. Above all, we have also compared the birthing outcome before and after the intervention was introduced into practice (Level 4b).

However, due to challenges related to study design that entails direct observation of participants in a 'natural' setting, we were unable to assess a change in observed clinical behaviour/teamwork that may have helped to directly connect workshop learning with clinical practice, which may be done using clinical checklists.[21]

Patient care and clinical outcomes are rarely reported as evidence of effectiveness of educational programmes.[22] Most likely this is because programmes need to be embedded prior to evaluation and coverage of a sufficient proportion of the workforce needs to be achieved before improved care and outcomes would be expected. This can take many years.[23–25] An evaluation of the PROMPT programme elsewhere demonstrated a significant decrease in brachial plexus injury, incidence of pH less than 7 and a reduction of hypoxic ischaemic encephalopathy by 50% when assessed over a 7-year interval.[20] We were unable to explore detailed outcome data prior to 2010 as previously documented notes had missing clinically relevant details, hence precluding us from assessing 5 years before and after PROMPT that may have provided a better reflection of birthing outcomes. However, this may not have changed the result as a similar study failed to show a significant reduction in the composite obstetric outcome in units where multiprofessional simulation training was introduced.[8]

A major strength of this evaluation is that it allowed insights into service delivery and identification of potential deficiencies. For instance, we observed a reduction in the completion of shoulder dystocia management forms. In addition, our current record form lack certain outcome measures that would be of interest to evaluate clinical management, such as fluid volume usage during PPH.

Interpretation

Participants indicated that communication, situational awareness and leadership skills are key factors for managing emergencies as a successful team. The next level of evaluation planned will be to check the team performance in a real obstetric emergency setting to determine if the transfer of learning has occurred. This can be achieved by integration of level 3 assessment (behaviour) into our training development strategy by direct observation of performance in a simulated and/or clinical setting. Apart from more proactive management noted in postpartum haemorrhage, no significant difference was noted in clinical outcome. This may be due to existence of previously run simulation programmes, which focused on individual skills but not on effective teamwork. Although participants recognise the importance of teamwork and communication in their learning, this was not transferable to a change in clinical outcome.

This evaluation has already resulted in changing the organisational practice at our institution (Level 4a).[26] An annual attendance of PROMPT is encouraged for all staff, and a 2 yearly attendance is a mandatory requirement for staff working on the birth unit. It is used for credentialing the staff members with remediation plans for participants unable to meet the expected standards of performance for both technical skills and NTS. Our goal will be to continue to strengthen this process and to formalise it further, linking it with professional development.

CONCLUSIONS

The study highlights the need for teaching teamwork, communication and leadership skills in managing obstetric emergencies through a high-fidelity simulation programme. The impact on clinical outcomes seems limited, yet we identified some differences related to management of shoulder dystocia and postpartum haemorrhage that could have made a difference in certain individual cases. Improved participant confidence with up-skilling of both procedural skills and NTS has a potential to change clinical practice and outcomes, hence, validating the incorporation of these IPE simulation strategies in clinical care.

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Evaluation of learning from Practical Obstetric Multi-Professional Training and its impact on patient outcomes in Australia using Kirkpatrick's framework: a mixed methods study

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Chapter 8

Conclusion

I have demonstrated in the thesis, how participants from the three interprofessional simulation programs have acquired clinical and non-technical skills, due to which, these programs were embedded in routine training. The three learning programs have different cohorts with medical and midwifery undergraduate students in the WHIPLS program, midwives and paramedical staff in the home birth simulation and hospital medical and midwifery staff in the PROMPT program.

In the chapter describing level 1 of Kirkpatrick's framework, I have demonstrated evidence of positive reaction from participants after attending the WHIPLS program, with similar results from the other two programs. I questioned what medical and midwifery students thought about the WHIPLS program being relevant to their clinical practice and if it was pitched to their level of knowledge and skills. They reported an improvement in their confidence on performing intimate vaginal examination and conducting a normal vaginal birth and estimation of blood loss. Similarly, the midwifery and paramedical staff in the home birth simulation and medical and midwifery clinicians in the PROMPT program reported improved confidence and knowledge levels after the attendance of the program.

As evidence for level 2a of Kirkpatrick's framework, I have cited example of the WHIPLS program to demonstrate a change in medical and midwifery students' attitude towards interprofessional teams and recognizing roles in healthcare. However, I have noted similar results in the other two programs, with "recognition of roles of other teams in healthcare" listed as a key learning message in both the home birth and the PROMPT studies. Although the undergraduate cohort had very little exposure to interprofessional education, while the midwifery, medical and paramedical clinicians often interact in clinical practice, they had similar perspectives on team-based learning. This may suggest

that learning in teams can start in the early undergraduate years with introduction of more complex programs at a clinical practice level. This may help to improve sharing of knowledge and skills at all levels of learning. Teams can potentially rely on each other's practice to support healthcare, both in routine clinical work and in crisis situations.

Similar level of knowledge acquisition was noted through the WHIPLS program in the pre-test and post-test study, as demonstrated in the chapter describing the level 2b of the Kirkpatrick's framework. Based on the medical and midwifery students' background knowledge and experience, there was a significant difference in the performance of the two groups in the pre-test. However, after the attendance of the WHIPLS program, both groups of student had a similar level of test scores. This possibly suggests effective knowledge acquisition in both the learning groups through the interprofessional simulation.

Our paper in support of the Level 2a Kirkpatrick's framework demonstrated a change in attitude of medical and midwifery students that resulted by the attendance of WHIPLS. This was the first formal interpofessional exposure for the two learning groups and they not only learnt about the other professional group's role, but also assisted each other in their learning. Besides, they reported how they used the newly acquired learning skills, when they applied it to clinical procedures on patients.

If I combine the results from the WHIPLS studies, where both student groups thought that the learning was relevant to their individual practices with demonstration of improved attitudes and learning in both groups; this supports the role of exploring interprofessional learning opportunities in student curricula. It encourages the course coordinators to try finding overlaps where learning could be facilitated. A common course can be integrated into the current undergraduate curricula with some creativity, where relevant skills and knowledge can be delivered together to the learning groups that may further facilitate the role sharing referred to in the above paragraphs.

In the case of WHIPLS program, I have embedded it in medical and midwifery student curriculum and the program has successfully run for 7 years The steps to achieve this outcome are listed in the chapter in support of level 4a of the Kirkpatrick's framework,

using the Kotter's 8-step model. The lessons that were learnt in the process of embedding the WHIPLS program can be helpful in facilitating this process for other IPE programs. This change management framework provides a road map for other course coordinators to consider using shared learning opportunities in other healthcare disciplines. It provides opportunity to strengthen interprofessional relationships of both the faculty and students through learning programs.

The home birth and the PROMPT program were designed using similar principles of knowledge and role sharing in addition to providing in situ training. In situ training facilitates access to resources that are usually available for clinical work. The program was introduced for both PROMPT training in the birth unit and in home birth simulation, which are two very different settings. The home birth midwives are used to a low risk practice where the skills for emergency training are rarely used while most hospital medical and midwifery staff are frequently confronted with the task of managing obstetric emergencies together in a team-based setting.

However, the key learning messages that were learnt through both the programs were very similar. As described by the participants, the most important message was recognizing the importance of clear communication with staff members of their own professional and interprofessional background. The other key messages were prioritisation of tasks, and planning ahead (with increased situational awareness to manage the obstetric or neonatal emergency). Similar learning outcomes were achieved in the two programs that may suggest that these learning outcomes can be translated to other settings as well where emergency healthcare is required. An example of this can be in the emergency department or in operating theatre with training of nurses and doctors can take place simultaneously. These programs can also apply to other high-risk obstetric and low risk midwifery care units with expectation of similar learning outcomes.

I have used the Lewin's 3-step model (freeze-unfreeze-refreeze) to demonstrate the change management process on how the PROMPT program was embedded as a credentialing tool for doctors and midwives. Similarly, I have demonstrated how WHIPLS was integrated into medical and midwifery curricula after its success had been established by the research showing improved learning and attitudes. I have also shown

in chapter describing the level 3 of the Kirkpatrick's framework, a changed clinical protocol of management in an emergency situation in home births. In all these situations, the integration into routine practice occurred only when the benefits of the program had been recognized not only by participants and course-coordinators/ facilitators but also by educational/healthcare institution. In all these programs, the change was embedded after at least five years of the implementation of the program, suggesting, "Changing educational or clinical practice takes time and persistence".

My final study on the PROMPT paper evaluation demonstrates a change in clinical outcome and improved management of postpartum hemorrhage. As seen in chapter describing Level4b of Kirkpatrick's framework, the change in clinical outcome was preceded by participant satisfaction. There was evidence of improved learning and a changed approach to teamwork, with participants being more aware of the situation in management of the emergency situations. Although the paper could not show a direct association between these positive findings, the improvement across all these domains supports the use of the Kirkpatrick's sequential model.

The success of programs (involving innovative educational initiatives) cannot be defined solely by a single positive outcome. Programs need to be assessed rigorously, using multiple "lenses" or evaluation tools before we can confirm their role in routine educational/clinical practice. Learning programs that are built on the foundation of sound principles of research rigour, are more likely to sustain, create a lasting impact on learning or work-culture and will be transferable to other educational settings.

At the end of the thesis, I summarise a few learning points from the research that I think can be transferable to other programs. I offer a few recommendations that can be helpful. As clinical learning opportunities (where students and trainees learnt on the patients) are decreasing, there arises a need for increased simulation based education (SBE). SBE is particularly relevant as a form of skills based training in the current era of increased litigation and for achieving excellence in standards of practice in healthcare. Its role is not just limited to teaching emergency management in healthcare, but also for teaching routine clinical skills that are difficult to teach on patients. Simulation based educational programs can be flexibly designed to suit the learner needs, can be administered

frequently if needed and can be used to standardise clinical practice, when used for assessment or credentialing.

Simulation offers a unique opportunity for promoting interprofessional education. These opportunities can be utilized in both undergraduate domain and in clinical practice. Interprofessional learning helps in improving teams' attitudes and behavior, which may further affect patient management and outcome. Knowing and understanding teams can start to be addressed as early as the entry level of a healthcare course and be reinforced repeatedly through the course. This may help to maximize impact on students and promote interprofessional competency prior to entering clinical practice. This will likely encourage a culture of mutual understanding, respect and trust in the other professional teams involved in healthcare. At this stage, more longitudinal studies are needed in the field of interprofessional education and practice to assess its true impact on healthcare management and outcome.

Chapter 9

My journey from a clinician to an educator, to a researcher…

Six years ago, when I qualified as a consultant in obstetrics and gynaecology, I did not have any idea that a career in education can be an option for a practicing clinician. However, the sequence of events that followed my appointment as a consultant in a public hospital, led me to branch out into medical teaching and research. If you have ever experienced a *Eureka* moment, when a new concept takes birth, this article could become the story of your life too!

How did it start?

My perception of the problem:

My appointment at Casey hospital, Monash Heath as a full-time consultant, gave me the opportunity of interacting with trainees who were progressing towards a specialist-training pathway (as I had recently done), and also with much younger medical students who were striving to work towards their undergraduate qualification exams. These students were remotely different from the senior trainees (that I refer to), as they appeared to be at an early learner's level. They did not seem to have much information as to what career paths will be available for them in a couple of years. My job also involved teaching midwives in clinical practice at the hospital, who worked in the same environment. But, sadly, for the midwives, there were limited overlapping opportunities of learning together with the medical trainees. Midwifery students had absolutely no direct interaction with, either the doctors or the medical students, who were learning on same ward.. Everywhere I looked, there were learners in their own silos…(there seemed to be a cultural divide between medical and nursing/midwifery practitioners and between senior learners like the trainees and junior learners like the medical students).

Incidentally, I was given an opportunity of tutoring medical students, which consisted of two tutorials a week as a Problem Based learning (PBL) group. The other issues that I observed/ faced was, that a lot of effort was spent on organizing the medical students lectures and tutorials, but there was less emphasis on them being clinically involved in teaching; an experience that they relished and seemed to learn a lot more from, even without realizing it! Even when I made an effort to deliver the best lecture or tutorial I was capable of, there were a few disengaged learners in the group, that I struggled to connect with. This made me realize that possibly, I did not know as much about teaching as I gave myself credit for and this epiphany set the stage for my journey as a student…

I enrolled in the graduate certificate course for health professional education (which was not so onerous and could be pursued as a part-time course, lasting a year) at Monash University. I was pleasantly surprised to find myself in the company of health professionals from various disciplines with just one thing in common – the keenness to learn and teach effectively! The course coordinators were not only inspiring educators but also attempted mentorship of participants to help them in their individual learning contexts. The course content (through their flexible assignments) was also designed to address individual learner needs. It was through an assignment I conceived the idea of my first research project, which I was able to implement a few years later. While pursuing the course, I was able to put into practice some new teaching techniques that I learnt. I applied those learning methods while teaching my tutorial group and could instantly observe the effect of various educational interventions on the learners. Hence, when the opportunity arose, I accepted the role of the course coordinator for all medical students enrolled in obstetrics and gynaecology. I was thrilled to be in a position, to put theoretical concepts into practice, that I had learnt for many years. I could apply those learning strategies to the whole group of students. I wanted to have a systematic approach in studying the benefits of my interventions and this started my career as an educational researcher…

Introduction to research

As I indicated, my first research project was inspired by an assignment I had undertaken on simulation. The observation was that students learnt better when they participated in an activity and this form of learning engaged both motivated and reluctant learners. The

concept of students being "active learners" and seeking out their own information and assimilate it at their own pace, was new to me. However, when I thought about it, it sounded like a rational concept, as no two learners will learn the same. This formed the basis of the introduction of the work in this thesis. I was now, not only in a position to apply these learning methods to my little tutorial group (that I had already worked with for three years), but could also extend that knowledge and support to all students enrolled in the course. It was absolutely thrilling to realise that this intervention could be applied even to the midwifery students, which could encourage interprofessionalism (a concept that I had been wanting to introduce after realizing how many overlaps existed in the curriculum and how poor the interprofessional relationships were at the early learners' level).

Needless to say, this was quite a challenge to undertake, (the planning and implementation were both time consuming and difficult, with problems related to rostering and meeting funding requirements for equipment, educators etc). The thought that this effort could be wasted was disheartening, (as it may get discontinued in a few years, unless I managed to get some sort of validity of these learning methods). Then, the suggestion came from my mentor, that I should consider publishing this (and if the results were favourable, this could be incorporated in the curriculum). That suggestion set the background for my enrollment as a PhD student.

The PhD….

I needed a few projects for my PhD but I did not need to look too far for it. I was already assisting in setting up a homebirth service at Monash Health. The publicly funded homebirth project was introduced to provide a safe birthing option to low risk women by providing management guidelines and training to the midwifery homebirth staff. As I was learning about simulation in my GCHPE, I thought this was a perfect opportunity to set up an in-situ homebirth simulation drill (also involving the paramedical staff who were called for an emergency transfer to the hospital, in the case of a homebirth emergency). The concept applied was similar to that described above with the WHIPLS. It related to experiential learning and improving interprofessional relationships for improving teamwork performance. The enrollment into the PhD course was a trigger to undertake a

formal evaluation of the workshop, to assess if it met it the learning requirements of the participant group.

The WHIPLS program was introduced with the help of a small grant to facilitate interprofessional learning for medical and midwifery students. My role as the clinical supervisor of medical students made me aware of how difficult it was to facilitate a pathway for medical students towards becoming a doctor. I also realized that other disciplines like midwifery, shared the same challenge. On further assessment of the problem, I was able to identify that the gap was in teaching clinical reasoning. Although students attended/participated in clinical sessions and patient management, it may not be obvious to students to see the connection between what they read in theory and how it could be applied into practice. The WHIPLS program facilitated this through pre-reading, demonstration and also provided an opportunity to practice hands-on clinical skills. The WHIPLS program was initially optional for students to attend but after its benefit was recognized by both students and facilitators, it was embedded in the course for both medical and midwifery students.

My epistemological and ontological positioning…

I started my research work with the background of a positivist paradigm. This was because my previous exposure to research was limited to science-based experiments and clinical research projects, where focus was on "fact-finding" to contribute to evidence. My understanding of results was limited to an "objective reality". This is also evident from my initial projects, where I have used the Likert's scale to establish the benefit of the WHIPLS program and, following that, used a pre-test and a post-test analysis to evaluate learning. It was only when I was exposed to a constructivist paradigm, that, I began appreciating, that multiple versions of truth can exist within the domain of a constructivist paradigm and still make valuable contribution to evidence. Later, when my research questions became more complex, I started studying the change in attitudes of participants and how they were affected by learning programs. This change in attitudes, further, led to a change in their behaviour, where my positivist thinking was challenged. I started to appreciate results derived from a change in behaviour, leading to a change in clinical management, and also affecting outcomes. This paradigm shift was a slow process and also resulted from the extensive reading I undertook during the PhD, where I was

able to compare my own research work with existing studies. This ontological shift in my understanding of how things worked, helped me ask more complex research questions and also find valid ways (through qualitative research) to explain the phenomena that I observed through the programs that I introduced.

I currently follow both the realist paradigm (that helps me explain what makes programs work or not work) and the constructivist paradigm that allows me to question how things work and, if my understanding of these phenomena was deep enough. I began appreciating the use of learning theories in research and how different theories were able to explain my observations from a different perspective. The concept of new learning, developed on the background of what was already known, and how this learning integrated with the learner, has helped me question interprofessional education with an ethnographic lens. I feel that now, I have a broader and a deeper understanding of the effect of IPE on both individuals and the communities, they identify themselves with. Questioning processes that lead to identity formation, and developing further interventions that can affect identities and role development, will help me embark upon more research projects, following the completion of the doctorate thesis.

I have learnt a lot about using both qualitative and quantitative research methods through these evaluations. Prior to starting the PhD, I was only exposed to quantitative scientific research. Initially I limited myself to quantitative methods by considering scales for evaluation and studying discrete outcomes (mainly through objectively structured questions). It was much later that I started to recognize the importance of the "how" and " why" questions, as they seemed to address the overarching research questions. It was a similar experience as finding the missing link in a puzzle. The paradigm shift from a positivist approach took a lot of time and an active effort to initially unlearn what I understood to be research methods and then open my mind to how multiple versions of truth could still exist, and yet not defy basic laws of science. This provided me an opportunity to be a mixed-methods researcher, so I could choose which method suited my research questions. I learnt that being a mixed- methods researcher, I could get answers to direct questions (like measuring incidence of complications in relation to patient outcome) and be able to dig deeper into the "mechanism" that led to those outcomes.

I used quantitative methods to measure student performance in the comparison of WHIPLS pre-test and post-test and evaluating Birthing Outcome Statistics (BOS) data to assess patient outcome in the PROMPT paper. It has provided me with confidence to use quantitative methods, with a little statistical support from a statistician. The use of qualitative methods included a content analysis on the key learning messages from the home birth simulation and a thematic analysis of the transcripts from the interviews for home birth midwives. I also conducted focus groups of medical and midwifery students for the WHIPLS study. This has equipped me with skills to collect and analyse qualitative data.

The experience of setting up these programs and evaluating them will form the basis of my future research projects, which I will develop for my post-doctoral research. In the next section, I provide a brief outline of the projects that I have introduced and have been inspired by the work undertaken for this PhD.

Current progress and next steps…

Many other projects have been inspired due to the success of the WHIPLS, PROMPT and the home birth simulation. The WHIPLS program is currently being evaluated for checking students' retention of the learning assessed by a multiple choice question paper six months after attendance of WHIPLS. The results of their performance in the test will also be compared with student performance in their final exam.

In the same undergraduate cohort of medical and midwifery students at Monash University, a new workshop has been introduced to teach emergency obstetric skills. This workshop titled Women's health Emergency Workshop (WHEW) has already been piloted in 2017 and is being formally evaluated in 2018 for its benefit to students. The evaluation will include what was learnt at the workshop and how students can apply the newly learnt skills. The workshop not only focuses on acquisition of clinical skills but also teamwork, communication, prioritization of tasks to improve situational awareness in medical and midwifery students. The data collection methods can be a combination of homogenous and mixed focus groups.

Another interprofessional workshop commencing in 2018 is a surgical skills workshop for medical and nursing students, where they will be taught suturing on task trainers, female catheterization and familiarisation with surgical instruments, basic principles of scrubbing, gowning and gloving. They will not only get an opportunity of practicing hands-on skills but also of learning to assist each other in teams in an interprofessional setting.

I have also used the learning from this research to set up a skill-based program called Obstetric and Neonatal Emergency Simulation (ONE-Sim) that has been designed for developing countries. The project has already been implemented in three states of India and in Vanuatu. The project evaluation consists of qualitative data collection using detailed semi-structured interviews 6-12 months after training to assess the clinical application of learning from the program. An initial evaluation using a standardized questionnaire evaluated the learning immediately after the attendance of the program. The participants were asked to describe their learning through an open-ended question. The thematic analysis of the textual data was undertaken and this paper is under review by a peer-reviewed journal at the time of submission of this thesis. This paper is attached in the appendix section of the thesis.

The above listed programs and their evaluation are examples of work that I have undertaken as the principal investigator. Over the next few years, I intend to develop these programs further and aim to approach them with more rigorous evaluation methods that I have learnt through the process of undertaking this PhD.

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APPENDIX 1: WHIPLS Evaluation Survey

1. You are a
   - o Medical student
   - o Midwifery student
2. Date:

From the options given below, please select the **MOST APPROPRIATE** option:

a) I benefited from attending this workshop with students from another profession	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
b) The reading material provided prior to the workshop was helpful	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

3. **Vaginal Birth and Estimation of Blood Loss**

a) The content was relevant to my course	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
b) The teaching of this topic is pitched appropriate to my level of knowledge and skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
c) This topic was explained well by the use of the model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
d) I would like another session at a later date to practice on this model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
e) The workshop has significantly improved my confidence in this skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
f) Time allocated for this topic was sufficient	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
g) I feel it is helpful for this skill to be taught by doctors	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

h) I feel it is helpful for this skill to be taught by midwives	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
i) I feel it is helpful for this skill to be taught by both doctors and midwives together	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
j) I feel it is helpful for this skill to be taught by either doctors or midwives	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

COMMENTS:

4. **Vaginal Examination in Labour**

a) The content was relevant to my course	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
b) The teaching is pitched appropriate to my level of knowledge and skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
c) This topic was explained well by the use of the model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
d) I would like another session at a later date to practice on this model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
e) The workshop has significantly improved my confidence in this skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
f) Time allocated for this topic was sufficient	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
g) I feel it is helpful for this skill to be taught by doctors	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
h) I feel it is helpful for this skill to be taught by midwives	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
i) I feel it is helpful for this skill to be taught by both doctors and midwives together	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
j) I feel it is helpful for this skill to be taught by either	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

doctors or midwives					

COMMENTS:

5. Speculum Examination, Bimanual Palpation, Pap Smear

a) The content was relevant to my course	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
b) The teaching is pitched appropriate to my level of knowledge and skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
c) This topic was explained well by the use of the model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
d) I would like another session at a later date to practice on this model	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
f) The workshop has significantly improved my confidence in this skill	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
g) Time allocated for this topic was sufficient	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

COMMENTS:

APPENDIX 2: WHIPLS Pre-test and post-test questionnaire

MONASH University
Department of Obstetrics and Gynaecology
Faculty of Medicine, Nursing and Health Sciences

MCQ EXAM QUESTIONNAIRE PRE/ POST-WHIPLS WORKSHOP

Module 1: Progress in first stage of labour

1. Bishop's scoring does NOT assess	
a. Station of the presenting part	
b. Cervical consistency	
c. Position of the presenting part	
d. Cervical length/effacement	
e. Not answered	
2. Which of the following is **FALSE** regarding a Partogram:	
a. It is a helpful tool to assess progress in labour and manage deviations from the normal more effectively.	
b. If labour is progressing well, the cervical dilation should always stay to the right of the action line.	
c. It also records the frequency, strength and duration of contractions.	
d. Current use of partogram defines the start of monitoring only when a woman is in labour.	
e. Not answered	
3. With regards to the assessment of a woman in labour by a pelvic examination, which of the following statement is **TRUE**?	
a. When assessing the position of the fetal head in a vertex presentation, the anterior fontanelle is the easiest fontanelle to be felt in a well flexed head.	
b. The posterior fontanelle is a diamond shaped fontannelle with four sutures leaving it.	
c. Moulding of the head refers to the amount of overlapping of the skull bones and is always a pathological feature.	
d. In a deflexed head, both anterior and posterior fontanelles may be palpable.	
e. Not answered	
4. In relation to the assessment of descent of presenting part in labout, which of the following statement is FALSE?	
a. The formation of caput succadaenum is due to the cervical ring pressing against the presenting part, which may falsely give the impression of descent of the presenting part.	

b. The abdominal assessment of descent of presenting part in number of fifths above the pelvic brim is no longer necessary to be assessed in labour.	
c. During a vaginal examination, the station of the presenting part is assessed in relation to the ischial spines on the maternal pelvis.	
d. In relation to the head, the fetus is said to be engaged when it reaches the mid-pelvis or at a zero (0) station.	
5. Which is of the following statements is **FALSE** regarding the stages of labour?	
a. The active phase of the first stage of labour is marked by dilatation of cervix to 4 cm onwards with regular painful contractions till full dilatation (10 cm) of cervix.	
b. The active phase of the first stage of labour is shorter for parous women compared to nulliparous women.	
c. The latent phase of first stage of labour is constant for most women.	
d. The duration of the first stage of labour is 10-14 hours for nulliparous women and 6-8 hours for multiparous women.	
e. Not answered	

Module 2: Management of Second and Third stages of labour

From the following options, please select the **most** appropriate option:

1. Second stage of labour is considered prolonged after	
a. 2 hours of duration in a nulliparous woman without epidural analgesia	
b. 15 minutes of pushing in a multiparous woman	
c. Half hour of pushing in a nulliparous woman	
d. 1 hour of duration in a nulliparous woman	
e. Not answered	
2. The correct **sequence of events** in mechanism of normal labour is	
a. Flexion, Descent, Engagement, Internal rotation, external rotation, restitution, Lateral flexion	
b. Internal rotation, Flexion, Restitution, Descent, Engagement, External rotation, Lateral flexion	
c. Engagement, Descent, Flexion, Internal rotation, Restitution, External rotation, Lateral flexion	
d. Descent, Engagement, Flexion, Internal rotation, External rotation, Restitution	
e. Not answered	
3. The station of the presenting part will be termed as -1 station when	
a. The presenting part is 1 cm above the pelvic brim	
b. The presenting part is 1 cm below the pelvic brim	

c. The presenting part is 1 cm above the level of ischial spines	
d. The presenting part is 1 cm below the level of ischial spines	
4. The smallest engaging diameter on the fetal head is	
a. Sub-occipito-bregmatic diameter	
b. Sub-occipito-frontal diameter	
c. Occipito-frontal diameter	
d. Mento-vertical diameter	
5. Which of the following is suitable for an instrumental vaginal birth?	
a. Brow presentation	
b. Cervix is 9cm dilated	
c. Station of the presenting part is -1	
d. Right occipito-transverse position at +1 station	
e. Not answered	
6. The second stage of labour may be identified by	
a. Contractions last 30 seconds and occur at a frequency of 3 in 10 minutes	
b. There is fresh vaginal bleeding noted with every contraction	
c. The woman has an uncontrollable urge to push and there is perineal stretching during a contraction	
d. An acceleration of the fetal heart rate is noted with each contraction on FHR auscultation/CTG	
7. Which of the following is most appropriate for the management of a normal vaginal birth?	
a. Elective right mediolateral episiotomy on crowning in all nulliparous women	
b. Intramuscular oxytocin/syntometrine at the birth of the anterior shoulder/ immediately following the birth of the baby in all women	
c. Perform an instrumental birth if the woman is fully dilated for more than an hour or pushing for more than 30 minutes in all women	
d. Perform McRoberts manoeuvre (Flexion and abduction of the hip joint) to prevent shoulder dystocia in all women	
8. How much blood loss is considered within normal limits during 3rd stage of labour in a woman who has a normal Full Blood Examination?	
a. <300ml	
b. < 500 ml	
c. <1000 ml	

d. <1.5 l	
9. Which medication is most commonly used as a first line to treat Postpartum Haemorrhage?	
a. Syntometrine/ Ergometrine	
b. PGF2 alpha	
c. Misoprostol (PGE1 analogue)	
d. PGE2	
10. Which of the following is the commonest cause of Postpartum Haemorrhage?	
a. Vaginal wall/ Perineal trauma	
b. Retained placental cotyledons/membranes	
c. Atonic uterus	
d. Coagulation disorders	
e. Not answered	

Module 3: Speculum examination, Pap smear, Bimanual palpation

1. Which of the following statements is TRUE regarding the technique of a Pap smear/speculum examination?	
a. The blades of the speculum should be left open while removing the speculum after taking the pap smear.	
b. The cells should be collected from the external surface of the cervix and not from the endocervical canal.	
c. The speculum can be inserted horizontally if the opening is patulous enough, but, for comfort and ease, the insertion is usually done at an oblique angle (45°).	
d. To avoid discomfort to the patient the speculum should not be inserted to the full length of the vaginal wall.	
2. Which of the following is FALSE regarding the cervical transformation zone?	
a. Transformation zone is the area in between the active and original squammo-coloumnar junction	
b. 95% of cervical carcinoma develops in the transformation zone	
c. Occasionally transformation zone may not be viewed during a speculum examination.	
d. Presence of squamous metaplasia is a pathological finding in the transformation zone and can lead to cervical carcinogenesis.	
3. Which of the following is TRUE regarding the technique of sample collection for a pap smear	

a. Use of Ayre's spatula should always be supplemented with the use of an endocervical brush for adequate sampling.	
b. The spatula/ brush should not be rotated to more than 180 degrees to avoid bleeding	
c. When using the Ayre's spatula and the brush, the endocervical brush sample should be taken first.	
d. With the conventional Pap smear, accurate assessment can be made even when the sample is blood stained.	
4. Which of the following is TRUE regarding the pap smear collection/fixing the cells?	
a. Poor sample collection is the most common source of unsatisfactory Pap smears.	
b. For adequate fixing, it is preferable for the sample smeared on a glass slide to be dried slightly before spraying the fixative.	
c. The slide should be labelled with patient name and Date of Birth immediately after fixing the slide with the spray fixative.	
d. A multi-layered smeared specimen is preferred to a mono-layered specimen to ensure fixing of a sufficient number cells on the slide.	
5. In the presence of an abnormal pap smear (LSIL) in a 24 year old nulliparous woman with a background of normal and regular Pap smear screen tests 2 years ago, the next step is to	
a. Treat the pap smear abnormality immediately	
b. Reassure the patient that Pap smears have a high false positive rate and routine 2 yearly screen will determine if Pap smear abnormalities persist.	
c. Refer for an urgent colposcopy	
d. Repeat a Pap smear in 12 months duration and if abnormal again, refer for a colposcopy to a specialist.	
6. Which of the following is TRUE regarding the technique of bimanual palpation?	
a. When a bimanual palpation is being perfomed to assess the uterine size, no additional information will be gained by performing a prior abdominal palpation. .	
b. A normal sized uterus is not felt on a bimanual palpation unless it is enlarged due to presence of fibroids or adenomyosis.	
c. The presence of a retroverted uterus is pathological and is usually suggestive of adenomyosis/endometriosis.	
d. Uterus is usually palpated on a bimanual palpation as a firm, smooth central, mobile and a non-tender structure	
7. Which of the following is likely to be FALSE regarding palpation of a 16 weeks sized uterus with multiple fundal fibroids?	
a. Firm nodular consistency	
b. Soft cervix with presence of cervical excitation	
c. Limited mobility	
d. A bimanual palpation is usually sufficient to make a diagnosis	

8. Which of the following is FALSE regarding the adnexal assessment during a bimanual palpation?	
a. The ovaries are mostly difficult to palpate in a postmenopausal woman	
b. It is relatively easy to feel for any adnexal masses (measuring 3-5 cm) in most women and most clinicians will have consistently similar findings	
c. The presence of cervical excitation/ adnexal tenderness may be elicited with a history of Pelvic Inflammatory Disease or an ectopic pregnancy	
d. In premenopausal women, follicular and luteal cysts are the most common adnexal masses present.	
e. Not answered	

APPENDIX 3: Home birth/ PROMPT evaluation

MonashHealth

SITE_____ **DATE**_____

This information provided will help us to evaluate the effectiveness of the Homebirth Drills and ways to improve course presentation. All feedback will treated as confidential and reported in a non-identifying manner.

PLEASE COMPLETE - ARE YOU: **MEDICAL STAFF** **MIDWIFERY STAFF** **AMBULANCE PERSONEL**

PLEASE ANSWER THE QUESTIONS 1, 2 & 3 BEFORE WE START TODAY'S SESSION
(Circle one answer for each row)

1. **How would you rate your KNOWLEDGE about the following maternity emergencies?**

MATERNAL COLLASPE	**Limited**	**1**	**2**	**3**	**4**	**5**	**Extensive**
SHOULDER DYSTOCIA	**Limited**	**1**	**2**	**3**	**4**	**5**	**Extensive**
NEONATAL RESUS	**Limited**	**1**	**2**	**3**	**4**	**5**	**Extensive**
PPH	**Limited**	**1**	**2**	**3**	**4**	**5**	**Extensive**
Breech	**Limited**	**1**	**2**	**3**	**4**	**5**	**Extensive**

2. **How would you rate your level of CONFIDENCE in managing the following maternity emergencies in the home?**

MATERNAL COLLAPSE	Not confident	**1**	**2**	**3**	**4**	**5**	Extremely confident
SHOULDER DYSTOCIA	Not confident	**1**	**2**	**3**	**4**	**5**	Extremely confident
NEONATAL RESUS	Not confident	**1**	**2**	**3**	**4**	**5**	Extremely confident
PPH	Not confident	**1**	**2**	**3**	**4**	**5**	Extremely confident
Breech	Not confident	**1**	**2**	**3**	**4**	**5**	Extremely confident

3. **How many Homebirth maternity emergencies have you been involved in to date?**

MATERNAL COLLAPSE	**0**	**1-2**	**3-5**	**6-10**	**10+**
SHOULDER DYSTOCIA	**0**	**1-2**	**3-5**	**6-10**	**10+**
NEONATAL RESUS	**0**	**1-2**	**3-5**	**6-10**	**10+**
PPH	**0**	**1-2**	**3-5**	**6-10**	**10+**

TO BE COMPLETED AT THE END OF THE TRAINING SESSION

4. How useful was participating or observing in the scenario drills for each maternity emergency?

MATERNAL COLLAPSE	Not useful	**1**	**2**	**3**	**4**	**5**	Extremely useful
SHOULDER DYSTOCIA	Not useful	**1**	**2**	**3**	**4**	**5**	Extremely useful
NEONATAL RESUS	Not useful	**1**	**2**	**3**	**4**	**5**	Extremely useful
PPH	Not useful	**1**	**2**	**3**	**4**	**5**	Extremely useful

5. How valuable was the debriefing session after each scenario?

SHOULDER DYSTOCIA & NEONATAL RESUS	Not valuable	1	2	3	4	5	Highly valuable
PPH & MATERNAL COLLAPSE	Not valuable	1	2	3	4	5	Highly valuable

6. Did you learn anything new from the DRILL training today? (Circle one answer)
YES / NO
Please explain further:_____
_____

7. Following the DRILLS how would you rate your overall KNOWELEDGE in managing these maternal emergencies.

Poor 1 2 3 4 5 Extremely good

8. Following the DRILLS how would you rate your overall CONFIDENCE in managing these maternal emergencies.

Poor 1 2 3 4 5 Extremely good

9. Did the drills help you to further understand the roles, resources & responsibilities of other disciplines in the emergency care of the birthing women?

Not useful 1 2 3 4 5 Extremely useful

10. Is there anything in the DRILL training day which you did NOT like? YES / NO
Please explain further:
_____

Please provide any comments on how the DRILL training day could be improved.

_____

Thank-you for your feedback

APPENDIX 4: Submitted Manuscript: Mobile obstetric and neonatal simulation based skills training in India: A qualitative study

Manuscript Details

Manuscript number	WOMBI_2018_116
Title	Mobile obstetric and neonatal simulation based skills training in India: A qualitative study
Article type	Research Paper - Qualitative Research

Abstract

Problem: The developing world has a significantly high risk of women and babies dying during childbirth. Background: Interprofessional simulation training has improved birth practices and outcomes by impacting clinical and non-technical skills like communication, teamwork, leadership and effective use of resources. While these programs become a training requirement in many high-income countries, they have not been widely introduced in the low-income, lowresource settings. Question: To explore the use of a structured Obstetric and Neonatal Emergency training (ONE Sim) program in India. Aim: The aim was to identify the challenges faced by birthing staff in their clinical practice and the key messages learnt from the ONE Sim program that is applicable to their clinical practice. Methods: Mobile interprofessional obstetric and neonatal workshops were piloted in three locations (metropolitan, primary rural and secondary hospitals) of India for medical and midwifery staff and students. Using a pre-test post-test design, participants were asked to describe their role and challenges in their birth practice and the key learning acquired by the program. Findings: Participants at all sites described maintaining safety of women and babies as their key role. Their main challenge was lack of availability of medical back up, resources, structured training and poor compliance from women. The key learning was gaining knowledge and procedural skills, non-technical skills, a systematic approach to obstetric and neonatal emergencies and learning through simulation in teams.

Keywords	skills training, obstetrics, newborn, maternal, child health, post partum haemorrhage, perinatal asphyxia
Taxonomy	Education, Birth, Developing Countries, Intrapartum Care, Post Partum Haemorrhage
Manuscript category	Qualitative Research
Corresponding Author	arunaz kumar
Corresponding Author's Institution	Monash University
Order of Authors	arunaz kumar, Tarundeep Singh, Utkarsh Bansal, Jaivir Singh, Stacey Davie, Atul Malhotra

Submission Files Included in this PDF

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Fig 1.tiff [Figure]
Table 1.docx [Table]
Table 2.docx [Table]
Table 3.docx [Table]
Ethical statement.docx [Ethical Statement]
Authorship agreement.docx [Author Agreement]
To view all the submission files, including those not included in the PDF, click on the manuscript title on your EVISE Homepage, then click 'Download zip file'.

15th Mar 2018

The Editor,

"Women and Birth" Journal

Australia

Dear editor,

We are excited to present our paper titled "**Mobile obstetric and neonatal simulation based skills training in India: A qualitative study"** for consideration for publication in "Women and Birth".

This study was inspired by our keenness to encourage simulation-based education in up-skilling midwifery and medical workforce in low-resource settings. Midwifery and medical clinicians need to feel better supported in their clinical practice. We wanted to assess the impact of simulation training introduced to improve education, teamwork of inter-disciplinary staff that work together in a birth setting in India and changes that can apply to their practice to facilitate safer births.

In the context of our paper, we have demonstrated how midwifery and medical staff learn together in a simulated setting of birth and its complications. We envisage this as a step towards empowering women to exercise their right to birth in a safe environment at home and support the midwives who care for them.

We confirm that there are no conflicts of interest to disclose. The article is our original work, has not received prior publication and is not under consideration anywhere else. All authors have approved the final version of the manuscript. They agree to abide by copyright terms and conditions of Elsevier and the Australian College of Midwives.

Funding sources that have supported this research are mentioned in the paper. The project falls under the category of quality Improvement activity at the respective health care institutions where this education was conducted and hence participant consent was not required.

Thank you for your kind consideration and we look forward to hearing from the reviewers.

Sincerely,

Dr Arunaz Kumar, *FRANZCOG*

On behalf of all the co-authors

Original Article

Mobile obstetric and neonatal simulation based skills training in India: A qualitative study

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Abstract

Problem: The developing world has a significantly high risk of women and babies dying during childbirth.

Background: Interprofessional simulation training has improved birth practices and outcomes by impacting clinical and non-technical skills like communication, teamwork, leadership and effective use of resources. While these programs become a training requirement in many high-income countries, they have not been widely introduced in the low-income, low-resource settings.

Question: To explore the use of a structured Obstetric and Neonatal Emergency training (ONE Sim) program in India.

Aim: The aim was to identify the challenges faced by birthing staff in their clinical practice and the key messages learnt from the ONE Sim program that is applicable to their clinical practice.

Methods: Mobile interprofessional obstetric and neonatal workshops were piloted in three locations (metropolitan, primary rural and secondary hospitals) of India for medical and midwifery staff and students. Using a pre-test post-test design, participants were asked to describe their role and challenges in their birth practice and the key learning acquired by the program.

Findings: Participants at all sites described maintaining safety of women and babies as their key role. Their main challenge was lack of availability of medical back up, resources, structured training and poor compliance from women. The key learning was gaining knowledge and procedural skills, non-technical skills, a systematic approach to obstetric and neonatal emergencies and learning through simulation in teams.

Key words: skills training, post partum haemorrhage, perinatal asphyxia, education

Conclusion: Mobile obstetric and neonatal training workshops were useful for medical and midwifery staff and students in varied health settings in India and may have a role as a routine training tool.

Statement of Significance

Problem or Issue

Childbirth skills training are rare or non-existent in low-income and low-resource settings, where the incidence of maternal and neonatal mortality is high.

What is Already Known

Interprofessional simulation workshops improve both clinical and non-technical skills like communication, resource allocation, leadership and teamwork with evidence demonstrating transfer of skills from simulation to clinical practice.

What this Paper Adds

Mobile obstetric and neonatal emergency skills training workshops are feasible, practical, reproducible and improve learning in low income settings.

Introduction

Simulation based education is an integral component of skills based learning in healthcare in the developed world. It is gradually being embedded in routine undergraduate and postgraduate educational curricula through interprofessional workshops to promote collaborative practice (1-3). These workshops attempt to train both clinicians in practice, and pre-registration learners who belong to various health professional groups and need to work cohesively together as a unit. Literature suggests that health professionals or students can benefit from learning together as a team in a simulated setting (4). This form of teaching is particularly relevant for professionals involved in managing an emergency situation with training delivered either in a simulation centre or taught as "in situ" simulation to mimic the clinical setting (5-7). These training sessions have been found to improve learning (8), clinical practice and patient outcomes (9-11).

An example of interprofessional simulation is obstetric based training to improve maternal and neonatal outcomes (12). Many such workshops like the Practical Obstetric Multi-Professional Training (PROMPT), Management of Obstetric Emergencies and Trauma (MOET) and Advanced Life Support in Obstetrics (ALSO) are implemented in healthcare institutions in a birth setting. These workshops are intended to teach obstetric and midwifery staff expeditious and safe management of obstetric and neonatal emergencies (12-15). These workshops are particularly relevant in the context of birth practice, as obstetric emergencies can occur even in low risk pregnancies and may arise without prior warning, requiring efficient team based management for safe patient care (16).

In contrast to the above, there are many healthcare settings and institutions where neither the pre-registration learners nor the practicing clinical staff members are exposed to any kind of simulation-based education. These centres may be poorly resourced, where technology, equipment and expertise required for developing simulation-based scenarios may not be available (17), or time poor, where the time required to conduct these activities is not available, possibly due to excessive patient load. Skill based teaching and learning in these units mainly relies on exposure

to real patients with real clinical problems. Learning occurs by observing senior clinicians who act as role models for the junior staff or students. The learners tend to repeat the examination/clinical procedure that has been demonstrated. Alternatively, they may perform examination or a procedure directly under supervision but without prior visualization, hence not provided with "scaffolded" learning. This form of learning is still feasible in an outpatient or a non-emergency setting. However, it may neither be feasible nor is appropriate in an emergency situation where time is critical or in a situation where expert intervention is required by a senior clinician. This may lead to lack of support or systematic training for novices. Besides, in this set up, an opportunity may not arise for clinical experts to teach non-technical skills that are based on teamwork, communication and prioritisation (18), or perhaps the role of these non-technical skills may be underestimated (15).

The risk of women dying from maternal complications in resource-limited settings is three hundred times more compared to well-resource settings (19). Similarly, intrapartum hypoxia and ischemia accounts for close to a million neonatal deaths in a year in these settings around the world (20). In countries like India, the maternal and neonatal mortality rates are very high necessitating the need for high quality teaching experiences to support clinical practice. Due to limited financial resources and lack of facilities available for teaching, high cost simulation workshops have not yet been introduced. There are a limited number of studies available in these settings that have assessed how simulation or skills training workshops can be introduced to teach maternal and neonatal complications at birth (18, 21, 22).

We piloted low technology simulation workshops designed as hands-on skills training workshops, which were easy to apply in various settings. These workshops aimed to address both obstetric and neonatal emergencies through an education session designed to meet the learning requirements of these groups. The Obstetric and Neonatal Emergency Simulation (ONE-Sim) workshop was conducted for medical and midwifery staff, health care workers and undergraduate medical and midwifery students involved in the care of the mother and newborn. The primary aim

of the study was to assess the role and the challenges faced by the staff and students in the birth setting and the key learning messages from the workshop that helped them. The secondary aim was to assess the feasibility and acceptance of this mobile obstetric and neonatal simulation workshop in a low resource setting.

Methods

Mobile obstetric and neonatal emergency simulation (ONE-Sim) workshops were piloted in three states of India. All workshops were approved as quality improvement initiatives by the respective institutional ethics review boards.

Participants

Local health professionals (doctors, midwives, multipurpose workers) involved in the care of the mother and newborn at childbirth were invited to participate in the workshops. The Indian healthcare setting does not have an independent course for midwifery, and nurses enrol in a four-year nursing course where they specialise in training equivalent to midwifery education in their final year. For the purpose of reporting in this paper, we have referred to them as midwifery staff and students. The doctors were the consultants, registrars and residents from obstetrics and neonatal teams in their respective units. Medical and midwifery students were also invited to attend the sessions conducted at the teaching institutions.

Setting 1- Rural primary health centres

In the state of Punjab, the workshop was introduced in two rural (primary level) community health centres supported and supervised by the School of Public Health, Post Graduate Institute of Medical Education and Research (PGIMER), XX. The community health centres are staffed with midwives (who care for women in labour and conduct normal low risk births). An obstetrician is available on call (but not present on site) to attend any obstetric emergency and to perform a complicated birth (including an instrumental birth using a forceps, and an emergency caesarean section as indicated). These procedures could be performed on site. Similarly a paediatrician is

available on call for a neonatal emergency. These clinicians are required to attend within 30 minutes to one hour after being called in. The rural healthcare centres are able to deliver babies at gestations more than 36 weeks.

Setting 2 - Secondary level (district) hospital

The workshop was implemented independently in a medical and midwifery college (XX Institute of Medical Sciences) and its affiliated health service (secondary level hospital) in XX, XX district, Uttar Pradesh state. The secondary level hospital (accepting pregnancies more than 34 weeks gestation) is staffed with both midwives and junior doctors available on site and rostered to attend birth emergencies. A senior obstetrician and paediatrician is on call and available to support the medical staff, when needed.

Setting 3: Secondary level (metropolitan) hospital

The ONE-Sim program was also implemented in the city of Bhopal, in the state of Madhya Pradesh, in a metropolitan hospital - XX Medical College Hospital. Mostly midwives who conduct low risk births staff the birth suite. There are also resident doctors (undertaking their specialist training) and obstetric consultants who are available on call to attend emergencies. The hospital has a basic neonatal intensive care unit with radiant warmers (no incubators) as well as operating theatres (for caesareans births) and wards or designated rooms for women with complications.

Study design

The study follows a pre-test and post-test workshop design. Qualitative data is collected both from the pre-test and post-test from all sites and participant groups and thematically analysed.

Equipment

The simulation models used included a Prompt Flex model (Limbs and Things, Bristol, UK) and a neonatal resuscitation baby (Laerdal Medical, Stavanger, Norway). The portable simulators fit in a

suitcase and can be easily transported to the site, where simulation can take place. They were set up in respective health centres (set up time 15 minutes) followed by an interactive educational workshop (duration 3.5-4 hours).

The ONE-Sim workshop

The participants were first familiarised with the simulators through a demonstration, followed by hands-on skill training under the supervision of lead facilitators (AK, SD and AM) and local medical leaders/facilitators (TDS, UB and JVS).

All workshops were identical in design and content. The workshops included skill stations and scenario sessions on conducting normal labour, recognition and management of obstructed labour, breech birth, shoulder dystocia, postpartum haemorrhage and neonatal resuscitation of an asphyxiated infant (30 minutes each). The participants practised management of obstetric and neonatal emergencies on the simulators both independently and later in teams to replicate the real birthing scenario. When the participants practiced skills independently, feedback was given simultaneously at the skill station by the facilitators. Various team based clinical situations (where conflict was anticipated) were simulated, leading to discussion about management and division of roles (Figure 1). This was followed by debrief and clinical case discussions where all participants contributed and salient learning points from the workshops were highlighted.

Qualitative data collection

Participants were offered pre-workshop and post-workshop questionnaires consisting of open-ended questions requesting free text responses of about 100 words in each section. In the pre-workshop questionnaire, they were asked to describe their background experience on birth and the challenges faced by them in their clinical practice. In the post-workshop questionnaire, they were asked to identify and describe the “key learning messages” from the workshops describing how it applies to their clinical practice. Text data was transcribed and a coding framework was developed (23). A thematic analysis was undertaken by three authors independently and inductively (AK, SD

and AM) to identify key categories. After establishing consensus, all data was recoded to reach higher order themes. Any discrepancies were negotiated enabling final attribution of text within categories that were reassigned under selective codes.

Results

Participant characteristics

A total of 150 participants, including 104 health professionals (29 doctors and 75 midwives) and 46 students (26 medical and 20 midwifery students) attended 8 workshops conducted over 6 days in the three states (Table 1) in 2016-2017. The health professional participants were involved in the provision of care to the mother and newborn during childbirth in their respective health centres with a median experience of two (range 0-30) years. Both medical and midwifery students were in the clinical years of their four or five year undergraduate course. None of the participants had been exposed to any kind of simulation-based education in healthcare previously. Participant feedback was very positive regarding the low technology simulators and enjoyed the opportunity to practise clinical and teamwork skills in a safe environment.

Qualitative data analysis

1. Role as a birth attendant

The perception of the participant's role as a birth attendant led to four themes, which were: supporting the senior clinicians, recognising their clinical and administrative role, providing support for birth and recognising differences in learning and experience of the medical and midwifery teams (Table 2).

a) Supporting senior clinicians

The main theme was to support the senior clinicians (senior doctors and senior midwives) to manage birth and its related complications. In all three settings, the midwives conducted normal births and cared for both mother and baby, while obstetricians and paediatricians were called in and involved in case of complications. Both midwives and students described their role in

"following the senior clinicians' orders" and assisting in clinical procedures like instrumental deliveries, caesarean sections or neonatal resuscitation.

b) Recognising clinical and administrative role

The theme on recognising the participants' clinical role consisted of activities like monitoring of mother and baby (e.g. taking regular observations of blood pressure, monitoring contractions, maintaining intravenous lines and hydration, checking fetal heart rate and examining mother at regular intervals). These roles were shared by midwives and also by junior doctors, if available on the ward. A major role of the midwifery staff was in maintaining cleanliness and hygiene. This included checking the mother for communicable diseases, giving enemas in labour, shaving and preparation of parts, conducting the birth in a clean environment, cord clamping and cutting using a clean method, and checking sterilisation of instruments.

The administrative work consisted of maintaining documents and partographs (to monitor progress and wellbeing of the mother and fetus in labour). There was explicit mention of recording the date, time of birth and baby weight for the purpose of maintaining census documents but recording complications like shoulder dystocia and postpartum haemorrhage wasn't routine practice.

c) Supporting the mother

The midwifery staff and students recognised their role to provide psychological/emotional support and confidence to the mother, creating a positive environment and also providing education and counselling about labour and emergencies. At the start of labour, an assessment is made about the woman's background knowledge and confidence in coping with labour. The pain relief options are limited to giving parenteral opioids and a lot of emphasis is on providing psychological support and preparation for the woman and their families.

d) Recognising differences in experience of midwifery and medical groups

The midwifery groups consisted of only female members and the junior doctors described a gender-based difference in exposure to births and birth related complications as the female medical students had a more exposure to hands-on experience while some male medical students had never witnessed a real birth. Both medical and midwifery students described scant exposure to birth-related emergency complications.

2. Challenges faced by doctors and midwife: Safety concerns for woman and baby

a) *Medical back up for supporting midwifery practice*

All groups of participants reported their keenness to provide complete care from the start of labour till the woman and baby were discharged from the hospital. Statements on concerns of mother and baby safety were frequent and this was referred to as their primary concern. Senior medical staff got involved in patient care only when complications occurred. They referred to their role in being available as back up and for the teaching the midwifery staff and students. The birth attendants'/midwives' main concern was about their role in providing timely referral to the on-call specialists, concern regarding support required for checking progress of labour and performing the birth followed by immediate care of the mother and the neonate.

b) Lack of resources

The other challenge communicated was lack of resources with scant/faulty birthing equipment or lack of specialist back up support. Difficulty in availability of anaesthetists, availability of blood and of experienced birth attendants and paediatricians was a common problem in rural health centres. This was different in the secondary hospitals, where specialists were available on-call and junior doctors were rostered to be present in the hospital.

c) Unbooked women and poor compliance

Poor compliance of women and refusal to treatment was a relatively common sub-theme at all centres. All centres reported presentation of unbooked women with poor or no antenatal care. There were examples of non-institutional home births, which became more complicated at the

attendance in the hospital. Rude behaviour by patients and their relatives was experienced by many of the midwifery staff and they felt unsupported in managing these situations.

d) Lack of structured training opportunities

Scarce training opportunities existed on births and birth related complications and were highlighted as common problems. The midwifery staff mentioned specific skills like shoulder dystocia, postpartum haemorrhage and fetal distress where they experienced difficulty in managing obstetric and neonatal emergencies. This was usually in the setting of sudden complications arising during birth with specialist support available through a phone call or until the specialist arrived at the birth centre. The students also described a combination of lack of training in a simulated setting and scant exposure in clinical practice.

3. Key learning messages from the interprofessional simulation workshop

The key learning messages from the workshop led to five themes which were acquiring knowledge and procedural skills, learning non-technical skills, developing a systematic approach to obstetric and neonatal emergencies, recognising simulation as a mode of learning and learning in teams (Table 3).

a) Acquiring knowledge and procedural skills

The participants recognized the addition of new knowledge over their background knowledge. They described some knowledge about birth related complications but were not clear about the pathway to follow for effective management. Learning about use of medications (as in postpartum haemorrhage) and clinical manoeuvres (in shoulder dystocia) and the pitfalls to avoid (e.g. pulling on the baby during breech birth) assisted in developing confidence in their management plan, so delay in enactment could be avoided. The hands-on practice of performing skills and procedures complemented their background theoretical knowledge. They described developing confidence in managing clinical variation, learning various techniques to manage the problem and learning the correct technique for each procedure.

b) Learning non-technical skills

Participants described learning both clinical procedural and non-clinical skills through the ONE-Sim workshop. Developing skills like "calling for timely help," developing effective communication to seek help, anticipating the next level of complication, multitasking to look after both mother and baby, organizing the equipment and considering the sequence to follow for prompt enactment in an emergency.

c) Developing a systematic approach to obstetric and neonatal emergencies

A step-wise sequence of approaching an emergency was identified by initial recognition of the problem, initiating first-aid management, superimposing additional steps with the normal procedures (or omitting the normal procedure to be replaced by different steps, if complexity required), maintaining a systematic approach all through the process and re-evaluating to assess if the situation had changed or responded to management **(Figure 1)**.

d) Recognising simulation as a mode of learning

The exposure to interprofessional simulation was an unfamiliar experience that helped to increase confidence in pre-learned skills. It was recognized as a safe learning environment where mistakes could be made without putting patients at risk. The participants also valued cross training of staff (training special care midwifery staff about birth and those involved in births to resuscitate the baby) and the confidence gained by being a part of the livid clinical experience.

e) Learning in teams

Team-working skills was described to have the presence of a leader (which usually was the senior-most medical doctor or the senior-most midwife available on site). The senior doctors used the ONE-Sim workshop as an opportunity to teach clinical skills to their junior staff and set expectations about adequate timing for calling for help. Emphasis was made on giving clear

instructions and assisting each other (e.g. doctors requiring midwifery staff to initiate management plans prior to their arrival and midwifery staff requesting early involvement of senior doctors).

Discussion

Participants of mobile simulation workshops were keen to improve their management of high-risk pregnancies with complications especially postpartum haemorrhage and neonatal resuscitation. Following safe clinical practices was recognised as their prime role as a clinician. Challenges were similar for both medical and midwifery staff and also described by the medical and midwifery students. The common problems in their clinical practice were mainly related to lack of availability of senior staff support, scant resources and a low exposure to structured training opportunities for both staff and students. The key learning messages from the ONE-Sim workshop were about gaining confidence, learning new skills and knowledge, recognising the value of teamwork and effective communication, early recognition of complications and developing a proactive and systematic approach to addressing the problems.

Socio-material theory

We relate the interprofessional simulation-based learning in the ONE-Sim program with theory of socio-materiality introduced by Fenwick et al (24-26). According to Fenwick, the learning experience is based on interaction of learners with the environment. The approach to learning and its outcome is dependant on social situations, clients, rapport with other interprofessional learners and facilitators; this is referred to as “engagement with the communities”. The learning is also influenced by material or technological factors like facilities, equipment, resources and other objects that the learner may be interacting with. These objects or materials are not just as available in the background but are core components of student experience and learning. Learners engage with both the social surroundings (as in the case of interprofessional learning) and also with the technological equipment (material based simulation contributing to physical realism). Neither the social nor the material factors are constant in the real clinical world, which adds to the complexity of clinical management and requires the clinicians to be engaged during the process of decision-

making. Creative ways to provide training are required that can be facilitated thorough varied realistic scenarios presented to professional teams through simulation.

The ONE-Sim workshop is proposed to function as an effective training tool to up-skill both medical and midwifery staff and also medical and midwifery students at the same time. We have replicated this workshop in three different settings in different geographical locations across India and demonstrated the transferability of this workshop across various birth and educational settings. Although the birth settings used in this study were different, the problems that were initially identified were quite similar across sites, suggesting that similar solutions through these teaching workshops can possibly be sought. The learning was also similar in members belonging to medical and midwifery groups of practitioners and students.

Other studies have been conducted in low resource settings to demonstrate improvement in learning (22) and self-efficacy with retention of skills from three months (21) up to two years (27). Improved clinical practice has been noted with implementation of emergency obstetric and newborn training (the PRONTO program) in Guatemala (28). Similarly, the PROMPT program was introduced in Zimbabwe (29) demonstrating improved learning of emergency obstetric skills and also improved clinical outcome.

In our study we have used highly realistic but low technology and low maintenance simulators that are easily transportable. Commonly used simulation equipment may be technologically complex, bulky or immobile, and may also require regular maintenance, storage facilities, and technological expertise to develop scenarios. Introducing such expensive equipment may be a challenge for low resource settings. Low cost simulators have been shown successfully to facilitate training in low-resource countries (30). However, even if the initial cost of the simulator is high, with repeated use, the running cost of each simulation session can be decreased justifying its cost effectiveness. These costs can only be determined after long term use of simulation (31). Use of mobile training resources have shown to improve clinical reasoning, decision making,

recognition of patient deterioration and self-reflection in the rural setting (32). Mobile simulators have been proposed to be cost effective (33), especially in areas where the simulator is not frequently used. The simulator can be packed and moved to different locations to maintain its optimum use and participants can retain their skills by regular attendance of the program ranging between six-monthly to two-yearly intervals.

Fidelity can be described as the extent to which the simulation can mimic the real clinical situation and not to be confused as being high in technology. A high fidelity simulator does not have to be static or consist of technologically complex equipment. As shown by Kneebone, distributive simulation is immersive in nature, can be rolled out on demand as required, and transported across sites with creation of a simulated environment (34). The ONE-Sim workshop also uses a simulator that can be transported and set up at ease in a short period of time. Although visual fidelity is created, for example, by excessive blood loss in the postpartum haemorrhage scenario, it mainly relies on creating the simulated environment by scenario design and immersion into the simulated situation presented to the participants.

Another complexity in simulation is to design the scenarios based on local protocols for improving clinical management and using local resources (including both material based and manpower related). In the ONE-Sim workshops, local faculty initially participated in train-the-trainer workshops and then assisted in teaching students and colleagues using local management protocols. For successful introduction of these simulation-based workshops, both faculty and participants (learners – that may be uniprofessional or interprofessional clinicians or students) need to find this form of learning acceptable, relevant to their practice, beneficial in their training and accessible for future use as we have shown through the ONE-Sim evaluation. Faculty members need to see the value of this form of training in supporting the learners' needs. Once consensus for the need for these learning workshops is reached, they need to invest their time and effort to be trained to effectively use the simulation equipment. Institutional support is required to encourage and support the faculty for making a change to their educational practice and resources

need to be mobilized to facilitate the provision of ongoing training. Currently, the ONE-Sim workshops are being considered for use as a mode of providing regular training in all three locations.

As described by Andreatta et al in 2010, simulation can be maintained at three levels: task, clinical and environmental (4). In the ONE-Sim workshop, we rely on all three aspects of simulation to provide a realistic and meaningful experience to participants. The simulator requires participants to practice clinical examination and procedures (e.g. performing manoeuvres in managing shoulder dystocia or bimanual compression to manage postpartum haemorrhage) representing the task-based learning experience. The clinical contextual simulation refers to participants applying clinical reasoning, resource management and judgment in managing emergency situations. This is created by the scenario design, which is specifically tailored to meet the requirements of the learners in their individual setting. An example in the ONE-Sim workshop is occurrence of fetal distress where management will vary if obstetricians were available on site (as in the case of the hospital) versus the rural setting where only birth attendants had to manage the situation. The third aspect focuses on creating the clinical environment. Due to the mobile nature of the simulation used in the ONE-Sim workshop, it can be transported from an undergraduate teaching space to a hospital or a rural setting, enabling the participants to relate to their individual environmental contexts.

Limitations

A limitation of the study is that we have only evaluated the participant response on what was learnt and how they contextualise that learning in their birth setting. An assessment of learning using a pre-test and post-test of knowledge was considered but rejected as the focus on this paper was on assessing feasibility and benefit recognised by participants in the various settings. An evaluation is currently underway to assess the retention of skills and how they were used in clinical practice one year after attendance of the workshops.

Conclusions

All groups of participants from different settings of clinical practice had a positive learning experience following the introduction of the mobile simulation workshops. Participants described similar take-home messages after attendance of the workshops. Mobile obstetric and neonatal simulation training was found to be useful by all groups of participants in their educational and clinical contexts. Mobile low technology simulators that can be transported easily, facilitate ease of training delivery across locations. Regular attendance of workshops on obstetric and neonatal simulation should be considered for addressing clinical challenges faced in birth settings across low resource settings.

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Table 1. Participant data

Location	Doctors	Nurses	Medical students	Nursing students	Total participants
Punjab (Rural primary health centres)	14	33	0	20	67
Uttar Pradesh (Secondary level district hospital)	15	29	4	0	48
Madhya Pradesh (Secondary level metropolitan hospital)	0	13	22	0	35

Table 2. Role as a birth attendant

Theme	Medical	Nursing/ Birth attendant	Medical students	Nursing students
Supporting senior clinicians	*Assist senior doctors in birth complications* *I have knowledge of all instruments if the senior doctors need it* *As senior obstetricians we support the junior doctors* *As senior paediatricians we support and teach our trainees*	*Keep all instruments ready when the doctor arrives Handing over instruments to doctors and follow orders* *Timely assessment of complication and refer to doctor* *Explains birth procedures* *Obey what the doctor says*	*Assistance to the doctor in delivery and monitor patients after birth* *Assist in caesarean sections* *We assess and communicate to the doctor in case of complications like postpartum haemorrhage*	*Assist senior nurse in conducting birth*
Recognising clinical and administrative role	*Manage complications* *Care for high risk women* *Reducing maternal morbidity and mortality by early intervention* *Provide safe birthing* *Assist in difficult births* *Assess if normal delivery can take place*	*Conducting safe birth for low risk women* *Prior assessment of mother and fetus* *Preparation for birth and maintaining patient hygiene* *Recording birth details* *Check sterility of instruments* *Monitor vitals* *Check discharge summary* *Ensure equipment is*	*Regular monitoring of vitals* *Check for complications and inform doctors* *Monitor labour including uterine contractions and progress of labour* *Assist in neonatal resuscitation* *Go to outreach clinics in rural areas and assess complications*	*Participating in births* *Attend birth with senior nurse* *Manage all stages of labour* *Assess for communicable diseases* *Assess progress of labour* *Assistance to senior nurses*

		ready *Keep medications ready* *Give medications as per instructions* *Complete partogram* *Prevent birth complications* *Identify abnormalities* *Conduct safety checks for baby* *Not been involved in complicated births* *Vital role for nurses in hospitals* *Provide comprehensive care to women an*		
Supporting the mother	*Educating women in the antenatal period about birth complications* *Inform women about signs and symptoms*	*Preparing the mother mentally and physically* *Maintain privacy* *How to bear labour pains* *Create relaxing environment* *Take consent form mother and relatives* *Teach the mother about labour*		*Provide psychological support* *Understanding mother's feeling of mother while she suffers pain* *Encourage the mother to be cooperative in labour*

		Prevent infections *Give confidence to mother to give birth*		
Recognising differences in experience of midwifery and medical groups	*Call the senior doctor if baby not crying* *As senior consultants we do antenatal clinics, complicated births like breech, caesarean section, mange postpartum haemorrhage* *As a neonatal resident, I have frequently seen both normal labour and also difficult births but my role is in resuscitating the baby*	*Support junior nurses* *Check baby cry* *Refer to higher centre*	*Seen births in training but never conducted one* *I practiced and assisted in up to 15 births in training* *As a student I assisted in births but never performed them* *Seen around 5-6 births and 5-6 caesarean sections* *As a male student no exposure to births*	*Learn to conduct normal birth and assist senior nurses* *Trained in both newborn care and births* *Learn about complications* *Exposure to theatre procedures like caesareans* *Being a second assistant in caesareans*

Table 3. Key learning messages from workshops

Theme	Medical	Nursing/ Birth attendant	Medical students	Nursing students
Acquiring knowledge and procedural skills	*I was able to revise and upgrade the knowledge I already had…*	*Our doubts regarding procedures to manage complications have been cleared.* *Learn techniques to manage risks that occur to mother and baby.* *There are times when senior consultants are not available...this will help to manage haemorrhage and neonatal resuscitation*	*For me, normal delivery and how to remove placenta was good…* *It is good to aware of complications*	*It increased my confidence in conducting deliveries* *The session gave me both knowledge and skills to conduct delivery* *Techniques for post partum management were very useful*
Learning non-technical skills	*Call for help and involve all other staff available*	*It was good to learn the correct techniques and knowledge as a team, which can help, save mother and baby's life…* *It is a very satisfying session as I learnt to ask for help early and think for further steps that are needed in time critical situations*		*I learnt how to call for help and initiate resuscitation before doctor arrives*
Developing a systematic approach to obstetric	*Each and every step during birth is important*	*I learnt which step to follow first in newborn*	*We have to prepare ourselves for the*	

and neonatal emergencies	*to reduce maternal and neonatal morbidity especially while managing emergencies.* *If I am not able to manage the emergency, I will call ambulance early and refer to higher centre…* *It is important to prepare for every birth complication before hand...* *Be organized by arranging blood if necessary..* *Better management of complications prior to arrival of senior doctor*	*care…I also learnt how further complication can be prevented by early management* *I learnt the sequence of events to follow for managing the emergency*	*upcoming emergency, have all equipment ready, maintain patient safety (by inserting IV line) and use preventive measures (for e.g. give oxytocin) to prevent PPH.* *Know the correct method to do resuscitation and chest compressions…not only in distressed babies but also in preterm births*	
Recognising simulation as a mode of learning	*…will incorporate this teaching in my practice to increase the confidence that is acquired by regular practice* *Learning from workshop will change my further management in clinical emergencies…it is an*	*I learnt about different ways complications can present..* *It was a new opportunity to not only increase knowledge on these topics but to clinically handle the models…* *Learning process is very interesting as it can*	*We need to manage difficult births in an urgent manner….a good learning to think what we should in the time to prepare ourselves* *Not only an enjoyable experience but managed clinical procedure from beginning to end*	*Demonstration of procedure followed by conducting the procedure is the best way to learn* *Even though it was a dummy, we learnt the procedure very clearly*

	interesting way to learn and will help in clinical practice	*clinically applied to practice…* *Although the clinical situation were stressful, learning was not stressful…*		
Learning in teams	*We learnt to consult our senior doctors in case complications occur….* *…how to deal with difficult births in a team and support our students and staff to deal with such a situation.* *Team building is the main objective to improve health care involving interns, residents and staff.* *Management of both mother and baby by early involvement of senior consultant…*	*We all need to learn together in this way, so we get an opportunity to practice the way we work…* *This is the first time our senior doctors are teaching and learning a procedure with us in a class…* *We learnt effectively in teams…now to work in teams effectively will be our goal…especially in abnormal labour*		

Ethical statement

The study complies with Institutional Quality Assurance framework for each health care institution. Participants gave informed and free consent to participate in the study. They were verbally consented (as per guidelines from the host institution's Ethics Review Committee) for the interview and reassured about confidentiality.

Authorship agreement

I confirm on behalf of all authors that that the article is my original work. I also confirm that the article has not received prior publication and is not under consideration for publication elsewhere. I confirm that all authors have seen and approved the manuscript being submitted and I abide by the copyright terms and conditions of Elsevier and the Australian College of Midwives.

Dr. Arunaz Kumar

On behalf of all co-authors