DOCTORAL THESIS

Translational simulation: reframing the contribution of simulation to healthcare quality and safety

Brazil, Victoria A.

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Translational Simulation:

Reframing the contribution of simulation to healthcare quality and safety

Victoria Brazil

Exegesis and Portfolio submitted in total fulfilment of the requirements of the degree of Doctor of Philosophy (PhD)

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Faculty of Health Sciences and Medicine

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ABSTRACT

In 2017, I proposed the term '**translational simulation'** as a "*functional term for how simulation may be connected directly with health service priorities and patient outcomes, through interventional and diagnostic functions*" (1). This provided a conceptual reframing of the potential contribution of healthcare simulation to healthcare quality and safety. This integrative exegesis of published works on translational simulation from 2017-2023 explores my contribution to that conceptual reframing, including a description of the context in which these works were produced, and a path for future research and practice.

The exegesis explicates a portfolio of 11 **published works.** The first of these works is the article '*Translational simulation, not where but why'*, which served as the foundation of the programme of research and scholarship represented by this exegesis, and is presented here as Chapter 3. The next nine published works are grouped into three thematic threads, each represented by a chapter in this exegesis.

1) Purpose of translational simulation (Chapter 4)
2) Process for translational simulation (Chapter 5)
3) Conceptual foundations for translational simulation (Chapter 6)

The final publication - "*Translational Simulation revisited*" is a capstone article, presented in Chapter 7, in which I reflect on the evolving conceptual model for how healthcare simulation contributes to quality and safety in healthcare.
Within each chapter, I describe the context and rationale in which my prior work was published and reflect on the contribution that the article made to the academic conversations.

Two academic conversations related to translational simulation have been sharpened by my reflections and critique in this exegesis: ongoing conceptual reframing, and the challenges of practical integration of translational simulation into healthcare improvement. I conclude the exegesis by elaborating these conversations and looking ahead to future scholarship and practice in this area.

KEYWORDS

Translational Simulation, Healthcare simulation, Quality Improvement, Patient safety, *In situ* simulation, Healthcare teams

DECLARATION BY AUTHOR

This exegesis and portfolio is submitted to Bond University in fulfilment of the requirements of the degree of Doctor of Philosophy by Published Work.

This exegesis represents my own original work and contains no material that has previously been submitted for a degree at this University or any other institution, except where due acknowledgement has been made.

Name: Victoria Brazil

Signature:

Date: 7th August, 2024

PORTFOLIO OF PUBLISHED WORKS

1. Brazil, V. **Translational simulation: not 'where?' but 'why?' A functional view of in situ simulation**. Adv Simul 2, 20 (2017). https://doi.org/10.1186/s41077-017-0052-3 (1). Reproduced under Creative Commons licence CC BY 4.0

2. Brazil, V., Purdy, E., Alexander, C. et al. **Improving the relational aspects of trauma care through translational simulation**. Adv Simul 4, 10 (2019). https://doi.org/10.1186/s41077-019-0100-2 (2). Reproduced under Creative Commons licence CC BY 4.0

3. Brazil, V., Lowe, B., Ryan, L. et al. **Translational simulation for rapid transformation of health services, using the example of the COVID-19 pandemic preparation**. Adv Simul 5, 9 (2020). https://doi.org/10.1186/s41077-020-00127-z (3). Reproduced under Creative Commons licence CC BY 4.0

4. Brazil, V., McLean, D., Lowe, B. et al. **A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH)**. BMC Health Serv Res 22, 1108 (2022). https://doi.org/10.1186/s12913-022-08463-8 (4). Reproduced under Creative Commons licence CC BY 4.0

5. Nickson, C.P., Petrosoniak, A., Barwick, S. Brazil, V. **Translational simulation: from description to action**. Adv Simul 6, 6 (2021). https://doi.org/10.1186/s41077-021-00160-6 (5). Reproduced under Creative Commons licence CC BY 4.0

6. Brazil, V., Scott, C., Matulich, J. et al. **Developing a simulation safety policy for translational simulation programs in healthcare**. Adv Simul 7, 4 (2022). https://doi.org/10.1186/s41077-022-00200-9 (6) Reproduced under Creative Commons licence CC BY 4.0

7. Brazil, V., Purdy, E., El Kheir, A. et al. **Faculty development for translational simulation: a qualitative study of current practice.** Adv Simul 8, 25 (2023). https://doi.org/10.1186/s41077-023-00265-0 (7) Reproduced under Creative Commons licence CC BY 4.0

8. Brazil V, Purdy EI, Bajaj K. **Connecting simulation and quality improvement: how can healthcare simulation really improve patient care?** BMJ Qual Saf. 2019 Nov;28(11):862-865. http://dx.doi.org/10.1136/bmjqs-2019-009767 (8). Reproduced with permission from BMJ Publishing Group Ltd. License number 5722251400080

9. Brazil V. **Simulation for the real world**; [Keynote presentation] Transforming healthcare teams and systems THIS space; Cambridge UK, and virtual: THIS institute; 2020 (9)

10. Brazil V, Purdy E, Bajaj K. **Simulation as an Improvement Technique**. Cambridge: Cambridge University Press; 2023. (Elements of Improving Quality and Safety in Healthcare). Series: Elements of Improving Quality and Safety in Healthcare. DOI: https://doi.org/10.1017/9781009338172 Online ISBN: 9781009338172. Cambridge University Press (10). Reproduced under Creative Commons Attribution licence CC-BY-NC-ND 4.0

11. Brazil V, Reedy, G Translational Simulation Revisited: An evolving conceptual model for the contribution of simulation to healthcare quality and safety. **Adv Simul** 9(1):16 https://doi.org/10.1186/s41077-024-00291-6 (11). Reproduced under Creative Commons Attribution licence CC-BY-NC-ND 4.0

Declaration of Author Contributions

Publication co-authored	Statement of contribution
Brazil V. Translational simulation: not 'where?' but 'why?' A functional view of in situ simulation. Advances in Simulation. 2017;2(1):20.	Sole author
Brazil V, Purdy E, Alexander C, Matulich J. Improving the relational aspects of trauma care through translational simulation. Advances in Simulation. 2019;4(1):10.	Lead author (> 50%) and project lead for all phases: Study design, ethics submission, invitation of co-authors, project and research team management, data collection and analysis, manuscript preparation and revisions.
Brazil V, Lowe B, Ryan L, Bourke R, Scott C, Myers S, et al. Translational simulation for rapid transformation of health services, using the example of the COVID-19 pandemic preparation. Advances in Simulation. 2020;5(1):9.	Lead author (>50%) and project lead for all phases – study design, project management, data collection and analysis, manuscript preparation and revisions
Brazil V, McLean D, Lowe B, Kordich L, Cullen D, De Araujo V, et al. A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH). BMC Health Services Research. 2022;22(1):1108.	Lead author (>50%) and project lead for all phases – study design, ethics submission, invitation of co-authors, project and research team management, data collection and analysis, manuscript preparation and revisions.
Nickson CP, Petrosoniak A, Barwick S, Brazil V. Translational simulation: from description to action. Advances in Simulation. 2021;6(1):1-11.	Senior author (40%). Jointly developed concept and writing plan with first author. Lead writer for specific sections. Reviewed and edited all sections. Contributed to manuscript revisions.

Brazil V, Scott C, Matulich J, Shanahan B. Developing a simulation safety policy for translational simulation programs in healthcare. Advances in Simulation. 2022;7(1):4.	Lead author (>50%) and project lead for all phases – simulation safety policy development, study design, data collection and analysis, manuscript preparation/ revisions
Brazil V, Purdy E, El Kheir A, Szabo RA. Faculty development for translational simulation: a qualitative study of current practice. Advances in Simulation. 2023;8(1):25.	Lead author (>50%) and project lead for all phases – study design, ethics submission, invitation of co-authors, project and research team management, data collection and analysis, manuscript preparation and revisions.
Brazil V, Purdy EI, Bajaj K. Connecting simulation and quality improvement: how can healthcare simulation really improve patient care? BMJ Quality & Safety. 2019:bmjqs-2019-009767.	Lead author (>50%) of invited submission. Conceptualised article and selected co-authors. Wrote original draft, with selected input from co-authors.
Brazil V, Purdy E, Bajaj K. Simulation as an Improvement Technique. Cambridge: Cambridge University Press; 2023. (Elements of Improving Quality and Safety in Healthcare). Series: Elements of Improving Quality and Safety in Healthcare.	Lead author (>50%) of invited submission. Conceptualised idea and selected co-authors. Wrote the original draft and all three revisions, with selected input from co-authors.
Brazil V, Reedy, G Translational Simulation Revisited: An evolving conceptual model for the contribution of simulation to healthcare quality and safety. Advances in Simulation 2024;9(1):16	Lead author (>50%) and lead for all phases - narrative literature review, manuscript concept, drafting and editing of manuscript.

ETHICS DECLARATION

The research associated with this exegesis and portfolio received ethics approval from the relevant Ethical Review committees.

2. Brazil V, Purdy E, Alexander C, Matulich J. Improving the relational aspects of trauma care through translational simulation. Advances in Simulation. 2019;4(1):10.

The study was approved by the Gold Coast Health Service Human Research Ethics Committee. (HREC/18/QGC/13)

4. Brazil V, McLean D, Lowe B, Kordich L, Cullen D, De Araujo V, et al. A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH). BMC Health Services Research. 2022;22(1):1108.

The study was approved by the Gold Coast Health Service Human Research Ethics Committee. (HREC/2020/QGC/60733)

7. Brazil V, Purdy E, El Kheir A, Szabo RA. Faculty development for translational simulation: a qualitative study of current practice. Advances in Simulation. 2023;8(1):25.

The study was approved by the Bond University Research Ethics Committee. (VB00057)

Copyright Declaration

This exegesis makes careful note of all sections which have been previously published, along with relevant copyright information.

All of my published articles are open access works and carry a Creative Commons licence as stated in the citations provided in Frontmatter pages v and vi.

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- **Systems Integration: Engineering the Future of Healthcare Delivery via Simulation.** Book chapter In: The Comprehensive Textbook of Healthcare Simulation. (13)
- **Translational Simulation**. Opening keynote speaker at the Society for Simulation in Europe (SESAM) conference. 2018. (14)
- **Translational simulation.** Podcast. Jointly produced between the Boston-based Center for Medical Simulation (CMS) and *Simulcast.* 2018. (15)
- **Translational simulation: Transforming healthcare teams and systems**. Opening plenary talk at Royal College of Physicians and Surgeons of Canada Simulation Summit. 2021. (16)

CHAPTER 4

- **Raise the Red Blanket: Rapid transfer to theatre for simulated critically ill trauma patients**. Presentation Simtect Health; Melbourne: Simulation Industry Association of Australia. 2009. (17)
- **STEMI-sim. Process of Care Simulation can Help Improve Door to Balloon Times for Patients with ST Elevation Myocardial Infarction**. Conference presentation. 2012 (18)
- **Doing our work better, together** Keynote speaker. Norman Education Research Day, McMaster University, Hamilton, Ontario, Canada. 2018: (19)

- **Teams culture and getting better – improving quality in healthcare.** Association for Medical Education Europe (AMEE) Key Keynote address. Glasgow/ Virtual, UK: 2020 (20)
- **Translational simulation - targeting competence, culture or community?** Keynote speaker. International Meeting for Simulation in Healthcare (IMSH) San Diego, USA: 2020 (21)
- **Healthcare simulation for shaping relationships and culture in high performing teams - simulation for the real world**. Invited speaker International Pediatric Simulation Society (IPSS) Virtual Conference: 2021 (22)
- **Upstream Thinking.... working better, together, in complex systems** Keynote speaker. Association for Simulated Practice in Healthcare (AsPiH) UK: Virtual Conference: 2021 (23)
- **Building high performance healthcare teams - culture, relationships and translational simulation** Keynote speaker. Developing Excellence in Medical Education Conference (DEMEC), Manchester, UK: 2021 (24)
- **Simulation changing the face of healthcare improvement: a silver lining from the COVID-19 pandemic?** *Canadian Journal of Emergency Medicine.* 2022 (25)
- **Preparing maternity for COVID-19: A translational simulation approach**. *Australia and New Zealand Journal of Obstetrics and Gynaecology*. 2020. (26)
- **Assessing the risk of nosocomial infection posed by COVID-19 tracheal intubation.** *Anaesthesia*. 2020. (27)
- **Panic or complacency. COVID and emergency medicine education**. Keynote speaker. Australasian Conference for Emergency Medicine (ACEM) Annual Scientific Meeting; Virtual 2020. (28)Brazil V, Orr R, Canetti EFD, Isaacson W, Stevenson N, Purdy E. **Exploring participant experience to optimize the design and delivery of stress exposure simulations in emergency medicine.** AEM Educ Train. 2023 (29)

CHAPTER 5

- **Advances in Simulation: Translational Simulation in Action.** Simulcast Podcast 2021.(30)

- **Simulation and Patient Safety- a complex relationship**. Blog post International Clinical Educators Network (ICEnet) 2017. (31)
- **Simulation safety spotlight. A call for safety briefings in sim**. Blog post International Clinical Educators Network (ICEnet). 2019. (32)
- **Pause & Discuss – The Harms Involved in Improving Patient Safety**. Podcast. 2017. (33)
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- **The Purpose, Design, and Promise of Medical Education Research Labs**. *Acad Med*. 2022. (35)
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- Brazil, V and Purdy, E. **CT Safe and Fast: Simulation for High Performing Teams working in Complex Systems** Invited presentation. June 2021 (39)
- Lowe, B et al. **Virtual reality laparoscopic simulation for operating theatre efficiency: an outcome logic model program evaluation** Int J Healthcare Simulation. November 2023. (40)

Abbreviations

Simulation-Based Education (SBE)

Quality Improvement (QI)

Institute for Healthcare Improvement (IHI)

Institute of Medicine (IOM)

Controlled Risk Insurance Company (CRICO)

In situ Simulation (ISS)

Latent Safety Threats (LSTs)

Low-dose, High-frequency (LDHF) simulation

Society for Simulation in Europe (SESAM)

Center for Medical Simulation (CMS)

Crisis Resource Management (CRM)

Australasian College for Emergency Medicine (ACEM)

High Performance Teamwork Strategy (HPTS)

Post-Partum Haemorrhage (PPH)

Gold Coast University Hospital (GCUH)

Relational Coordination (RC)

Simulation-based Clinical Systems Testing' (SbCST)

Society for Simulation in Healthcare (SSH)

Systems Engineering Initiative for Patient Safety (SEIPS)

Simulation-based Quality Improvement Observation Tool (SQIOT)

Healthcare Failure Modes Effects Analysis (HFMEA)

Society in Europe for Simulation Applied to Medicine (SESAM)

National Health Service (NHS)

CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

The simulation community has effectively responded to calls for a more direct contribution to healthcare quality and safety, and clearer alignment with health service priorities (41), but the conceptual framing of this contribution is vague. Part of the problem is that 'simulation' is an umbrella term describing a heterogenous collection of methods, with diverse educational and quality improvement aims, and without consistent taxonomy. A second issue is the lack of connection between the practice fields of healthcare simulation and quality improvement. Practitioners, methodologies, and terminology within these fields seem to have disappointingly little overlap. Consequently, there is little consistency in how we design, deliver or evaluate simulation activities that purport to improve patient care. Without a better conceptual framing, the contribution of healthcare simulation to quality and safety will suffer from inconsistency and incoherence.

A bias within the simulation community toward *techniques* and methods may also be a contributor to this lack of conceptual framing. As early as 2005, simulation practitioners started to employ novel techniques such as *'in situ'* simulation – delivered in the real clinical environment – to bring healthcare improvement and simulation practice closer together. However, there is a paucity of well-developed principles upon which to design these simulations, or broader strategies in which to situate them. The terminology - in situ - defined simulation activities by their location, missing an opportunity to frame this contribution to healthcare improvement conceptually.

Against this backdrop, I proposed the term '**translational simulation'** in 2017 as a "*functional term for how simulation may be connected directly with health service priorities and patient outcomes, through interventional and diagnostic functions, independent of the location of the simulation activity*" (1). Over the subsequent seven years, this conceptual reframing of the potential contribution of simulation to healthcare outcomes has emerged, begun to take shape, and gained momentum. This integrative exegesis of published works on translational simulation from 2017-2024 explores my contribution to that conceptual

reframing, including a description of the context in which these works were produced, and a path for future research and practice.

1.2 OUTLINE OF THE EXEGESIS

The exegesis is structured in chapters that reflect both temporal progression and thematic threads in my work in translational simulation. In the remainder of this introductory chapter, I provide an outline of the exegesis, describe my personal background, perspectives and scholarship, articulate my research orientation and reflexivity, and outline the methodologies for the works presented in this exegesis. In Chapter 2, I describe healthcare simulation practice and scholarship before 2017 and provide a rationale for offering new terminology to describe emerging simulation practices that directly targeted health service improvement. Chapter 3 includes the published manuscript that represented the foundation of this programme of research and scholarship, and which provides a definition of translational simulation and the conceptual reframing of simulation as a contributor to healthcare quality and safety. In Chapter 4, I provide three examples of translational simulation in action: enabling rapid process changes in healthcare during COVID-19, exploring culture and relationships between staff caring for major trauma patients, and supporting high performance teamwork in caring for women suffering from a post-partum haemorrhage. I reflect on how the COVID-19 pandemic raised the profile of translational simulation and raised new practical and theoretical questions about its application and implementation. Chapter 5 considers the 'how' of translational simulation; what strategies, processes and tools enable successful design and delivery of translational simulation activities within healthcare institutions? In Chapter 6 I explore more deeply the conceptual foundations of translational simulation and the intersections of healthcare simulation with healthcare improvement, patient safety and other fields of practice. In Chapter 7, I revisit the original conceptual framing in my 2017 article and, through critical reflection on published examples and personal observation of contemporary translational simulation practice around the world, I offer a revised conceptual framing. My final chapter, Chapter 8, summarises the contributions of the publications in this exegesis to scholarship and practice in healthcare simulation and reflects on their connection to underpinning theories and concepts. In Chapter 8, I propose translational simulation as a key diagnostic and implementation

strategy for improving teams and systems in healthcare, and I conclude by offering the next steps for research and practice in the field,

The exegesis explicates 11 **published works.** The first of these works is the article '*Translational simulation, not where but why'*, which served as the foundation of the programme of research and scholarship represented by this exegesis, and is presented here as Chapter 3. The next nine are grouped into thematic threads (**Figure 1**), each represented by a chapter in this exegesis:

- **Purpose:** Translational simulation in action (Chapter 4)
- **Process:** Implementation, design and delivery of translational simulation (Chapter 5)
- **Conceptual foundations** with healthcare quality and safety (Chapter 6)

The last of the prior works is a capstone publication - Translational Simulation Revisited – which is discussed in Chapter 7.

In each chapter, I summarise the published work(s), and situate them within the relevant academic conversations and contemporary simulation practice. I reflect on the impact of the works, on missed opportunities for further impact, and on next steps for my own contributions to those conversations. For coherence, each of Chapters 3 through 7 are structured with the following subheadings: -

- *What conversations was this article joining?*
- *Why this article at this time?*
- *What was the article's main contribution?*
- *How did this article impact the field?*
- *What were the next conversations?*

Where appropriate, 'article' is replaced by 'book chapter', 'presentation', or other descriptor. Most of the contributions in this exegesis are traditional academic outputs stemming from both conceptual and empirical work, e.g., journal articles and a book chapter. I have also included prior works of digital scholarship, cognisant that academic contributions such as blogs, podcasts and videos on online platforms are increasingly recognised as scholarship (42, 43), and can have significant measurable impact. Digital contributions are also reflective

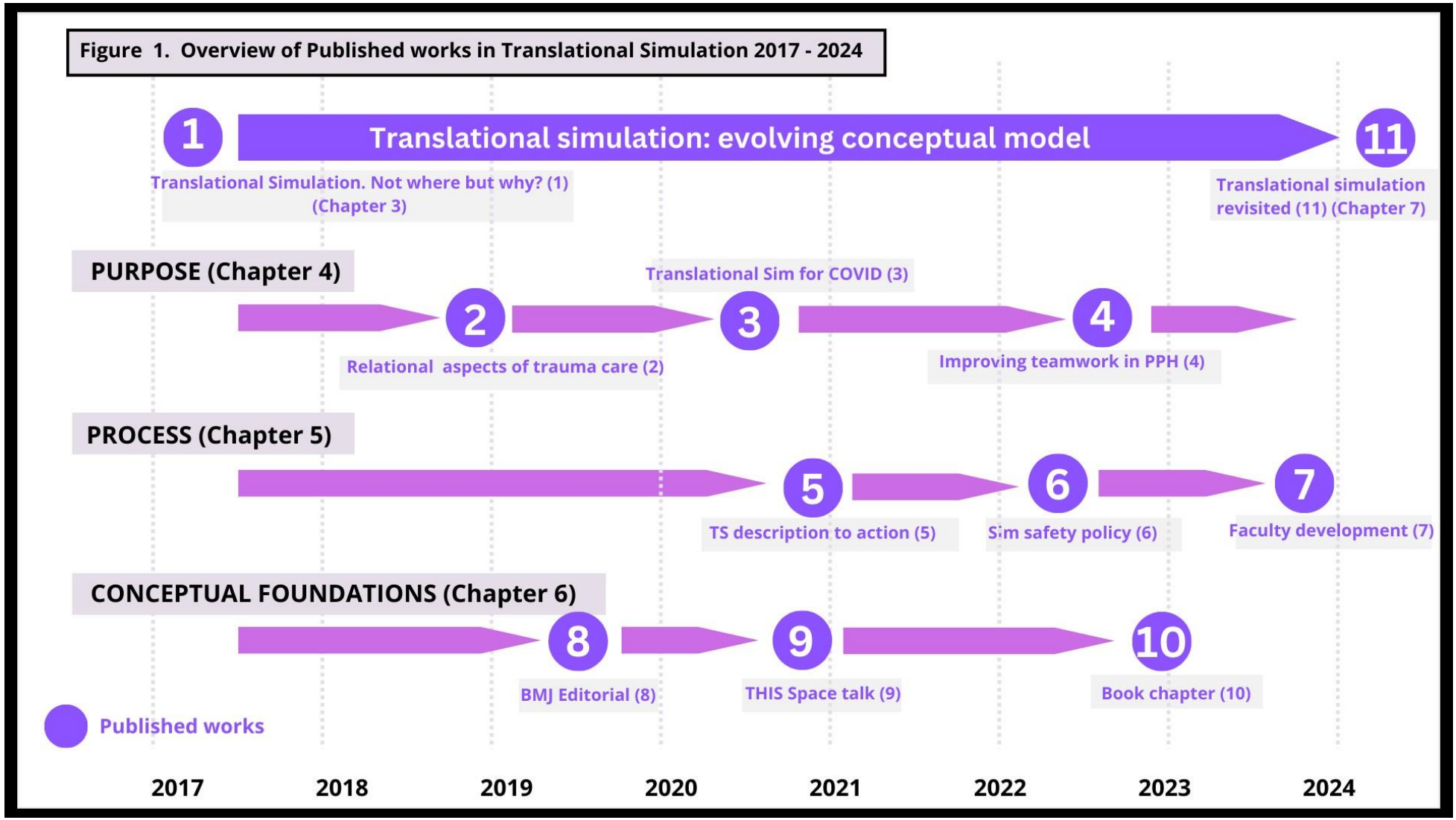

Figure 1a. Overview of published works in this exegesis in three themes: Purpose, Process and Conceptual Foundations.

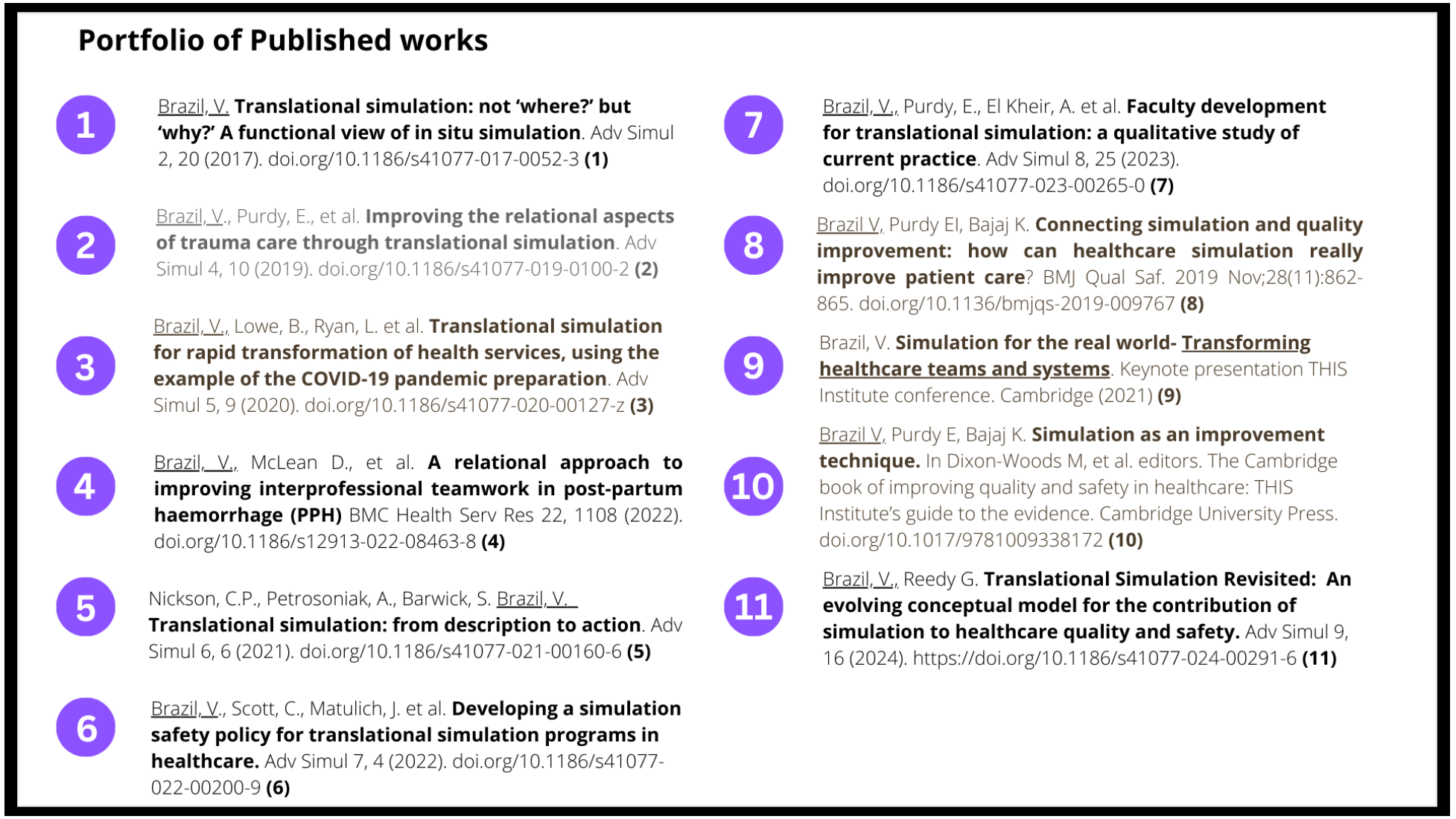

Figure 1b. Portfolio of published works

of my own scholarly work, including my role as a producer for the Simulcast podcast, as an author of blog posts in several international blogs, and as an invited speaker at numerous international healthcare simulation and education conferences.

The 11 identified prior works are complemented by a series of **supporting scholarly outputs** (p. xvii - xix), These scholarly outputs include presentations, other journal articles, book chapters, and digital scholarship relevant to this body of work. The works are illustrated diagrammatically in each chapter and described in the narrative where relevant. This supporting scholarship illustrates the depth of my contributions to the academic conversations reframing the contribution of healthcare simulation to healthcare improvement and demonstrates the breadth of dissemination activity I have undertaken to support the impact of my contributions.

In the remainder of this Chapter, I describe my background, in three intersecting professional identities: 1) a clinician educator, simulation practitioner and leader, 2) an advocate and opinion leader, and 3) a researcher and scholar. My discussion of research and scholarship segues into a more focused discussion of my research orientation and reflexivity for the works presented in this exegesis.

1.3 My background as a clinician educator, simulation practitioner and leader

My professional background as a clinician, educator and simulation practitioner has influenced my perspectives on how simulation might optimally contribute to healthcare quality and safety. In this section, I describe that background and those perspectives, and consider how they influence my stance as a researcher and academic.

I have practised emergency medicine for 25 years and have identified as a clinician educator for most of that time. My interest in healthcare simulation started in 2003 when I was introduced to crisis resource management (CRM) training (44) in the context of my clinical and educational practice. In this manifestation of simulation, interprofessional teams engage in short clinical scenarios in which the ‘patient’ (often a plastic manikin) is acutely unwell with conditions such as cardiac arrest or major trauma. The team has to assess and

manage the crisis. Scenarios are followed by a debrief in which team members reflect on individual and team performance. As both a learner and educator, I found these experiences to have a profound impact on my clinical practice, my knowledge of clinical teamwork, and the way I thought about reflective practice.

In the 20 years since those first experiences, I have been involved in design and delivery of simulation scenarios in diverse healthcare contexts, in parallel with my clinical emergency medicine career and other educational roles. The first of my simulation roles was as leader of a private company (*Medical Education Solutions*) providing simulation-based training to acute care teams in rural and regional practice in Queensland, Australia. This training required techniques that were novel to the simulation community at the time, e.g., 'mobile' simulation delivery, with mannikin and audio-visual equipment transported to the location, and scenarios set up in the resuscitation bays of small rural hospitals. As our team delivered this training, I appreciated how these simulations also afforded reflection on the adequacy of the equipment and physical layout within the resuscitation bays. Importantly, operating within a commercial framework meant that my learners were also *customers*, which provided a powerful focus on demonstrating value and return on investment. This relatively unique introduction to simulation has continued to shape my perspectives on the alignment of simulation purpose and practice.

Other key roles in healthcare simulation delivery have included:

1) **Director of Simulation, Bond University Medical Program** (2012 – 2022). In this role, I oversaw the design and delivery of scenarios for medical students. I had to consider delivery strategies for large cohorts of leaners and manage a large faculty team of clinicians, academics, technical experts and simulation patients. I have delivered and overseen faculty development to support this group in consistent, high quality simulation delivery, aligned with the broader Bond University Medical Program curriculum.

2) **Medical Director, Gold Coast Health Simulation Service** (2014 – present). In this role, simulation delivery occurs in a large and complex health service on the Gold Coast, Australia. The primary responsibility of health services is clinical care that is safe, efficient, effective and accessible. As the inaugural director of the simulation

service, I felt our work had to reflect these priorities. I have thus overseen the delivery of simulation that balances educational and quality improvement aims.

1.4 My background as an advocate and opinion leader

I have encouraged debate and helped shape opinion among communities of practice in healthcare simulation and medical education. In academic publications relating to performance assessment in simulation (45), the use of social media in medical education (46), and medical workforce development (47-49), I sought to influence opinion and advocate principles for practice. More of this advocacy-focused scholarship has been enacted through conference presentations (over 160 national and international keynote presentations since 2006) and through writing editorials and posts for influential simulation and emergency medicine blogs.

My work as a founder and co-producer of Simulcast (one of the most listened to healthcare simulation podcasts globally) since 2016 has sought to translate and deconstruct the healthcare simulation literature for the practice community (50). Over seven years and more than 180 podcast episodes, I have developed a familiarity with diverse threads of healthcare simulation research and been challenged to present this to listeners in practical and engaging ways. Deep dives into the research questions, background literature, and methodologies described in the articles reviewed for our monthly journal club, have significantly expanded my understanding of healthcare simulation scholarship.

Serving as a senior editor for *Advances in Simulation* has further extended my repertoire of research skills and perspectives. *Advances* is the journal of the academic society for healthcare simulation in Europe, which encourages contributions from diverse practitioners and embraces diverse simulation and research methodologies. In reviewing and handling dozens of manuscripts, I have learned to value alignment of paradigms, methodologies, methods and questions in healthcare simulation research.

1.5 My background as a researcher and scholar

My interest in healthcare simulation practice has been enriched through involvement in research, scholarship and participating in the healthcare simulation community of practice.

My early personal research efforts in healthcare simulation and medical education were reflective of my positioning as a clinician and educator. Many of my early publications were reports of educational programs in which I was involved (51-54), reflected upon through evaluation data, and seeking to establish 'proof' of the quality of my educational work. In retrospect, it is easy to see my stance in those efforts as positivist, i.e., I was operating in a paradigm in which reality is static, knowledge is objective and neutral, and methodologies aim to test hypotheses and establish truth (55). Positivism has been dominant in medical education research, largely due to the backgrounds of many clinician educators (like myself) in biological and physical sciences, and also due to its suitability as a framework for most basic and clinical science research.

Influenced by mentors and colleagues trained primarily in educational or social science traditions, I developed an awareness of the limitations of positivism in exploring and understanding complex and non-linear questions in medical education and in healthcare simulation research. These influences, combined with personal professional development efforts, led to participation in research using qualitative methodologies, drawing on interpretivist paradigms. These included studies exploring the experience of medical education registrars I had supervised over a 10-year period (56), the understanding of 'cultural competence' by clinical supervisors of junior doctors (57), the perceptions of medical students' safety skills in a simulated emergency department (58), the recognition and response to clinical deterioration by medical students' in simulation (59), and the prescribing practices of junior doctors' (60).

I participated in research using ethnographic methods in understanding the 'cultural compression' that can occur in healthcare simulation (61), and in a series of studies with a University of Queensland Business School team in which we explored complex work and educational dynamics in the emergency department (62-65). These experiences helped me embrace interpretivist paradigms, in which reality and knowledge are recognised as subjective with multiple interpretations, and associated with methodologies that focus on understanding and inductive reasoning through tools such as interviews and narrative surveys (55).

1.6 Research orientation and reflexivity of prior works

The body of work presented in this exegesis reflects a range of research questions, aims and methodologies, underpinned by a pragmatist paradigm (66). This paradigm "*orients*

itself toward solving practical problems in the real world" (55). Pragmatism embraces methodological approaches across the spectrum from post-positivism to constructivism, but only if it has utility in terms of the research question (55). Pragmatism aims to create 'useful' knowledge, favouring the study of whole systems, including the social consequences of research (67). Long suggested that pragmatism was well aligned with the "*rapidly changing context of health services implementation and evaluation*" (67). Pragmatic research investigates both effectiveness and implementation outcomes (68).

Consistent with a pragmatic stance, the 11 prior works presented in the exegesis illustrate a range of methodologies, each appropriate for the purpose of the research and research questions. The first and last articles (1, 11) are conceptual and draw together theory and practice to present conceptual models. The book chapter (10) is a comprehensive narrative literature review. Three peer-reviewed articles (2, 4, 7) involve empiric research using qualitative methodologies and thematic analysis. A description of these methods is provided within the relevant chapters of the exegesis. Three articles (3, 5, 6) are practical descriptions of translational simulation practice, reflecting on lessons learned and offering recommendations for translational simulation practitioners.

My positioning as a clinician, educator and leader of a simulation program that is deeply embedded in (and funded by) a health service supports a pragmatic world view that extends beyond practice to scholarship. The scholarly contributions presented in this exegesis include descriptive conceptual work, practical application and implementation research, as well as participatory action research. Methodologies within the works in this exegesis vary according to the specific research question and aims**.** I am strongly influenced by my responsibilities for healthcare simulation to directly improve patient safety and healthcare quality and to demonstrate value to taxpayers.

In considering my reflexivity, I am aware that my position as a senior doctor and leader in our Australian health service affords privileges and presents ethical dilemmas. As Olmos-Vega et al describe, "*Reflexivity is a set of continuous, collaborative, and multifaceted practices through which researchers self-consciously critique, appraise, and evaluate how their subjectivity and context influence the research processes*."(69). My research and scholarship are inextricably linked to my simulation practice at Gold Coast Health (Australia), and this 'contextual reflexivity' (70) is important. Healthcare simulation is a "*cultural, social, and political undertaking that is embedded in systems of power*" (71). As a leader in my

institution and field more broadly, I have a researcher positioning that allows deep insights into practice, but which necessitates careful consideration of those power dynamics in study design, participant involvement and the choices made about the healthcare simulation delivery under investigation.

CHAPTER 2: HISTORICAL CONTEXT FOR THE EMERGENCE OF TRANSLATIONAL SIMULATION

In this chapter, I describe the history of healthcare simulation practice in health professional education, and the aspirations – fulfilled or otherwise – to improve quality and safety in healthcare. The chapter begins with a definition of healthcare simulation, followed by an account of how simulation has been applied to health professions education from 1990s to the present. I then outline how the theory and practice of healthcare improvement has evolved over the same period. This is a brief introduction to a wider discussion of quality improvement in Chapter 6. In the second half of this chapter, I describe emerging simulation practices from the early 2010s that directly targeted health service improvement. These practices built upon, **but are distinct from** those targeting health professions education. Drawing on these histories, my aim is to provide the context in which I developed the concept of translational simulation.

2.1 WHAT IS HEALTHCARE SIMULATION?

According to the Healthcare Simulation Dictionary, simulation is "*a technique that creates a situation or environment to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions*." (72). Healthcare simulation encompasses diverse approaches: Human patient manikins, simulated patient actors, screen-based computer simulations, and virtual or augmented reality systems. Images of resuscitation teams performing compressions on a plastic manikin in a simulated cardiac arrest are pervasive and perhaps illustrative; but they belie the breadth of simulation applications in healthcare. These include procedural and communication skills training, competency assessment, teamwork training, understanding of patient experience, and much more. This breadth necessitates clear descriptions of exactly what is meant when describing a healthcare simulation activity. It has prompted efforts to create a functional taxonomy for healthcare simulation, such as Gaba's eleven

dimensions of simulation (73). These dimensions include participant attributes, simulation objectives, technology required, and method of feedback used, and are illustrative of a broad range of activities under the umbrella term of simulation. Gaba's description of simulation as a *technique* may, however, be fundamentally inadequate.

Park and colleagues offer an alternative definition of healthcare simulation, suggesting "*a more comprehensive understanding ..., beyond tool, technique or experience, to understanding it now as a professional practice*." (74). This definition implies expert use of methods and techniques, with a deep understanding of the context in which they are applied. It also shifts emphasis toward the practitioners. Healthcare simulation practitioners are diverse, fostered by the breadth of simulation techniques and purpose. Many are educators and clinicians, reflective of the origins of healthcare simulation as a clinical training tool. Healthcare simulation practitioners also include individuals with expertise in psychology, biomedical engineering, human factors, organisational behaviour, social sciences and other fields. This melange of backgrounds has created fertile ground for intersections of practice and scholarship. A vibrant community of practice is reflected by the number of healthcare simulation conferences, journals and publications (75) and connections with simulation practice outside of healthcare, e.g., aviation and defence (76). Conversations about the role of simulation professionals as advocates and leaders and the development of a Healthcare Simulation Code of Ethics (77) further support the claim of healthcare simulation as a professional practice (74).

2.2 HEALTHCARE SIMULATION AS AN EDUCATIONAL APPROACH

Since the 1990s, simulation has been widely adopted for the training of healthcare professionals, including midwifery, medicine, nursing and allied health disciplines. Theories, models, and conceptual frameworks from education frequently underpin both the study and the practice of simulation, including theories of adult learning, experiential learning, social-cognitivist, constructivist learning, and cognitive load, as well as guiding frameworks for curriculum development, evaluation and assessment. Integration of simulation-based education (SBE) into health professions curricula has been (variably) encouraged by accreditation requirements, dedicated funding, and the development of best practice standards for SBE (78). In practice, this means that most health professional students and

postgraduate trainees now participate in some form of SBE for clinical skill development, team training and/or assessment.

DOES SIMULATION AS AN EDUCATIONAL APPROACH IMPROVE PATIENT SAFETY?

Evidence of the *educational* effectiveness of SBE (79-81) across domains such as procedural skills, healthcare communication (82) and teamwork is substantial. SBE researchers have moved beyond proving 'it works' to focussing on understanding the features and contexts that support desired outcomes (75, 83-85). Most of that scholarship is based on conceptual frameworks from education that measure learners' knowledge, skills and behaviours as outcomes (86). Evaluation of *patient* outcomes – effectiveness, safety, efficiency or accessibility of care – has been less frequently undertaken (86).

While it is tempting to assume that well-trained healthcare professionals will deliver improved patient safety and healthcare quality, evidence that SBE has led to consistent quality and safety improvements is elusive. This is despite many healthcare simulation programs incorporating patient safety elements such as team communication, role allocation and leadership (87). Safety concepts like situational awareness, graded assertiveness and the use of cognitive aids and/or checklists are often integrated into simulation training for healthcare professionals, but may fail to be observed in subsequent clinical practice (88). There are, however, exemplar programs in which simulation has had a demonstrable impact on safety and quality outcomes (41, 89, 90). These have been widely cited by those seeking support for their simulation endeavours, in part because they are few in number. Without a change in approach, healthcare simulation risks being relegated to an educational expense, without demonstrated return on investment for healthcare institutions or improved patient outcomes.

2.3 WHAT IS HEALTHCARE QUALITY AND SAFETY?

The movement to develop a culture of healthcare quality and safety was also achieving prominence during the 1990s to about 2010, when healthcare simulation was becoming more widespread. The 1995 Quality in Australian Health Care Study (91) revealed hospital inpatients had an adverse event rate of 16.6%, and suggested that up to 18,000 Australians may be dying each year from adverse events in healthcare. In 2000, the landmark report -

To Err is Human; Building a Safer Healthcare System (92) - highlighted the unacceptable rate of adverse events in healthcare in the United States, with calls (and funding) for action. National organisations were set up in the USA (93), Australia (94), the UK (95) and other countries to oversee a predicted new era of improved patient safety.

Action on patient safety since that time has mostly followed a 'Safety I' approach (96), which sought to identify the causes and contributory factors of adverse outcomes, with a view to eliminating them. Within this paradigm, tools for measuring performance are mostly technical and quantitative, with strategies for improvement frequently designed at the systems level, e.g., introducing a new checklist after a medication administration error. Drawing on human factors engineering principles, safety practitioners used 'forcing functions' in process or equipment design to make it impossible to do a task incorrectly (97). For example, connectors to the oxygen and nitrous oxide gas containers in an operating theatre are designed to make it impossible to physically connect them to the wrong cylinder. The aim of Safety I is thus to remove inevitable human fallibility from performance as much as possible.

Quality healthcare is, however, more than simply the absence of harm. In 2001, the Institute of Medicine's (IOM) *Crossing the Quality Chasm* Report proposed six domains of quality healthcare: Safety, effectiveness, timeliness, efficiency, equity and patient-centredness (98). These wider targets for improvement recognised broader deficits in the delivery of healthcare. More recent descriptions require quality healthcare services to be well led, sustainable and equitable (99). The Australian Commission on Safety and Quality in Health Care (100), established in 2006, developed National Safety and Quality Health Service Standards (101) which provide comprehensive detail for health services and are an accreditation requirement for healthcare institutions. Similar policy frameworks and organisations have been established in most developed countries and have been instrumental in defining the agenda for healthcare quality and safety.

Defining healthcare improvement targets is important but targets need to be matched with strategies to achieve them. Quality improvement (QI) can be defined as a "*systematic and coordinated approach to solving a problem using specific methods and tools with the aim of bringing about a measurable improvement*" (99). Berwick's 1995 'Plan-Do-Study-Act' framework (102) for QI is still used widely today. QI encompasses a wide range of measurement tools, strategies for change, and research approaches. Theoretical

frameworks for QI draw on diverse disciplines including psychology, economics, marketing and organisational behaviour. Traditionally, QI tools have been mostly quantitative, measuring performance through audit of practice, and seeking explanations for unexplained variance (103). More recently, attention has turned to relational aspects of improvement, involving and engaging staff, and co-producing improvement efforts with consumers (99). Systems-level interventions have been favoured, and the success of organisations like the US-based Institute for Healthcare Improvement (IHI) has been attributable to the effectiveness of these QI approaches across contexts.

Paradigm shifts in healthcare quality and safety from 2015

Despite more than 15 years of international work on patient safety issues, health system outcomes continue to be suboptimal. Practitioners have started to question whether a traditional Safety I approach is adequate. Hollnagel's 2015 White Paper (96) shifted the paradigm. New ways of thinking about quality and safety led to his description of 'Safety II', which embraced healthcare complexity (96). In articulating this paradigm, Hollnagel suggests that "*the purpose of investigations changes to become an understanding of how things usually go right, since that is the basis for explaining how things occasionally go wrong*" (96). The White Paper revisits the safety role of health care professionals, who are no longer viewed as fallible weak links in a healthcare system, but rather as vitally necessary elements for system flexibility and resilience. The tacit expertise that expert health professionals develop is necessary to act when 'workarounds' are needed, i.e., when unpredictable changes in complex systems occur and require weighing trade-offs between different courses of action. Teams of healthcare professionals are re-positioned as agents of improvement and organisational learning and as sources of potential 'resilience' and adaptability when things do not go to plan. 'Resilience engineering' (104) acknowledges that acceptable outcomes and adverse outcomes have a common basis, i.e., everyday performance adjustments by team members. Proponents of Safety II highlighted the divide between 'work as imagined' (written in carefully constructed procedure documents) versus 'work as done' through high levels of tacit expertise and adaptability by healthcare teams (105). These new ideas do not seek to preclude using the strengths of a Safety I approach. Incident investigations, human factors and reducing variance through guidelines and protocols still have relevance. Safety II, however, offers important new frameworks for safety practitioners, including those in the simulation community.

2.4 HEALTHCARE SIMULATION PRACTICE IN QUALITY AND SAFETY AGENDAS

The healthcare simulation community was quick to step into a role in patient safety in the late 1990s and arguably continues to be well positioned to do so. Simulation offers a safe place to practice procedural skills, decision-making and teamwork without placing patients at risk. Education can be 'on demand,' as both common and rare clinical situations can be re-created and scheduled to suit learners and teachers. Training encounters can be repeated as needed and offer deliberate practice with feedback for learners. Recommendations for more staff education frequently arise from adverse event investigations. Where the value proposition for simulation training can be made, malpractice insurers may fund simulation activities, such as the Controlled Risk Insurance Company (CRICO) which funds operating theatre team training at Harvard hospitals in Boston, USA (106).

But, this approach of using simulation for safety perpetuates a focus on education and training, despite these being recognised as relatively weak interventions for healthcare improvement (107). Simulation based *education* that is focused on individuals may fail to capture the emergent properties of complex healthcare systems and their important role in patient safety. Clinician educators and simulation specialists may not have any familiarity with theoretical frameworks for safety science or healthcare improvement (108). An educational approach to improving patient safety is useful, but fails to fulfil the potential of simulation.

Safety II thinking highlighted weaknesses in the way healthcare simulation was being used to improve quality and safety prior to 2015. Tacit knowledge and adaptability – the sources of Safety II resilience - were rarely explored or discussed as positive attributes in simulation training. More often, simulation training was used to correct practitioners' 'mistakes', i.e., when they did not conform to 'work as imagined' (105) performance. Offsite simulation training centres and the scenarios delivered in them rarely incorporated many of the 'work as done' realities that affected healthcare performance, i.e., physical environments, equipment, workload pressures and relationships and culture within and between teams. The time was ripe for a paradigm shift in healthcare simulation to match what was occurring in patient safety and healthcare improvement.

Innovators in the healthcare simulation community were beginning to recognise the limitations of prior approaches and saw opportunities for simulation to embrace Safety II. Aided by advances in technology, *in situ* simulation (ISS) became increasingly employed to train teams in their own clinical environment (109, 110), which afforded opportunities to explore team and system performance. Early ISS programs, however, focused primarily on identifying latent safety threats in practice (109, 111), which is (ironically) a predominantly Safety I approach. ISS was also being employed for testing new clinical spaces as part of assessing readiness for real patient care (112). Missing from the literature, however, was evidence of integration with existing QI tools and approaches as well as a deeper theoretical basis for design of these ISS activities (other than the *place they occurred)*. Research seeking to determine the superiority of ISS over simulation centre-based training (113) made little contribution to the literature, precisely because it gave no consideration to the critical elements of simulation purpose or function. Justifiable concerns were expressed about the safety risks of introducing 'fake' training materials into clinical environments (114, 115), such as a real patient receiving a fake medication left in a clinical environment. The ISS community lacked a conceptual framework to assess these risks and benefits. ISS held promise for exploring and improving system performance, but more work was needed to realise that promise.

As simulation practitioners were exploring ISS, emerging academic conversations considered theoretical and conceptual frameworks through which healthcare simulation might support Safety II. Drawing on principles of appreciative enquiry and 'exnovation' (a process through which 'hidden competence' can be unmasked (116)), Dieckmann called for healthcare simulation to embrace 'learning from success' (117) and to apply Safety II principles in scenario design and delivery. He suggested that we should be "*supplementing the widespread deficit-oriented, corrective approach to simulation with an approach that focusses on systematically understanding how good performance is produced in frequent (mundane) simulation scenarios*" (117). Other articles described integrating concepts such as design thinking (118), systems engineering (13) and situativity theory (119) in simulation design and delivery. Work was being undertaken to develop documentation frameworks for reporting the findings of ISS and methods to integrate tools such as risk assessment matrices (120). The US-based Society for Simulation in Healthcare (SSH) had added 'systems integration' as a category for accreditation of simulation programs (121). The potential contributions of simulation to patient safety were outlined in 2019 in "Five Topics

Health Care Simulation Can Address to Improve Patient Safety: Results From a Consensus Process" (122). An international expert panel reviewed the literature and practice on how simulation goes *"beyond education and can probably impact patient safety beyond improving skills, knowledge, and attitudes in health care professionals"* (122). The Panel recommended further work on simulation for technical skills, non-technical skills, system-probing, assessment, and effectiveness as important contributions to patient safety. The evolving field was ripe for clearer terminology, more consistent methodology and closer integration with contemporary theory and practice in quality improvement and patient safety.

Within this context of evolving practice in healthcare quality and safety and in healthcare simulation, I offered the term 'translational simulation' as a conceptual reframing of the contribution of healthcare simulation to quality and safety (1). This reframing built upon, but is distinct from, the extensive and foundational contributions made by simulation through education and training paradigms. Translational simulation is a both a functional descriptor for simulation activities that are directly focused on improving quality in healthcare, and a descriptor for an evolving suite of methods for achieving that aim. In the next chapter, I provide an in depth explanation of the term, a summary of the foundational article (1) and a discussion of the impact of the work on the healthcare simulation community.

CHAPTER 3: A CONCEPTUAL REFRAMING: SIMULATION CONTRIBUTING TO HEALTHCARE OUTCOMES

My first article in this exegesis – ***Translational simulation – not 'where' but 'why'*** (1) - proposes new terminology and a conceptual reframing of simulation as a contributor to healthcare quality and safety. I argue that the *purpose* of simulation risks neglect if we become too focused on the simulation *process or location*. This chapter defines Translational Simulation and situates the article within scholarship and practice at the time of publication.

> "*The term translational simulation describes healthcare simulation focused directly on improving patient care and healthcare systems, through diagnosing safety and performance issues and delivering simulation based intervention, irrespective of the location, modality or content of the simulation*." (1)

Below, I offer a selection of the academic conversations I was joining, a description of the article's main arguments, an analysis of Figure 1 in the article (*Figure 4 in this exegesis*), which was to become influential in the simulation community, and a reflection on the dissemination and uptake of the publication. The timeline of this first publication in the portfolio and associated supporting scholarship are illustrated in Figure 2.

3.1 WHAT CONVERSATION WAS THIS ARTICLE JOINING?

As healthcare simulation practice matured and diversified, simulation-based activities were often described according to the simulation *process*. Commonly used terms in the simulation literature - 'interprofessional', 'high fidelity', 'centre-based' or 'rapid cycle deliberate practice' - are process descriptors, referring to the technology employed, the pedagogical process or the learner group characteristics. Technological and pedagogical advances in healthcare simulation over the 15 years preceding my 2017 article had

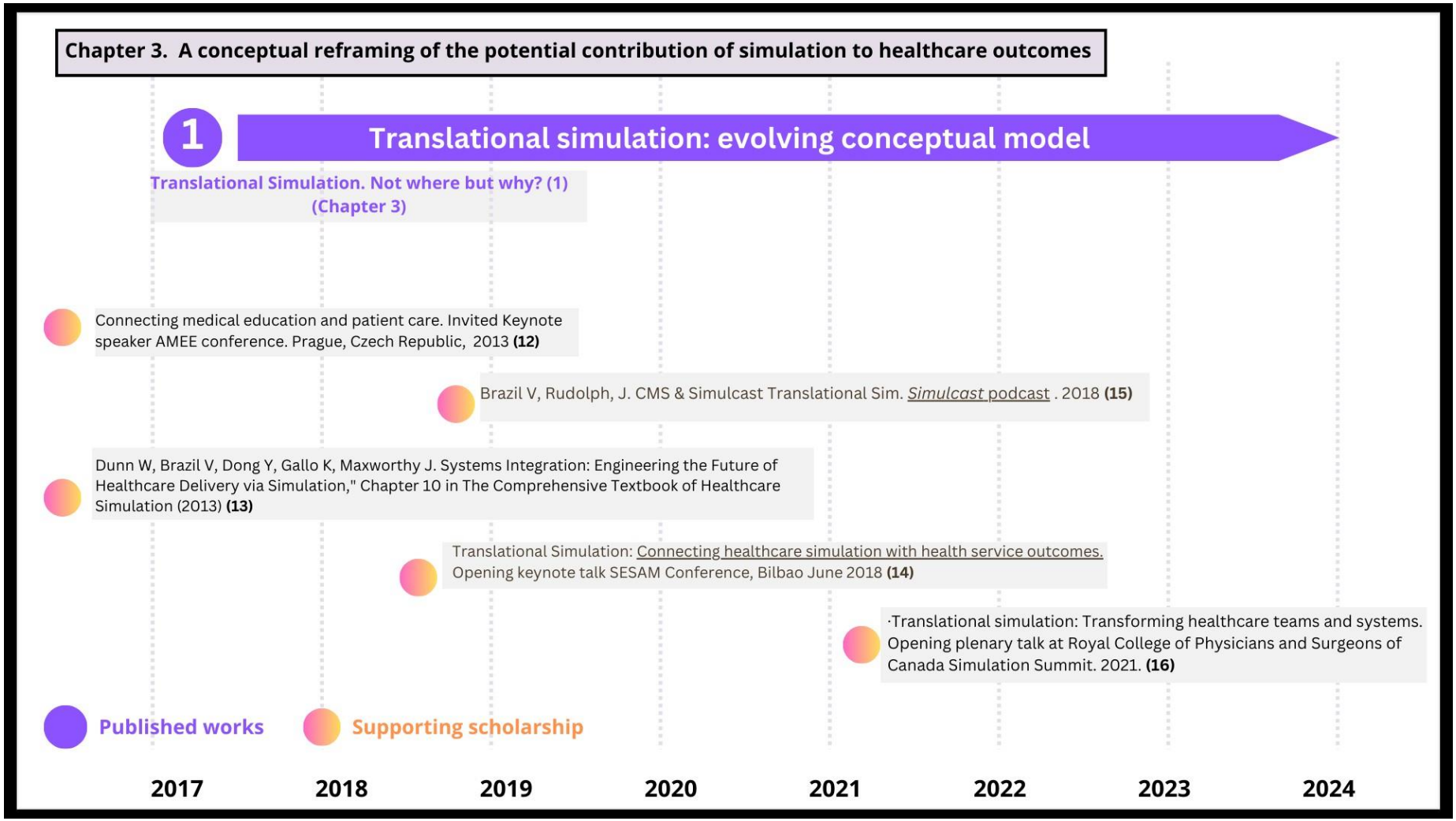

Figure 2. Published works and supporting scholarship for Chapter 3

enabled greater diversity of process. This diversity had been anticipated and described by Gaba in his 2004 landmark article (73) in which he offered a framework of 11 *dimensions* of simulation (Figure 3). Of the 11 dimensions, only the first focused on *purpose*, with the remainder describing aspects of simulation *process*. While useful in aligning our simulation methods with our aims, these *process* descriptors have a downside. Quoting from my article - *"Gaba's dimension 1 – the purpose and aims of the simulation – risks conceptual and practical neglect if we become too focused on those processes."* (1). Challenging the *status quo*, I felt that many of us in the healthcare simulation community had become overly focused on our simulation process, thereby losing focus on our core purpose: to improve the quality and safety of healthcare.

Figure 3. **List of Gaba's 11 dimensions of simulation**. (73).

1.	Aims and purposes of the simulation activity
2.	Unit of participation
3.	Experience level of participants
4.	Healthcare domain
5.	Professional discipline of participants
6.	Type of knowledge, skill, attitudes or behaviours addressed
7.	Simulated patient's age
8.	Technology applicable or required
9.	Site of simulation
10.	Extent of direct participation
11.	Method of feedback used

Examination of the impacts of healthcare simulation on healthcare quality and safety was not an entirely new conversation. McGaghie and colleagues had published a suite of SBE articles targeting 'T3' outcomes, defined as patient outcomes and institutional or system level outcomes (123, 124). Through their conceptual lens, and drawing upon prior work from Dougherty and Conway (125), SBE outcomes could be measured in educational laboratories (T1), patient care practices (T2), patient outcomes (T3) or collateral effects (T4). These published reviews identified a range of practices that supported transfer of learning

to practice, despite McGaghie viewing these as *educational* interventions. Using his perspective, the approach described as translational simulation, would be viewed as a 'complex service intervention' (123, 126). Complex interventions contain multiple interacting components, target a range of behaviour and system changes and their implementation is frequently non-linear (127). Evaluation of complex interventions is not simple. Outcomes are measured through a multifaceted evaluation of quality, i.e., efficiency, effectiveness, safety, patient-centredness and equity (41). My conceptual reframing of the role of healthcare simulation as a complex intervention that seeks to achieve quality and safety outcomes, and my use of new term for that conceptual reframing, contributed logically to this conversation.

3.2 WHY THIS ARTICLE AT THIS TIME?

My article was not merely a rebuttal of the terminology *status quo*. My intention was to refocus attention on how healthcare simulation could be more directly relevant to health service priorities. The article was thus the culmination of five years work attempting to reduce the growing disconnect between the content and means of training healthcare professionals on one hand, and the realities of healthcare practice and systems on the other. This work included speaking, writing and podcasting for audiences involved in clinical care, healthcare simulation and health professions education.

One example was an invited keynote presentation at the 2013 Association for Medical Education in Europe Conference in Prague (12). Titled "*Connecting medical education and patient care*", that presentation focused attention on growing disconnects between the complex world of frontline healthcare and the increasingly specialised world of medical education. Speaking to more than 2500 educators, I suggested that educators, including those involved in simulation, should be reshaping their learning objectives toward the complex systems of modern healthcare.

Another example of my work that informed the translational simulation article was a book chapter that I co-authored. *Systems Integration: Engineering the Future of Healthcare Delivery via Simulation* (13) was written for The Comprehensive Textbook of Healthcare Simulation. We described the emerging role of healthcare simulation as a tool for exploring and shaping systems, suggesting that *""Systems Integration" is conceptually at a higher plane that is proactively orchestrated and organizationally planned in order to create lasting*

institutional impact" (13). The chapter covered topics like Donabedian's Systems Engineering Initiative to Patient Safety (SEIPS) framework (128) and techniques like computer modelling and process engineering. The article broadened my exposure to the use of simulation for improvement in other disciplines and required a deep dive into the Society for Simulation in Healthcare accreditation requirements for programs (121) undertaking this work.

In considering my motivation for writing the translational simulation article, I can reflect on my role as a health service employee and a leader of a simulation program positioned within, and funded by, a healthcare institution. This positioning illuminated the need for simulation to embrace more than the education and training of health professionals if there was to be an impact on the quality and safety of patient care. I advocated for targeting our simulation methods at exploring and improving the complex adaptive systems of 21st century healthcare, including the teams that work in those systems. It was not enough to do simulation the *right way*. We had to be directing it at the *right things*.

3.3 WHAT WAS THE ARTICLE'S MAIN CONTRIBUTION?

In ***Translational Simulation – not where but why*** (1)***,*** I suggested new terminology to reflect a conceptual reframing of the contribution of simulation to healthcare quality and safety. Drawing on Berwick's 'Plan-Do-Study-Act' framework for quality improvement activities (102), I offered a novel conceptual model for the role of simulation. This model was described in the article text and diagrammatically presented (**Figure 4**, *labelled Figure 1 in the original article*), illustrating an expanded range of targets that simulation should encompass for the purpose of improving patient care and health systems. The 'why' in the article title - the purpose of the simulation - refers to examples of 'health service performance' listed in the green box in Figure 4. Many of these targets had not been considered within the remit of healthcare simulation, which had been traditionally focused on the *education and training* of health professionals. A structured approach to how these outcomes may be achieved through simulation was also offered in Figure 4, including how simulation can be used to *explore* performance, and to *test and embed* improvements in systems and processes. In describing these diagnostic and interventional functions, I suggested we could significantly widen the scope of simulation as a tool for improving health service performance.

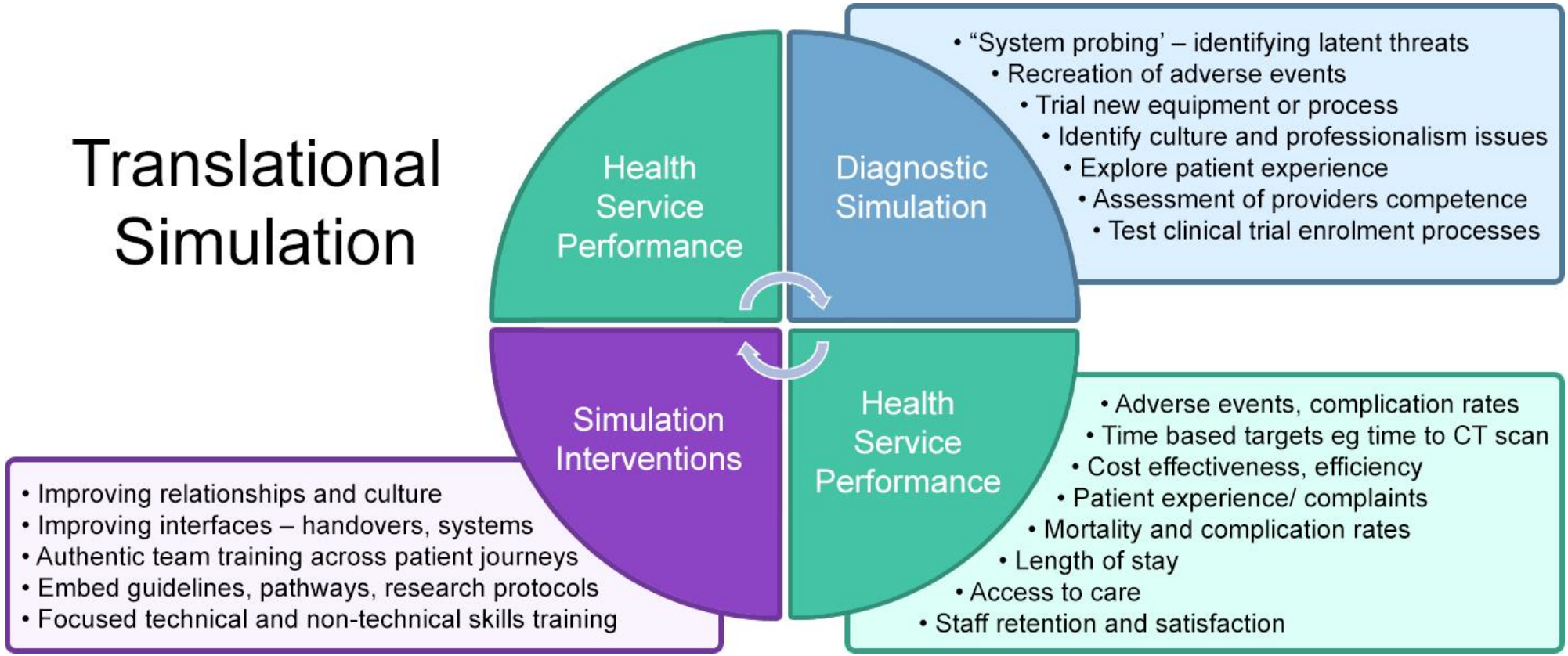

Figure 4. **The translational simulation concept.** From *Brazil V. Translational simulation: not 'where?' but 'why?' A functional view of in situ simulation. Advances in Simulation. 2017;2(1):20.* https://doi.org/10.1186/s41077-017-0052-3 (1). Reproduced under Creative Commons licence CC BY 4.0

In choosing the term ‘translational simulation’, I used language drawn from the biological sciences research context, with the word ‘translational’ referring to basic science research being moved into real world practice. Framing the “*bench-to-bedside enterprise of harnessing knowledge from basic sciences to produce new drugs, devices, and treatment options for patients*” (129) as a translational activity has focused biomedical researchers on their ultimate purpose, i.e. the health of patients and populations. I believed that explicit reference to translational simulation could advance simulation practice by sharpening the focus on patient and system outcomes.

Exploring health system performance, the ‘diagnostic’ function in the blue box in Figure 4. - was an emerging healthcare simulation practice at the time of writing. Enabled by new mannikin and wireless technology, simulation activities were easier to conduct ‘*in situ’*, i.e., in real clinical environments. In addition to recreating more realism for simulation learners, ISS delivery encouraged reflection on the strengths and weaknesses of that environment - physical spaces, equipment, staff workflows - and the contribution of those factors to team and systems performance. There were many published reports of identification of latent safety threats (LSTs) through simulation, e.g., problems with call systems or equipment inadequacies (109, 111). Other published examples of what I would term ‘diagnostic simulation’ included testing the functionality of new hospitals and physical workspaces before going ‘live’ for patient care (112, 130). A less frequently reported use of diagnostic simulation was the exploration of issues such as team culture (61) and patient experience (131). The idea of using simulating to *explore* rather than *fix* performance of individuals, teams and systems in healthcare was, and still is, a novel concept for many simulation providers and participants.

Testing and embedding improvements in healthcare through simulation was the second element of the conceptual model in Figure 4. the ‘interventional’ functions listed in the purple box. These simulation activities include the more traditional, educational role for simulation, with training targeted at a healthcare performance issue such as paediatric resuscitation or trauma care. More effective examples of these programs are directly targeted at measurable patient or system level outcomes, e.g., time to cardiac catheter laboratory for patients suffering myocardial infarction. In these examples the simulation focus shifts away from the individual provider knowledge and skills, toward other ‘performance-shaping factors’ (132) - the systems, processes and workflows of care. Testing better ways of delivering care (e.g.,

using a checklist, or introducing new equipment) can be tested safely within a simulation exercise before being used in real patient care.

The final section of the article suggested that translational simulation might be applied at a department level in healthcare, but also at an organizational, state or national health policy level. Information gleaned from diagnostic simulations can be aggregated over time and across institutions to give a snapshot of practice and healthcare outcomes. Translational simulation may encompass interventions targeting clinical outcomes at a state or national level. A recent example of this is the SAFER births program in Tanzania (133). This is a simulation-based initiative to improve neonatal resuscitation, involving an on-the-job low-dose, high-frequency (LDHF) simulation-based training model, utilising local data and feedback loops. Training is targeted, based on clinical data that highlights areas in need of improvement. The program has results in significant improvements in neonatal mortality (134), and has illustrated a close integration of simulation with clinical context and directly targeting clinical outcomes. The article concluded with encouragement for the healthcare simulation community to consider *"a change in terminology, with an attendant clarity of focus, offers an exponential impact for healthcare simulation to be used effectively as part of comprehensive health service improvement strategies".*

3.4 How did the article impact the field?

The article has had a measurable impact, as evidenced by traditional journal metrics. '***Translational Simulation – not where but why'*** has been cited 87 times since 2017 and has been accessed from the *Advances in Simulation* website more than 16,000 times. The Altmetric score of 123 is second highest for any *Advances in Simulation* publication. The citing articles include descriptions of simulation to support hospital relocation (135), design and test airway response teams (136), identify latent safety threats in an intensive care unit (137), test protocols during the COVID-19 pandemic (138), and analyse meta-cognitive processes (139).

The conceptual reframing offered by my article has been shared through other scholarship activities, including speaking, blog posts and podcasts. I have delivered numerous national and international presentations on translational simulation. In 2018, I was invited as the opening keynote speaker at the Society for Simulation in Europe (SESAM) Conference (14) in Bilbao, Spain, the theme being Translational Simulation. The conference was attended

by more than 400 simulation researchers and practitioners. In my address, I offered case studies and examples drawn from the original framework (Figure 4.). A podcast on translational simulation (15) was jointly produced between the Boston-based Center for Medical Simulation (CMS) and my own podcast, *Simulcast*. My conversation with the CMS Executive Director, Dr Jenny Rudolph, focused on my (then) new approach to positioning simulation in healthcare. We explored the principles underpinning translational simulation and situated the practice within an academic conversation about translational outcomes for healthcare simulation activities. The podcast has been downloaded from the *Simulcast* site more than 1250 times. In November 2021, I was invited to give the opening plenary talk - *Translational simulation: Transforming healthcare teams and systems* - at the Royal College of Physicians and Surgeons of Canada Simulation Summit (16), in which I described the concept and further work over the last four years. These ongoing conversations have developed from the novel terminology and novel description of emerging practice in the article, supported by a positive response by simulation community.

3.5 What were the next conversations?

While framing a conceptual shift and attendant terminology, my article left many unanswered questions. Translational simulation was poised to be integrated into the quality and safety functions of health services. In practice, however, this would require more than simply new targets for 'old' simulation. Effective translational simulation would require changes in governance structures, and decisions about how simulation programs could be positioned within health service organisational charts. It would also require new skills and methods for simulation providers, in addition to their existing technical and educational capabilities. While there have been many published examples, exemplars were lacking. Best practices in applying my conceptual model to quality and safety practice remained to be crystalised.

3.6 Summary

The 2017 translational simulation article provided a conceptual foundation for practitioners and researchers as well as terminology that has since been adopted widely. In my role as a simulation leader within a health service, it was timely advocacy for simulation, a resource-

intensive activity, to serve health service outcomes more directly. I concluded the article by suggesting that "*A change in terminology, with an attendant clarity of focus, offers an exponential impact for healthcare simulation to be used effectively as part of comprehensive health service improvement strategies*." (1)

Having described the translational simulation concept, I recognised that tangible illustrations of application to practice would benefit the healthcare simulation community. Those practitioners who were keen to embrace the concept required guidance as to how to orient their work to embrace new ways of supporting quality and safety. In the next chapter, I will explicate the translational simulation concept through two published examples: *Exploring team relationships in trauma care* and *transforming health services in the face of the COVID-19 pandemic*.

CHAPTER 4: PURPOSE: TRANSLATIONAL SIMULATION IN ACTION

This chapter describes my work in applying translational simulation in practice, including three peer-reviewed publications. I begin by briefly describing examples of my work in translational simulation prior to 2017, and how that experience informed my description of the translational simulation concept. The rest of the chapter is in three sections, each focused on one of my published articles about a translational simulation project. Within each section, I will summarise the article, quoting key pieces of text, offer reflections on the writing and publication process, and then describe the dissemination and impact of the publications.

> "*Our findings suggest that an established trauma simulation programme can have a profound impact on the relational aspects of care and the development of a collaborative culture, with perceived tangible impacts on teamwork behaviours and institutional systems and processes*" (2)

The main function of this chapter is to provide tangible illustration of applying the translational simulation concept to practice. A timeline of the three published works relevant to this chapter, and associated supporting scholarship is illustrated in Figure 5. The message from these published examples is the need for a clearly identified *purpose* for translational simulation activities and to recognise the role of health care teams as agents for improvement through translational simulation.

4.1 WHAT CONVERSATIONS WERE THESE ARTICLES JOINING?

Many healthcare simulation programs published examples of work focused on exploring and improving clinical outcomes between 2007-2017. Diverse programs and contexts have been described, including emergency medicine teamwork (109), paediatric emergencies (111), blood transfusion in operating theatres (140), assessing safety in new healthcare teams and new facilities (141), as well as developing checklists for emergency intubation (142). These examples provided tangible illustrations of the concept of translational simulation well before

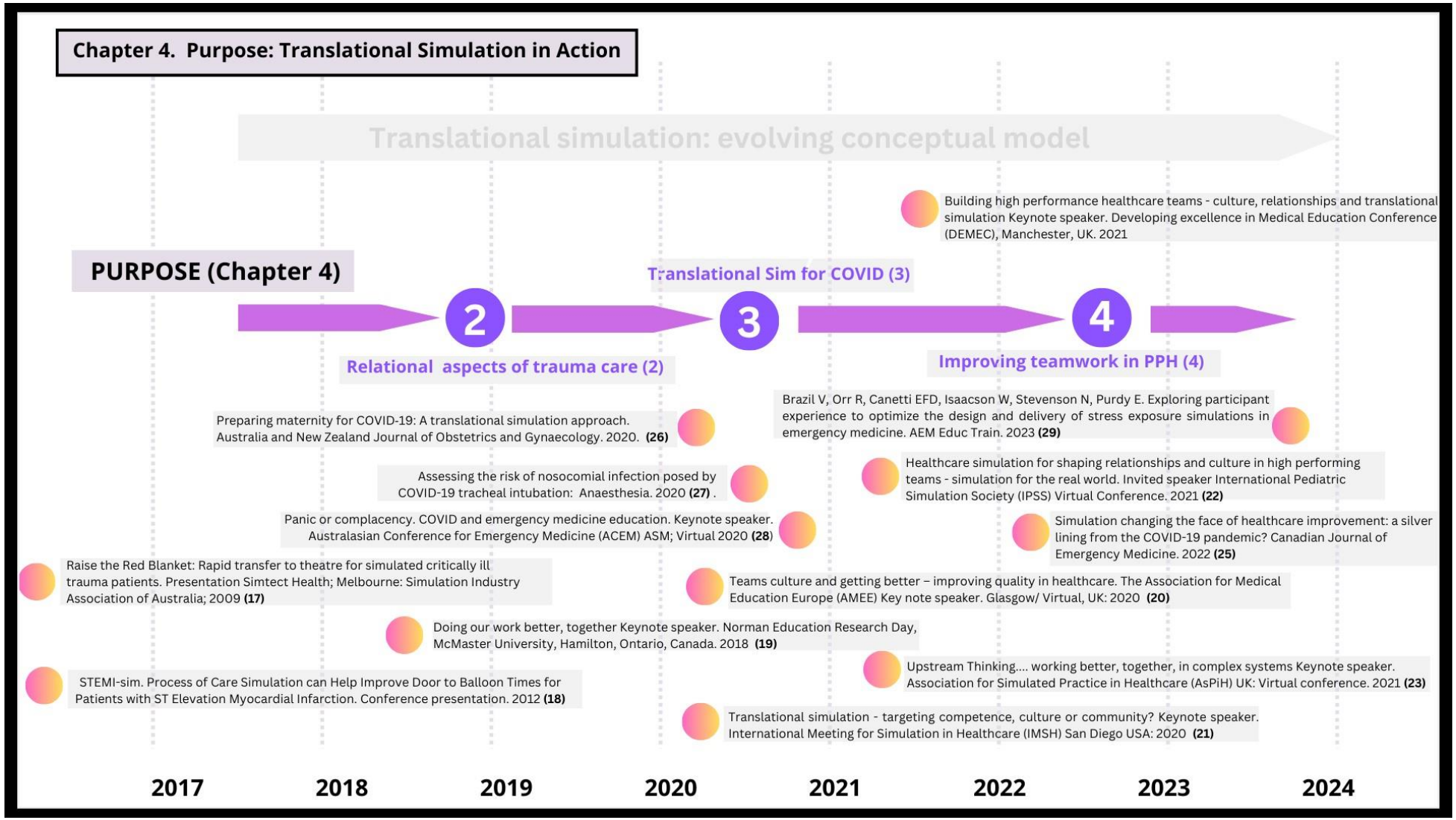

Figure 5. Published works and supporting scholarship for Chapter 4.

I suggested the term. Most of that work was presented in a positivist framework of 'proof' that the simulation activities could identify problems or improve the target outcome. This was understandable at a time when programs were seeking funding and resources to undertake this kind of simulation. It meant, however, that there was less reflection on the contextual and methodological elements of the work that were vital for distilling principles and guidance for practice.

There were also conversations attempting to crystallise underpinning theory and principles of emerging simulation practices. Emergency medicine practitioners working in healthcare simulation "*evaluated best applications of simulation techniques and technologies to systems in emergency medicine*" in a 2008 Academic Emergency Medicine Consensus Conference (143). Comprising many early adopters of *in situ* and systems focused simulation, that group explored the role of medical simulation methods in emergency medicine systems "*to promote a "quality-by-design" approach*" (143). That article advocated for recognising the 'nonlinear, complex, adaptive systems' of the emergency department and the need for simulation work to include probing and testing these systems. In posing a series of consensus questions for future work, they encouraged practitioners and scholars to move beyond showcasing examples of their systems focused simulation activities, toward generating conceptual frameworks and guidance for practice (143). Aware of this encouragement, I attempted to reflect on and crystallise these larger questions in publishing three examples of my own translational simulation work that are presented in this Chapter.

4.2 WHY THESE ARTICLES AT THIS TIME?

I had applied translational simulation concepts to my simulation practice for many years prior to the foundational 2017 TS article (1). This experience matured my approach to designing and delivering translational simulation, but which had not been formulated within a research framework or presented as manuscripts for rigorous peer review. This TS work included projects that aimed to:

1) Embed a new process for rapid transfer to the operating theatre for critically unwell trauma patients at the Royal Brisbane Hospital (RBWH) (17)
2) Reduce the 'door to needle' time for patients suffering a myocardial infarction who required safe and fast transfer from the emergency department to cardiac catheter suite at the RBWH (18)

3) Test the physical space, clinician workflows and patient experience in a new electroconvulsive therapy (ECT) suite at the Gold Cost University Hospital (GCUH) prior to accepting actual patients.
4) Reduce the time to antibiotic treatment for newborn babies at risk of Group B *Streptococcus* infection at GCUH through diagnosing issues that slowed the process.

These programs were practical applications of translational simulation prior to the advent of that descriptor. They included both diagnostic and interventional functions for simulation to achieve these health service goals. Similar examples were presented at conferences and shared with colleagues. From this, I learned that the principles drawn from my educationally focused simulation practice were a useful starting point for translational simulation in terms of clear objectives, carefully designed scenarios, skilful technical delivery and thoughtful debriefings. But, I found new considerations were needed for simulation activities more directly focused on system and patient outcomes such as strategic integration within health service governance structures, broader stakeholder engagement, mitigating risks of *'in situ'* delivery and modifying debriefing approaches. A distillation of these methodological issues for translational simulation will be discussed in Chapter 5. The rest of this chapter will illustrate part of that journey through three published applied TS examples.

4.3 IMPROVING THE RELATIONAL ASPECTS OF TRAUMA CARE THROUGH TRANSLATIONAL SIMULATION (2)

The second article in this exegesis - ***Improving the relational aspects of trauma care through translational simulation (2)*** – describes the application of translational simulation to improving major trauma care at my own institution, the Gold Coast Hospital and Health Service (GCHHS) a tertiary care hospital in Queensland, Australia. The article describes a study of simulation activities using a narrative survey of trauma providers from anaesthesia, emergency medicine, medical imaging, surgery, trauma service, intensive care, and pre-hospital providers at GCHHS, in conjunction with data from an ethnography of the trauma care. In this article, we "*aimed to understand how an established trauma simulation programme is perceived by trauma care providers to influence their relationships with others and to identify those aspects of the simulation experience contributing to relational outcomes." (2)*

WHY THIS ARTICLE AT THIS TIME?

Prior to the study described in (2), our GCUH simulation team and clinical leaders in the hospital had reflected that regular trauma simulation activities appeared to have a profound impact on behaviours and relationships within and between teams involved in major trauma care. The study was designed to better understand this. We reported results from our narrative survey and data from our broader ethnography of trauma care to explore perceptions of trauma providers at the institution. This article was a simulation focused element of a more extensive evaluation of how relationships affect the coordination of clinical trauma care at GCUH (144).

The study for (2) - and the broader QI project of which it was a part - was an opportunity for me to lead a large and diverse research team that included clinicians from different disciplines, an improvement specialist and an anthropologist. Most of this team has worked together as simulation faculty, so our professional relationships translated well into working together on research. This project was the first in a series of 'high performance teamwork' projects at our institution. We have subsequently applied a similar research process to simulation work in maternity care, clinical deterioration and cardiac emergencies. Building on the methods tested in this process, we successfully applied for an 'umbrella' ethics approval for the project series.

The research (2) offered an opportunity to further development my qualitative research skills, including a deeper experience of ethnographic methods, including thematic analysis. I had previously published using these methods in medical education research (56) and in health services research (65). This project, however, required coordination of a larger team and supporting others to contribute to thematic analysis and manuscript review.

WHAT WAS THE ARTICLE'S MAIN CONTRIBUTION?

The article (2) included a detailed description (Figure 6) of our trauma simulation process, following published reporting guidelines for simulation-based research (145). This granular description was important. At the time of publication, simulation practitioners were grappling with how to deliver *in situ* simulation consistently, safely and effectively. We anticipated other simulation programs might use the article to plan their own translational simulations.

Given the central focus on culture and relationships, we used the conceptual framework of Relational Coordination (RC) (146). The principles of RC - shared goals, shared knowledge, mutual respect and communication that is timely, frequent, accurate and problem-solving - were intuitively appealing to our study team. This choice was also a pragmatic one as there was a prior relationship between our institution and the Relational Coordination Collaborative (147) and one co-author was experienced in managing RC projects within our institution.

Figure 6. Description of the trauma simulation process. *From Brazil V, Purdy E, Alexander C, Matulich J. Improving the relational aspects of trauma care through translational simulation. Advances in Simulation. 2019;4(1):10.* https://doi.org/10.1186/s41077-019-0100-2 *(2)*

"These simulations are conducted involving providers from across the care continuum—paramedics, emergency department (ED) staff, medical imaging, operating theatre staff, surgery teams and intensive care teams, as well as support services such as blood bank, orderlies and security. These provider groups have voluntarily elected to join the trauma simulation process over that time. Staff are expected to participate in these simulations as part of their education, and as a standard part of trauma service delivery improvement. Trauma simulations are scheduled at a consistent time each month. Participating staff are aware of simulation in advance and are emailed written preparatory information, including the broad clinical issues that will be the focus. Scenarios are designed based on common and important trauma presentations drawn from GCUH trauma database. Scenarios are presented using both manikin and simulated patient methodologies, according to the case and challenges designed. A 5-10-min pre-briefing is conducted in a conference room, followed by a 45-min scenario conducted in situ - initially in the ED ambulance bay and trauma room, and in some cases followed by transfer to computed tomography (CT) scanner or operating theatre. Between 8 and 30 staff participate in these simulations, with up to another 40 staff observing via video feed in the conference room, where the subsequent debrief is conducted for a further 30–45 min. The debrief is led by an experienced simulation debriefer who is also a senior clinician within the institution…. The facilitator prompts reflection on the clinical processes and outcomes and enables discussion between providers to identify problems and proposed solutions. The debrief issues are summarised after each simulation in a quality activity report, provided to service leads from each department involved in the simulation."

We found this translational simulation program had both diagnostic and interventional utility. The simulations allowed us to understand ('diagnose') the systems, processes and relationships within the trauma teams, and supported testing and embedding improvements ('interventions') in trauma care. The findings supported the broad, intuitive sense of many simulation providers, that "a*n established trauma simulation programme can have a profound impact on the relational aspects of care and the development of a collaborative*

culture." (2) We easily identified all domains of the RC construct in our deductive analysis. We provided example quotes when trauma providers perceived the simulations to support shared goals, shared knowledge, mutual respect and effective communication. We also identified four additional major themes in our further inductive analysis of the data: 1) Behaviour, process and system change, 2) Culture and relationships, 3) Personal and team learning, and, 4) Impact of the simulation experience (2). We provided quotes offering granular detail about how tangible changes had been made. These encompassed modest, incremental improvements (e.g., checklists and handovers) as well as fundamental team behaviour changes.

Perhaps most importantly, the simulation activities sent powerful cultural messages about the value of teams working together to improve. We reflected that "*the habits of shared reflection seemed to be as important as the learning from any specific simulation experience*" (2). One of our study team members - an anthropologist - described our monthly trauma simulations as a 'cornerstone ritual' for our trauma teams. We concluded that "*simulation should be considered as a tool to build and strengthen relationships between practitioners across traditional boundaries. A dedicated trauma simulation programme may offer wide-ranging opportunities to improve culture and relationships that are difficult to approach using other strategies*" and that "*The learning from simulation is multi-faceted - including motivation, personal leadership, teamwork and communication behaviours, and local systems and protocols. Regular simulation affords practitioners the space to come together in an environment that stimulates the habits of reflection for both individuals and groups. Our participants suggest that this has an impact that extends well beyond simulation sessions*"(2). These observations characterised an emerging realisation that translational simulation can powerfully signal organisational values of commitment to improvement.

How did the article impact the field?

The article has been accessed more than 8000 times from the *Advances in Simulation* website. It has 32 citations, including publications in simulation, medical education and quality improvement journals. The article has an Altimetric score of 87, ranking it seventh overall in outputs from *Advances in Simulation.*

The publication and associated academic conversations were supported by my delivery of international keynote presentations on this topic which included:

- 2019. Norman Education Research Day, McMaster University, Hamilton, Ontario, Canada **Doing our work better, together (19)**
- 2020. Association for Medical Education Europe (AMEE) Glasgow/ Virtual, UK: **Teams culture and getting better – improving quality in healthcare (20)**
- 2020. The International Meeting for Simulation in Healthcare (IMSH) San Diego USA: **Translational simulation - targeting competence, culture or community? (21)**
- 2021. International Pediatric Simulation Society (IPSS) Virtual Conference. **Healthcare simulation for shaping relationships and culture in high performing teams - simulation for the real world (22)**
- 2021. Association for Simulated Practice in Healthcare (AsPiH) UK: Virtual conference **Upstream Thinking .... working better, together, in complex systems (23)**
- 2021. Developing excellence in Medical Education Conference (DEMEC), Manchester , UK: **Building high performance healthcare teams - culture, relationships and translational simulation (24)**

I suggest that the article prompted the simulation community to explicitly recognise that impacts on team culture and relationships, and that these constructs can be measured. Further, I believe it has provided encouragement and guidance for simulation providers to directly target these domains of high-performance teamwork in healthcare.

4.4 TRANSLATIONAL SIMULATION FOR RAPID TRANSFORMATION OF HEALTH SERVICES, USING THE EXAMPLE OF THE COVID-19 PANDEMIC PREPARATION (3)

> "*Turning the promise of simulation into reality for COVID-19 preparation requires a translational approach—a simulation program that is attuned to emerging priorities, has strong relationships with clinicians and service leadership and with the skills and capacity to apply (or develop) simulation strategies to address those issues*" (3)

The third article in this exegesis - *Translational simulation for rapid transformation of health services, using the example of the COVID-19 pandemic preparation* (3) - provides a case study example of the application of translational simulation for institutional preparation for

the COVID-19 pandemic. This Chapter subsection will consider the contribution of healthcare simulation to managing the pandemic, describe the article, and consider its impact on the simulation and clinical communities.

WHY THIS ARTICLE AT THIS TIME?

The COVID-19 pandemic presented myriad challenges for health services. Rapid changes to systems and care processes were necessary to protect patients and staff from infection and to increase health system capacity in anticipation of overwhelming patient numbers. Within this urgent and unique context, healthcare simulation had obvious training applications: safe use of personal protective equipment (PPE), staff transitioning to new and expanded roles (e.g., critical care skills and procedures) and for public health tasks (swabs, contact training). In addition, our Gold Coast Health Simulation Service recognised the need for a strategic approach that was "*attuned to emerging priorities, has strong relationships with clinicians and service leadership and with the skills and capacity to apply (or develop) simulation strategies to address those issues*"(3) We delivered more than 250 translational simulation session across GCHHS in the month following that decision. Cognisant of the shared challenges faced by health services across the world, we felt the need to share our experience and lessons learned.

WHAT WAS THE ARTICLE'S MAIN CONTRIBUTION?

The purpose of the article was simple: "*We describe our institution's simulation strategy for COVID-19 preparation and reflect on the lessons learned - for simulation programs and for health services seeking to utilise translational simulation during and beyond the COVID-19 pandemic*" (3). The introduction framed the challenges posed by the pandemic within the translational simulation framework, i.e., simulation helping to iteratively develop new or adapted ways of working. We described our strategy development process and examples of our simulation activities. The final section of the article suggested general lessons for rapidly responding to health service crises using simulation.

The need for simulation activity to be guided by a strategy was an important message in the article. In describing our strategy for pandemic preparation, we emphasized the need for

alignment with high level institutional plans, while working with clinical teams with whom we had existing relationships. Our six-point strategy was:

1. Practising patient care and teamwork while using PPE
2. Testing systems and workflows for the care of COVID-positive patients
3. Rapid upskilling of staff for critical care roles
4. Practising advanced airway and ventilation skills for patients with COVID-19
5. Testing physical transfer processes for movement of COVID patients around the hospital
6. Preparing staff for difficult conversations and palliative care strategies.

We provided examples to illustrate the practical delivery of simulation using this strategy. These included using simulation to test technology to support communication from isolation rooms to the outside and simulation to refine physical patient transfers to minimise exposure to others in the hospital. Some of these granular examples may have been helpful for those who shared contexts like our own.

We felt, however, that we had made a more powerful contribution to the simulation community. In our opinion, the most important reflections from this activity were about simulation enabling change and improvement within health services. We knew that responding to COVID-19 offered an exemplar of how translational simulation could contribute to that objective. Our aim was to outline principles that translational simulation providers and health service leaders could draw upon when novel crises emerge. We believed that there were generic lessons, applicable across the global spectrum of simulation capacity and healthcare resourcing. We listed these in the article:

- "*Develop a clear strategy for using translational simulation when rapid change is required in health services.*
- *Build longitudinal relationships between simulation programs and clinical services to help target high yield simulation activity and to optimise clinician engagement.*
- *Develop clear lines of communication and responsibility with other units responsible for change management throughout the institution.*
- *Develop a wide range of simulation skills and approaches to rapidly adapt to novel simulation objectives.*

- *Build a strong community of practice of simulation educators throughout the institution to share techniques and maximise simulation delivery capacity during a crisis.*
- *Advocate for a translational simulation service within the health service to enable rapid responsiveness to a crisis*" (3).

How did the article impact the field?

This article has been accessed over 6700 times from the *Advances in Simulation* website, with 28 citations. It was published when other groups were sharing their own pandemic experience, including two articles similar to our own. Brydges and colleagues shared an 'organisational and program level description' of their work (148). Echoing our contention, that group argued that "*this pandemic has cemented simulation programs as fundamental for any healthcare organization interested in ensuring its workforce can adapt in times of crisis*" (148). Dube et al. also described a large scale effort to use simulation to prepare for COVID-19 across the province of Alberta, Canada (149). They aimed to "*share the unique features and advantages of using a centralized provincial simulation response team, preparedness using learning and systems integration methods*" (149). Their message about a coherent system level strategy was aligned with ours, which emphasised "*the critical importance of embedding simulation as a central part of the organizational learning*" (149). What that article added, which ours lacked, was an example of systematic data collection, analysis and dissemination throughout the simulation process. This helped to define another gap in our translational simulation methods, i.e., that the diagnostic element of translational simulation requires robust and effective data collection systems, preferably aligned with other systems of quality and safety data collection in healthcare institutions. I collaborated with the first author (Dube) of that paper in a recent editorial, reflecting on the 'silver lining' of the pandemic, which repositioned simulation as a powerful tool for healthcare improvement (25).

Finding the right audience for these messages was also important. While *Translational simulation for rapid transformation of health services* (3) was directed at the simulation community, I felt our message was important for clinical leaders and medical speciality craft groups. Our group published a more focused paper in the *Australia and New Zealand Journal of Obstetrics and Gynaecology*, on the experience of preparing maternity services for COVID-19 at our institution (26). As the senior author, I helped shape the message for

clinician leaders who were more naïve to the translational simulation concept and application. I also joined academic conversations with anaesthesia clinicians about research using simulation as a test bed for new equipment for COVID-19 care, including safe endotracheal intubation (27). I presented on these issues in a keynote presentation to the Australasian College for Emergency Medicine (ACEM) Annual Scientific Meeting in November 2020 (28). In speaking to a national audience of emergency physicians, I reflected on the potential transformation of emergency medicine education and healthcare improvement through lessons learned during the pandemic. In addition to conversations with the healthcare simulation community, clinician audiences must also be engaged to fulfil the promise of integrating translational simulation into healthcare improvement.

What were the next conversations?

In preparing our manuscript (3), the author team was acutely aware of a tension. We needed to balance tangible lessons for simulation providers with recognition of the diverse contexts in which they might be applied. While a simple 'show and tell' would have been a tempting format, especially given the intense pressure of simulation delivery that was required at the same time, it would not have addressed two important points for the simulation community. First, we could offer an exemplar of tangible application of the translational simulation concept. Our article, and others published at the same time (148, 149), that showcased simulation as an tool for healthcare improvement, and which has subsequently been described as a 'silver lining' from the COVID-19 pandemic (25). Our experience and our article illustrated the benefit of having a simulation service and approach that was primed for health system transformation.

Secondly, we offered a granular reflection on the *methods* for translational simulation. The conceptual outline of translational simulation established in my first article (1) required elaboration. "Not where, but why?" needed extension to "And how?". Writing this article forced reflection on our local approach. We identified gaps in our simulation service governance, strategy, skills and resource allocation processes. This prompted on a new thread in my translational simulation scholarship, including collaboration on an article that is another published work in this exegesis – *Translational Simulation from Description to Action* (5) - which is considered in depth in Chapter 7.

4.5 A RELATIONAL APPROACH TO IMPROVING INTERPROFESSIONAL TEAMWORK IN POST-PARTUM HAEMORRHAGE (PPH) (4)

> "*Our lessons for simulation programs are to spend time and resources understanding teams' contexts – through simulation and other methods—before designing simulation based interventions*." (4)

WHY THIS ARTICLE AT THIS TIME?

Healthcare simulation is widely used for team training, with an extensive literature on the optimal design, delivery and debriefing methods for team training through SBE (150). For example, Crisis Resource Management (CRM) training is one approach to healthcare team training using simulation. It focuses on team behaviours that are known to be effective: allocating team roles, maintaining situational awareness, communicating effectively and demonstrating leadership. While evidence for improved patient outcomes resulting from simulation-based team training like CRM is inconsistent (151), there are some widely cited exemplars in maternity care (152) and resuscitation after cardiac arrest (153). The paradigm in which this evidence is sought is that of *simulation as an educational tool for team effectiveness*, and an assumption that effective teams deliver better patient care.

However, the *context* within which simulation-based healthcare team training occurs is a critical factor that influences its effectiveness. Described as 'conditions' in the book, *Teams that Work (154),* factors such as resource availability, leadership development, psychological safety and organisational practices and policies are critical influences on team performance. It follows then that while healthcare team training (whether simulation-based or otherwise) may be one element of improving team performance and patient outcomes, it might not be sufficient. Team improvement efforts also require attention to 'team development interventions' (155), including leadership training, team-building (interpersonal relationships and conflict management) and team debriefing. Simulation-based team training in healthcare is often conducted without consideration of the conditions in which team operate or to other team development interventions. This may limit its effectiveness in improving team performance and patient outcomes.

A parallel, but contrasting, conversation in the healthcare improvement community views *teams as agents of change and improvement* in complex adaptive systems like healthcare

(156). Through this lens, developing and training teams is central to enabling them to lead improvement. This conversation recognises that 'top down' approaches to improving quality and safety have significant limitations and thus there is a trend toward 'co-created' and 'co-produced' improvement initiatives that engage frontline clinicians and healthcare consumers directly (157). For example, van der Scheer et al. describe an approach to healthcare process improvements for obstetric emergencies during the COVID-19 pandemic. They used "*rapid, remote consensus-building*" to apply a five-step approach that is "*informed by a participatory ethos, crowdsourcing and consensus-building methods*" (158). Such approaches were aligned with the findings of our study of trauma teams described earlier in this Chapter, i.e. "*The learning from simulation is multi-faceted—including motivation, personal leadership, teamwork and communication behaviours, and improving local systems and protocols. …. Our participants suggest that this has an impact that extends well beyond simulation sessions*" (2). Within this paradigm, team training objectives are focused not just on clinical tasks, but also on a team's ability to improve care through improving systems and processes.

Drawing these conversations together, I suggest that translational simulation should encompass focused healthcare team training but should be delivered within a broader strategy of using simulation to explore and develop teams' work with the purpose of improving quality and safety.

Our eight-year experience in the Gold Coast Health Simulation Service was that the *context* (or 'conditions' using Tanenbaum's terminology (154)) in which we delivered team training was crucial for success. We delivered a number of team training programs, including for trauma care, maternity, mental health, medical emergencies, stroke care, community aged care. As an embedded, integrated simulation program in our health service, we were able to identify conditions that influenced the success of these programs, e.g.: Was there high-level leadership support for training? Was teamwork a value for these teams? Were teams already focused on improving their teamwork and on improving their systems and processes? Were teams already engaged in behaviours like team debriefing and other team development interventions?

Recognising the need to integrate our simulation activities within the broader healthcare improvement processes at Gold Coast Health, in 2019, I established a *High Performance Teamwork Strategy* (HPTS)(159). Endorsed by the Gold Coast Health Board and Executive,

the strategy connected the simulation service to other healthcare improvement units in the health service, as illustrated in Figure 7.

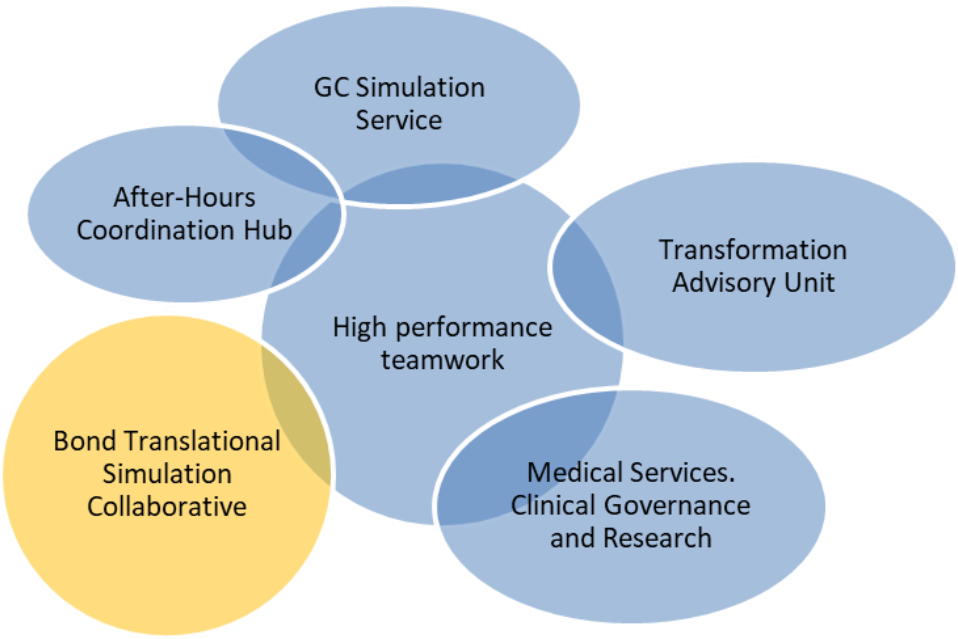

Figure 7. **Shared territory between various units involved in improving clinical teamwork at GCHHS**. *From Gold Coast Health High Performance Teamwork Strategy (2019) (159)*

The remit of this strategy was to coordinate healthcare improvement efforts in the health service and to ensure that simulation-based team training was integrated with other team development interventions. This encompassed both *diagnosing* quality and safety issues and designing and delivering *interventions* that included but were not limited to translational simulation. Since 2019, the HPTS has undertaken five major team development projects. Our approach embraces the duality of improving team performance through training and supporting teams to be agents of improvement. The next article presented in the exegesis - *A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH)* (4) – reports on one of these projects.

What was the article's main contribution?

The article (4) describes a multi-faceted process of exploring the performance of teams providing care to women suffering post-partum haemorrhage (PPH) at Gold Coast University Hospital (GCUH) and working with those teams to develop and implement interventions focused on performance improvement. We were "g*uided by the conceptual framework of Relational Coordination (RC) and using translational simulation as a diagnostic and testing*

tool, …to concurrently study and support teams improving the care of women with PPH" (4). Four overarching themes were identified: 1) Teamwork, clear roles and identified leadership are critical, 2) Relational factors powerfully underpin teamwork behaviours, i.e., shared goals, shared knowledge and mutual respect, 3) Conflict and poor relationships can and should be actively explored and addressed to improve performance, and 4) Simulation supports improved team performance through multi-faceted mechanisms. We suggested that our comprehensive approach could "*guide leaders and clinicians in maternity teams, and act as an exemplar for others enacting quality improvement in healthcare*" (4).

Our project team used a collaborative action research approach (160) - "*done with people in a social context and involves probing multiple understanding of complex social systems, with a process of data sharing and knowledge construction... The process of change is social*" (4). We used RC as our conceptual framework, which was described in Chapter 4 and which has become central to our work in the HPTS at GCHHS. The methods were multifaceted and iterative. The figure detailing the methods is reproduced here as Figure 8.

The methods are provided in detail here, as they are representative of an emerging methodology for our High-Performance Teamwork Strategy. They illustrate an approach that draws upon simulation as an exploratory and testing process, embedded within a range of other team development methods, and with an embedded focus on relationships, culture and empowering frontline clinicians.

As action research, our approach was an iterative, cyclical process of reflecting on practice, taking action, reflecting, and taking further action. Although presented sequentially here, our methods embraced this iterative approach.

1. **Stakeholder engagement**. Clinical leaders within midwifery were consulted for project scope, refinement of study questions and discussion of study design. Core staff groups involved in the initial care of women with PPH were identified (referred to as 'workgroups' in the Relational Coordination survey) A project team was formed with representatives from each work group and the research group.

2. **A Relational Coordination survey** of the healthcare providers involved in PPH management was undertaken. Using the validated RC survey instrument, the strength of communication and relationship ties between each respondent and each of the core disciplines was measured. Data from the survey was analysed by the survey provider (Relational Coordination

Analytics (RCA) team) according to RCA analytical procedures. Strength of ties (weak, moderate and strong) between and within groups were calculated based on norms from established data.

3. **A comprehensive qualitative study of the teams** involved in PPH was conducted, including data collection from narrative questions in the survey, interviews with individual staff members, focus group meetings, and review of protocols. This helped shape understanding of team functioning, communication, and relationships in PPH care, as well as gaps in systems and processes. Narrative data was reviewed by the research team (VB, DM, BL and EP) and themes identified through initial independent review of data generating proposed themes, and subsequent iterative refinement of themes to reach consensus. These themes were presented at focus group discussions and further refined with this input from staff.

4. **Collaborative development of interventions**. Initial quantitative and qualitative research findings were presented via email and at focus groups with work groups. The findings were discussed, and potential interventions proposed. These interventions were of 3 types. Relational interventions focused on improving relationships within the team, e.g., creating safe spaces for discussion, coaching and role modelling. Process interventions focused on the work itself e.g., process mapping and redesign. Structural interventions focused on organisational structures to enable and embed better care e.g., shared protocols, information systems and training.

5. We undertook a **follow up data collection** process 12 months after the initial survey, consisting of revisiting focus groups with project updates, and seeking data on staff perceptions of team performance in PPH and other maternity emergencies, and on the specific interventions undertaken as part of the study.

6. Performance data on rates of PPH and related clinical outcomes drawn from the existing databases and records, and compared data from 2019, 2020 and 2021.

Figure 8. **Study methods described in published work four.** *From Brazil V, McLean D, Lowe B, Kordich L, Cullen D, De Araujo V, et al. A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH). BMC Health Services Research. 2022;22(1):1108.* https://doi.org/10.1186/s12913-022-08463-8 *(4)* Reproduced under Creative Commons licence CC BY 4.0

Interventions – structural, process and relational - were co-developed with the maternity teams. These included supporting clear roles and role allocation when a PPH occurred,

encouraging clinical debriefings after PPHs, reviewing morning handover processes to enhance team familiarity, changing call systems, and addressing tensions between specific groups. Our findings provided insights into the factors influencing team performance, the role of simulation in exploring and shaping team performance in this context, and clinical outcomes achieved over the study period.

The **factors influencing team performance** included the themes described above, as well as deeper insights into the role of teams in leading improvement. *"We found that relationships and culture can be explored and shaped deliberately through a dedicated process that involves clinicians across professions and specialities. Clinicians are capable of supporting and leading self-driven, expert guided, context-improvement initiatives. Our approach of supporting everyday clinicians in structural, relational and process improvements is messier than many more linear quality-improvement projects but serves as a model that is appropriately respectful of, and responsive to, the tangled social-technical realities of providing care in birth units and other complex environments." (4)*

The **role of simulation** had been perceived by staff groups as a primarily educational tool prior to the study. However, over the course of the project, staff, research and faculty groups came to view simulation as a tool for exploring and improving the work of teams, including testing planned changes to practice.

There were **improved clinical outcomes** in PPH care over the period of the study (**Figure 9,** *Figure 9 in the original article*). Large PPH (>1.5 litres blood loss) numbers decreased by more than 40%, despite increasing workload for the unit. Large PPH numbers are significantly influenced by early recognition and early effective management of PPH. While we did not claim direct causation for this outcome, our clinician and hospital executive stakeholders viewed it as an important outcome.

We concluded the article with some key lessons. For simulation programs, we emphasized the need to *"spend time and resources understanding teams' contexts – through simulation and other methods—before designing simulation based interventions",* and to *"Expand your repertoire of team development activities beyond large scale immersive simulations so techniques can match objectives" (4).* Further, our process demonstrated that *"clinical teams were highly engaged in exploring their teamwork, values and relationships, and in developing and testing better ways of doing their work".* These conclusions align with the conceptual underpinning of translational simulation in this context; to embrace the duality of

a) improving team performance through training, and b) supporting teams to be agents of improvement.

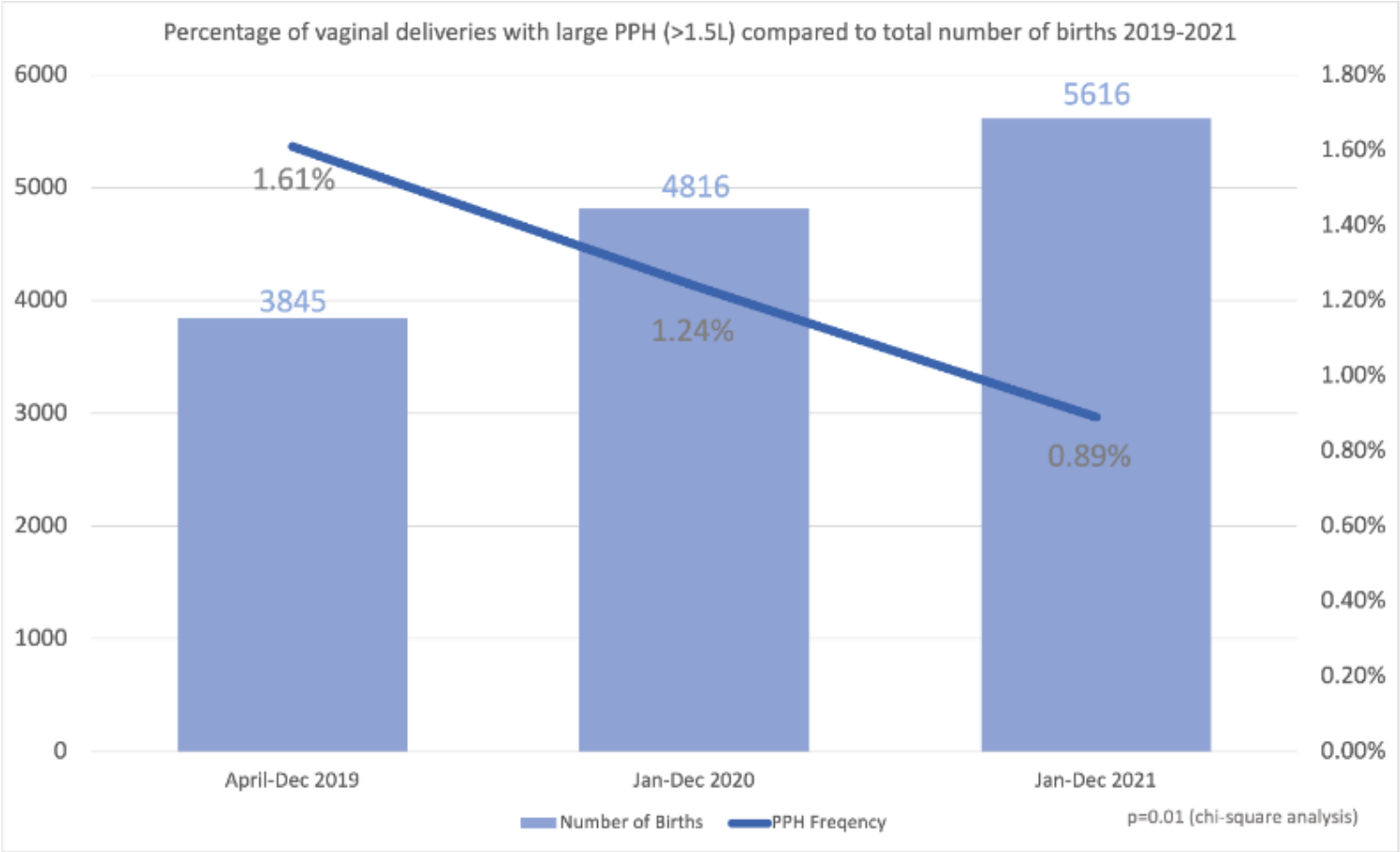

Figure 9. **Clinical outcomes of the RC intervention in PPH.** *From Brazil V, McLean D, Lowe B, Kordich L, Cullen D, De Araujo V, et al. A relational approach to improving interprofessional teamwork in post-partum haemorrhage (PPH). BMC Health Services Research. 2022;22(1):1108.* https://doi.org/10.1186/s12913-022-08463-8 (4) Reproduced under Creative Commons licence CC BY 4.0

How did this article impact the field?

There has been some measurable impact since the September 2022 publication of the article. It has been accessed from the journal website 2500 times, with three citations. The impact of this article at GUUH has been considerable. To this end, we have been tasked with three additional further projects, including team performance in Intensive Care Unit ward rounds, Cardiac Catheter Laboratory efficiency and the Children's Critical Care Unit teamwork. These clinical teams are highly motivated by potential for clinical performance improvement. In each case we are integrating our translational simulation activities with broader team development interventions to explore and shape performance. Each team and project have a unique context through which we are iteratively refining our process and the principles on which we are approaching team development using translational simulation.

What were the next conversations?

This work illustrates the value of healthcare teams as intermediaries for connecting simulation to healthcare quality and safety. This value has yet to be leveraged in most simulation programs within healthcare systems. Teams and teamwork are critical to healthcare outcomes (154). Improving team performance involves 1) the clinical knowledge and skills of team members, 2) their teamwork behaviours, 3) their relationships and culture, and 4) their ability to lead change and improvement. Simulation based team training in healthcare has focused on the first two of these, and to a lesser extent the third. I would argue that leveraging those impacts requires a new focus on the fourth; teams need to also be constantly focused on the systems, processes and culture that impacts their work, and to have methods for improving them, including simulation-based methods.

My work at Gold Coast Health in developing a model for integrating translational simulation into a high-performance teamwork strategy is in its infancy but has reinforced the need for simulation to contribute more than simple 'team training' to achieve quality and safety goals. Our HPTS group has reported some early success in the context of maternity care and post-partum haemorrhage (4) and building capacity for teams to recognise and regulate stress in the resuscitation room (29). Teasing out what works, why and for whom will, however, require significantly more operational and scholarly work. Fortunately, this work will build on

considerable foundations laid by scholars in team science and interprofessional collaborative practice. Rosen's comprehensive review of teamwork in healthcare teams identified six key 'discoveries' for enabling safer, high quality care (156). Rosen also unveiled a high level of complexity in understanding teams, their competencies, their performance measurement and their methods of improvement. Increasing recognition of teams as agents of healthcare improvement offers an opportunity to build connections between healthcare simulation and the healthcare improvement community.

4.6 SUMMARY

This chapter focused on three published examples of applying translational simulation in practice. The articles present detailed examples of the broader concept and demonstrated the value of clear purpose as part of explicit conceptual framing for how simulation contributes to quality and safety goals. The purpose in the first article (2) was to explore and shape relationships and culture within trauma teams. In the second (3), the purpose was to rapidly test and improve clinical pathways for patient care during the COVID-19 pandemic. In the third article (4), the purpose was supporting maternity teams to improve teamwork and systems in pursuit of improving clinical outcomes for women suffering PPH.

Throughout these articles, I(we) begin to describe and reflect on the process, implementation and methods - the 'how' - of translational simulation, in three quite different contexts. The elaboration of methods and approaches to delivery was a logical next step in the scholarly conversation, including guidance on integration of translational simulation in the health service, as well as matching methods to the objectives of a translational simulation program. The next Chapter examines these issues.

CHAPTER 5: PROCESS: IMPLEMENTATION, DESIGN AND DELIVERY

In this chapter, I discuss how translational simulation concepts might be *practically* applied to healthcare improvement. While many in the healthcare simulation community have become engaged in improvement projects, there is limited guidance on the *process* for translational simulation design and delivery, and on the *training of practitioners* engaged in this process. I begin the chapter with an overview of publications seeking to provide this guidance from 2010 to the present. In the three subsections that follow, I describe three publications. The first - ***Translational simulation: from description to action (5)*** - draws upon the combined experience of four simulation programs in Australia and Canada and offers a set of principles for translational simulation delivery, using an Input-Process-Output model.

> "..*guidance for how practitioners and organisations can enact translational simulation in everyday practice is lacking*" (5)

The second - ***Developing a simulation safety policy for translational simulation programs in healthcare (6)*** - has a narrower focus. It draws on the literature relating to the safety risks of *in situ* simulation (ISS) delivery and offers a case study of our Gold Coast Health Simulation Service experience of developing a simulation safety policy. The third - ***Faculty development for translational simulation: a qualitative study of current practice (7) -*** *e*xplores current faculty development practices within translational simulation programs worldwide and the rationale for the approaches. The timeline of these published works and relevant supporting scholarship is illustrated in Figure 10.

I conclude the chapter by describing current work on the strategy, implementation and methodologic issues for translational simulation, including the establishment of the Bond Translational Simulation Collaborative.

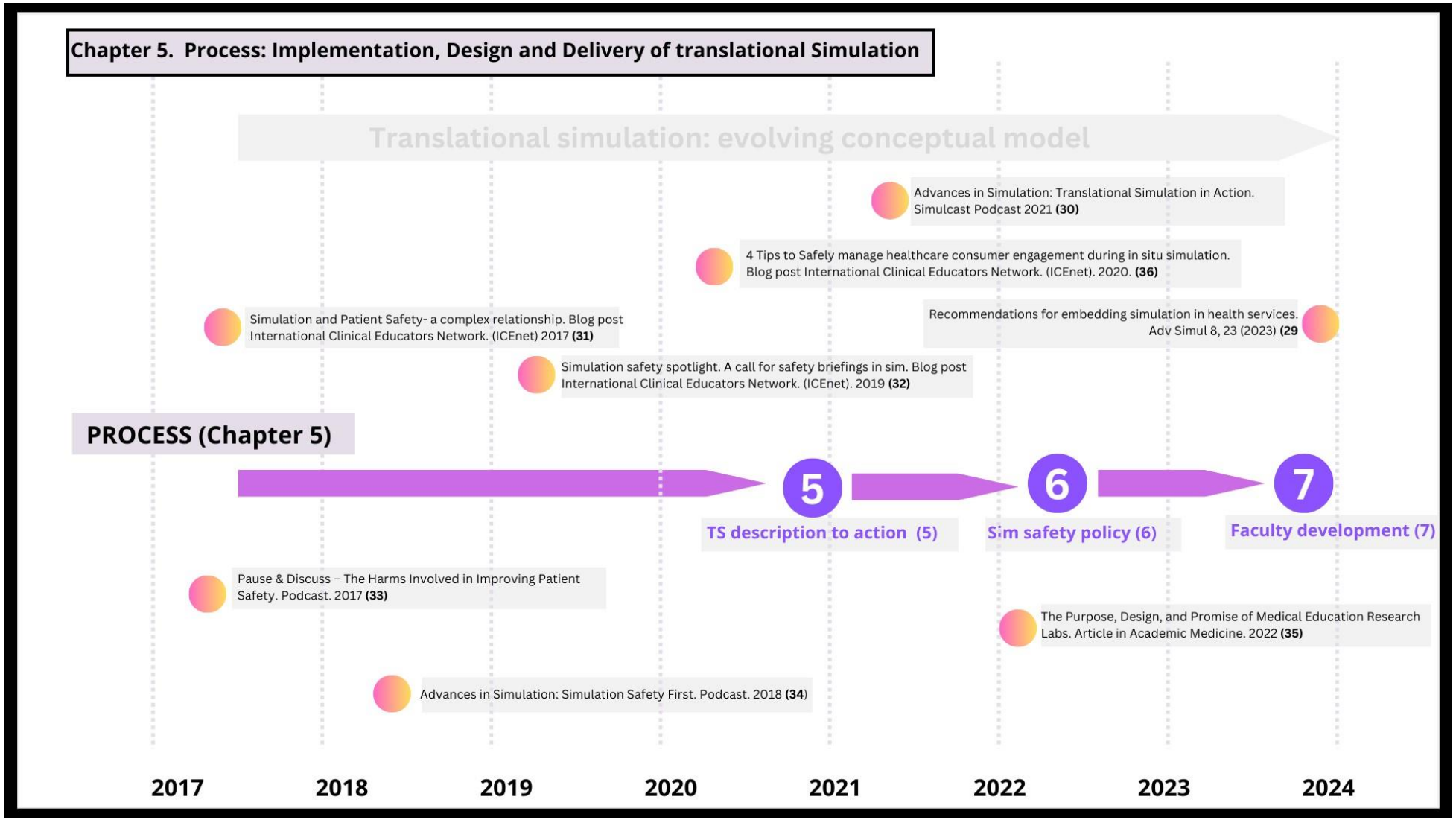

Figure 10. Published works and supporting scholarship for Chapter 5

5.1 What Conversations were these articles joining?

The term “translational simulation” offers a broad conceptual reframing of how simulation can contribute to healthcare improvement, but the *methods* by which these aims are achieved are not well established. Nor are the effective operational strategies or faculty development approaches to enable effective translational simulation well described. Published examples of translational simulation activities are mostly context-specific case studies (18, 109, 111, 161, 162), with simulation methods drawn from educational contexts and/or reliant on local resources and capacity. Efforts to distil broad principles and practical techniques have been published, but these tend to simply encourage replication of approaches that may have led to success in one institution. Crystallising best practice is a significant challenge when there is significant diversity in 1) the healthcare improvement targets encompassed by translational simulation, 2) the simulation techniques available, and 3) the contexts in which translational simulation may be applied. ‘Best practice’ may not even be a worthy goal, given the dynamic and highly contextualised nature of the field. My analysis of this diverse literature is that conversations about methods have largely focused on ***in situ*** **simulation** (including risks), **systems testing**, **‘systems integration’**, and **change management,** each of which will be discussed in the next few paragraphs. These concepts are overlapping, illustrating the inconsistent terminology used by practitioners. Although the literature relating to ISS is the most extensive, the other two concepts are sufficiently distinct to warrant discussion. Given the extent of this literature, this background section is longer than other chapters.

In situ *Simulation*

In situ **simulation (ISS)** is a relatively novel, and increasingly popular, simulation technique within the healthcare simulation community. Enthusiasts have been keen to share their successes and lessons learned in ISS delivery. Around 2014, early reports of the success of ISS (109, 111) in identifying latent safety threats or improving outcomes (162) were published, usually accompanied by a description of the methods to deliver the simulation. A review of these examples reveals little consistency in approach (163), with diverse contexts and aims. Spurr and colleagues offered a *Top ten tips to get started with in situ simulation in emergency and critical care departments* (164), drawing on combined experience from four different simulation programs. A similar offering was published in *Emergency Medicine*

Australasia (165). That advice was practical and covered technical issues, engagement with departmental leadership, simulation realism, linking of governance systems and simulation safety. A comprehensive guide and list of resources for simulation practitioners has been published in *Life in the Fast Lane (166),* the global leader among emergency medicine blogs.

More detailed synthesis and critiques of ISS practice have subsequently been published. A 2020 narrative review of ISS examined various design features and concluded that "*adopting a design that fits into the specific center's resources, educational needs and clinical demands is the most important consideration*" (167). The authors of that review offered a framework of considerations for ISS planning, briefing, scenarios, debriefing, repetition and evaluation (167). A subsequent systematic review that considered *outcomes* provided evidence that ISS training is statistically correlated with improved patient morbidity and mortality, but that the evidence was limited by the number of studies (nine), and by confounding variables (168).

Recognising that ISS was undertheorized, Gormley et al. offered a helpful contribution to the academic conversion, exploring how cultural-historical activity theory (CHAT) could provide analytical tools to recognize and analyse complex health care systems through in situ simulation (169) This lens is well aligned with the need to embrace complexity in organisational change, and provides guidance for simulation practitioners seeking to thoughtfully design and delivery ISS outside of previously dominant educational paradigms. Most recently Baxendale et al. undertook a scoping review of ISS publications from 2008 to 2018 and generated a conceptual model for ISS in healthcare settings (170). His conceptual model proposed consisted of four elements based on simulation purpose: Understand events, Design and Testing, Practice and Assess/ Evaluate (170), each aligned with key concepts such as complexity science, systems engineering, complex adaptive systems and knowledge transfer. That model is the most comprehensive integration of purpose, process and theoretical underpinning published to date.

Simulation safety issues appear prominently in the ISS literature and are featured in my simulation practice and scholarship. Conversations about the *risks* of ISS emerged after well publicised adverse events related to simulation delivery (171, 172). ISS exercises pose a potential threat to safe and efficient service delivery for real patients in clinical areas (114). For example, there are risks in deploying staff from clinical care into a simulation, in

preventing a real patient from using a physical space, or in mixing simulated and real equipment and medications. Simulation programmes have adopted systems and processes to mitigate these risks, including the development of formal 'no go criteria' for cancelling ISS exercises (173). This guidance is useful, but the unintended consequences of translational simulation activities are under-reported and underexplored. This safety issue is the subject of the eighth article in this exegesis and is discussed in the second subsection of this Chapter.

Systems testing and 'systems focused simulations'

Practitioners using translational simulation for '**systems testing'** of new buildings, physical spaces, and clinical processes have described diverse methodologic approaches. For example, in reporting experience in testing new building design, Barlow et al. offer a documentation framework for healthcare simulation quality improvement activities (120). Their framework draws upon established methods from quality improvement, including the Failure Modes Effects Analysis (FMEA) approach to collecting and analysing data from translational simulation activities. Another example offers lessons learned from using process-orientated simulations to test the opening of a new 300-bed healthcare facility (130). Seeking to develop a standardised approach to systems testing, Colman and a team drawn from multiple institutions presented a 'Simulation-based Clinical Systems Testing' (SbCST) framework, including documentation and evaluation tools (112). Drawing on a different conceptual framework, Petrosoniak et al. describe a 'design thinking-informed' simulation framework to test, evaluate and modify new clinical infrastructure (118). This included the key features (and language) of design thinking (174): End-user engagement, rapid prototyping and testing and an experimentation mindset. Although offering diverse methodological approaches, the conversations shared a common advocacy stance, perhaps expressed best by Dench et al.: "*It's time for the mandatory use of simulation and human factors in hospital design*" (175).

Systems integration

Systems integration is defined in the SSH Healthcare simulation dictionary as "*a category of simulation program accreditation that recognizes programs that demonstrate consistent,*

planned, collaborative, integrated, and iterative application of simulation-based assessment, research, and teaching activities with systems engineering and risk management principles to achieve excellent bedside clinical care, enhanced patient safety, and improved outcome metrics across the health care system(s)" (72). The accreditation standards referred to are under the auspices of the US-based Society for Simulation in Healthcare (SSIH) (121). The standards describe a variety of methods by which these aims may be achieved, drawing heavily on systems engineering principles and tools, including the Systems Engineering Initiative for Patient Safety (SEIPS) model of work system and patient safety (128). I co-authored the book chapter on Systems Integration in which the standards are described and explored (176). The accreditation standards are broad. They mandate baseline consistency but do not necessarily reflect the practices of programs engaging in context relevant approaches or innovations. A few reports of simulation to test protocols and systems use this terminology of "systems integration" (177, 178), as do some descriptions of simulation debriefing methods adapted for this purpose (179). The terminology is, however, not widespread outside the accreditation context nor outside North America.

Implementation and Change Management

Effective design and delivery of translational simulation in health services also requires more than practical methods and techniques. Deep integration and alignment with the governance, operational and resourcing strategies of health services is also critical. This an important distinguishing feature of translational simulation. The conceptual framing encompasses health service priorities as *outcomes*, but also health service systems and governance structures as *enablers or barriers* to success. The importance of integration of simulation programs within health services is reflected in the systems integration accreditation standards (121) described above. More detailed guidance - "*Recommendations for embedding simulation into health services*" (180) - has recently been published. This article (of which I was a co-author) offers 19 recommendations grouped in broad domains such governance and leadership, human resources, operational principles and planning. The guidance draws on theoretical lenses - relevant principles from implementation science and change management – as well as published examples of simulation service activities. Underlining this need for effective change management as part of a translational simulation strategy, Eller et al. "*describe eight change leadership steps*

adapted from Kotter's change management theory … to sustainably implement ISS programs." (181).

SUMMARY

The conversations about the *process* of translational simulation reveal diverse terminology, techniques and theoretical underpinnings. This presents a conundrum for translational simulation practitioners. *Do we need a consistent methodology, or are we better served by describing a suite of tools, to be drawn upon depending on local context, program aims and resources?* In the absence of consistency, it is difficult to evaluate whether our methods are the most appropriate or to benchmark quality against other programs. The contexts in which translational simulation are applied may, however, be too diverse to support a standardised approach. Addressing this conundrum requires a deeper focus than simply choosing techniques or tools. Translational simulation programs require a strategic approach to implementation, and practitioners need perspectives drawn from fields such as healthcare improvement, human factors, safety science, design thinking and architecture,

The three subsections that follow each describe a prior work. These three publications were written in the context of this conundrum and the relevant academic conversations.

5.2 TRANSLATIONAL SIMULATION: FROM DESCRIPTION TO ACTION (5)

WHY THIS ARTICLE AT THIS TIME?

The gap between embracing translational simulation as a conceptual approach and practically applying this approach to health service challenges was increasingly obvious to me. I had spent more than six years undertaking this work at Gold Coast Health, and my original article was an attempt to conceptualise that work in a manner that would help others – with principles and a conceptual model. And yet this was not enough to guide practice. I received numerous requests for advice from simulation programs wanting to 'do translational simulation'. Questions after my keynote presentations were often centred on how to 'make it happen', including questions of governance, simulation design, faculty development, technology, data collection, and reporting outcomes. Practitioners from other programs sought to visit our simulation service at Gold Coast Health, mostly seeking practical advice and tools. We began to offer visiting scholar opportunities lasting from a few days to three months for these practitioners. Aware that our own program was a product of our local context, the questions raised in these visits and at conference presentations began to crystalise some common challenges relating to strategy, design, delivery and outcomes for translational simulation programs.

The article, *Translational Simulation: from description to action (5),* originated when Dr Chris Nickson joined our Gold Coast Health Simulation Service as a visiting scholar. We discussed approaches to these issues in his program at the Alfred Hospital in Melbourne Australia and in our own. After his return to Melbourne, Chris proposed the article concept as a reference guide for translational simulation programs. I had a longstanding prior professional relationship with Chris, including collaboration on conference organising, clinical emergency medicine education, and writing for social media, and I thought this would be a timely contribution to the literature, and support my own simulation practice development.

After discussing the broad approach, we invited two other colleagues to join us in writing the article The first, Dr Andrew Petrosoniak, a simulation leader at St Michael's hospital in Toronto, Canada is engaged in simulation work relating to improving outcomes in trauma and resuscitation, including the physical design of resuscitation bays (182) and testing processes for massive transfusion of blood products in trauma (183). The second, Ms Stephanie Barwick, is the lead for simulation programs at the Mater Hospital in Brisbane,

Australia. One of her focus areas is the use of simulation to test healthcare physical spaces (175), including Mater's 'Optisim' program (184).

Developing the scope and tone of the article was difficult. In retrospect, we were confronting the same conundrum as I described in the opening section of this Chapter. We could produce a detailed 'how to' manual, with granular guidance, but it might not be relevant in many contexts due to resource constraints or institutional governance arrangements. Alternatively, we could produce advice that was so generic and broad that it provided insufficient guidance for anyone and didn't move beyond the conceptual reframing of my original article. We resolved this after robust discussions about our own methodological approaches and iterative reflection at various stages of the writing process. Our final article provided a balance of overarching principles, a detailed toolkit of methods and case studies.

WHAT WAS THE CONTRIBUTION OF THE ARTICLE?

We aimed to "*describe a 'road map' for practitioners using translational simulation to address health service and patient-oriented outcomes*" (5). Drawing on existing literature and our combined experience we suggested an operational framework for practitioners planning translational simulation activities. We used hypothetical examples to illustrate how that framework could be applied in different contexts and included a toolkit of relevant resources and techniques.

We opened the article with a synthesis of published examples of translational simulation activity, grouped into three broad threads: exploration of work environments and/or people in them, quality improvement through targeted interventions and design and testing of planned infrastructure or other process interventions. The examples cited included many referenced in the introduction to this Chapter. Given the timing of our writing (during 2020), we were able to also draw upon numerous examples from simulation applied to the challenges of the COVID-19 pandemic, including testing new processes and clinical workflows.

The next section of the article posed three hypothetical health service challenges, typical of those that translational simulation practitioners might target. All were drawn from our own experience, albeit modified to illustrate some key points. The first case vignette was focused on clinical space testing, and specifically the development of new trauma bays in an

emergency department. The second case was focused on process development, and specifically the development of an airway emergency protocol for electro-convulsive therapy (ECT) in a mental health unit. The final case vignette focused on exploring and shaping team relationships and culture, through the context of improving performance in a maternity unit managing women who suffer PPH. In this introductory section of the article, the vignettes were presented as challenges, with a paragraph of context detail in each and a plan to return to these examples once our principles and tools had been presented.

We then presented the guiding principles for how translational simulation may be "*conceptualised operationally*", including our Input-Process-Output (IPO) framework (5). The IPO framework drew upon the use of IPO models in other fields as a common and simplified representation of a system, and is reproduced in **Figure 11**.

The guiding principles for operational application of translational simulation we offered were:

1) **Systems approach**, embracing organisational learning principles
2) **Stakeholder engagement and participatory design**, promoting engagement of frontline clinicians and healthcare consumers
3) **Strategy, not an event**, emphasising that healthcare improvement requires an iterative and embedded approach
4) **Disciplined focus**, recognising that "*goals are more likely to be achieved if they are narrow, specific, and well communicated to those designing and participating in the translational simulation activities*" (5)
5) **Functional task alignment**, reflecting the diversity of simulation techniques and design choices, and how they should "*align with the objectives of the translational simulation strategy*" (5).

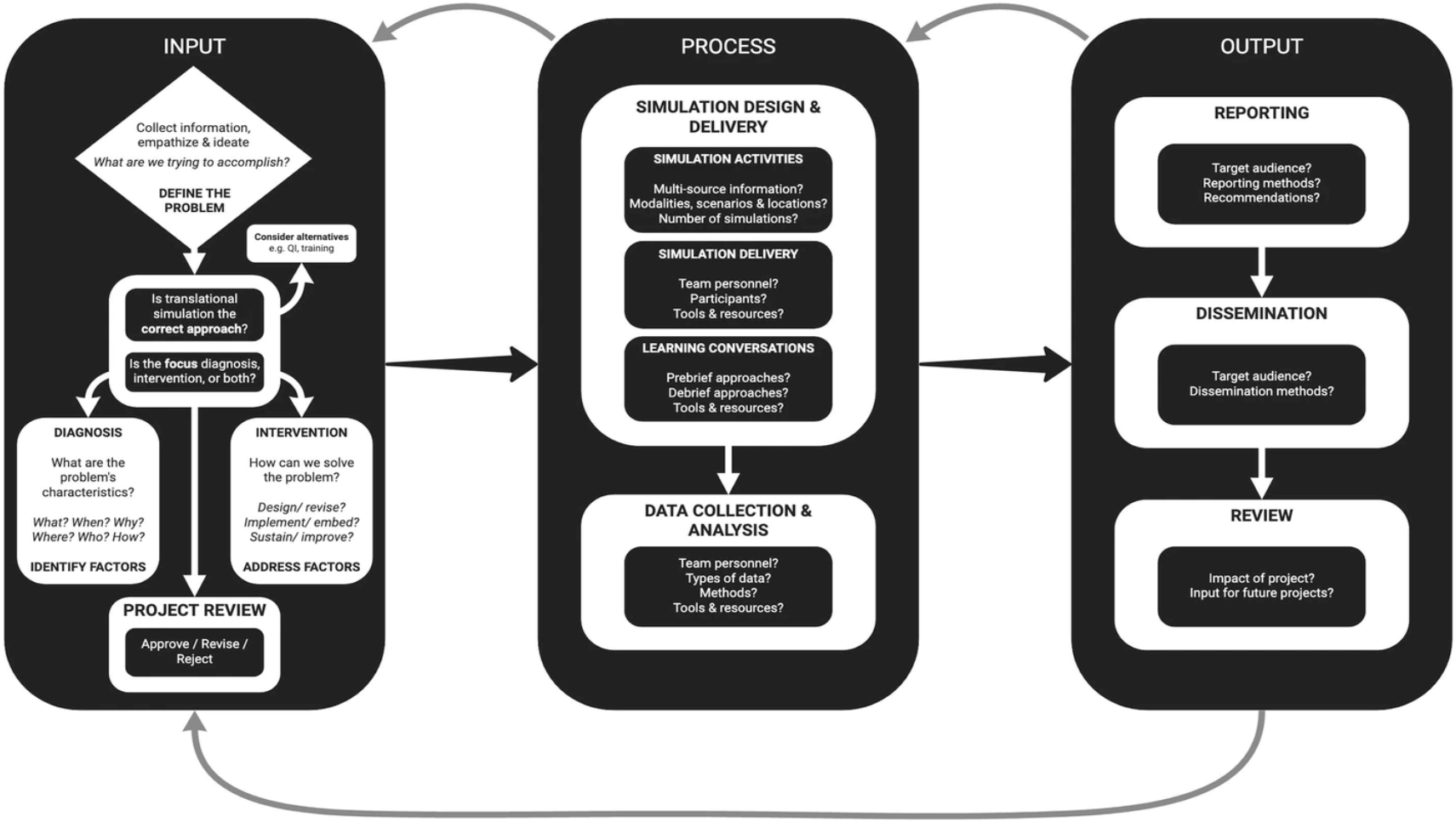

Figure 11. **Input-Process-Output Framework** *From* Nickson, C.P., Petrosoniak, A., Barwick, S. Brazil, V. **Translational simulation: from description to action**. Adv Simul 6, 6 (2021). https://doi.org/10.1186/s41077-021-00160-6 (5). Reproduced under Creative Commons licence CC BY 4.0

Using this overarching structure, we continued the article by adding detail to each of the elements of the framework, through text descriptions and tables. For example, Table 1 in the article listed considerations for the Input phase, including possible stakeholders to consider, sources of information useful for defining the problem, and factors that influence the value of translational simulation programs. In the important 'project review' element of the input phase, we suggested a series of questions for translational simulation practitioners to ask of the proposed activity*: a) Is it likely to lead to an improvement? b) Is it worth the cost? c) Will it have unintended consequences? and d) Is there capability to deliver it?* Likewise, we offered tables listing considerations for each of the 'process' and 'output' phases of the framework. This included detailed resources for simulation design, data collection, the structure of learning conversations and reporting and dissemination of findings from translational simulation. We balanced the detail in these tables with the need for a coherent and manageable message. We added an online supplementary resource for those interested in more granular detail, with particular emphasis on data collection and analysis.

Having provided the overarching framework and some detailed methods, we applied them (hypothetically) to the three case vignettes posed in the introductory section of the article. For example, the trauma bays in the first case vignette were designed in collaboration with architects, using an iterative process of tabletop and full-scale simulation testing. Data was collected from observations and debriefings and documented on the Simulation-based Quality Improvement Observation Tool (SQIOT) (120). These data from was then collated, risk rated, and reported on a Healthcare Failure Modes Effects Analysis (HFMEA) (185) summary report and incorporated into next versions of iterative design. In each of the three case vignettes, we aimed to model the application of IPO process and guiding principles to these diverse contexts, and to illustrate some potential outcomes, including unintended and negative ones.

We concluded the article with a discussion of four issues facing practitioners attempting to operationalise translational simulation concepts: Demonstrating return on investment, connecting translational simulation with quality improvement, building capacity, including faculty development, and the impact of the COVID-19 pandemic. We summarised our proposed IPO framework and reflected that "*Translational simulation remains a nascent but promising approach to supporting solutions for the growing complexity of healthcare*" (5).

How did the article impact the field?

Since publication in March 2021, there have been more than 10,000 downloads and 33 citations. Citing articles include reports of simulation projects where the approach is aligned to our framework. One example was a simulated thermoregulation intervention to improve very low birth weight infant initial admission temperatures in a neonatal intensive care unit, in which the authors described their work as "*an operationalized example of … translational simulation, with a simulation-based intervention*" (186). Our author team has reflected on the personal impacts, and the wider breadth of methods resources we now employ in our own programs as a result of writing the article. For example, I have revised our reporting processes for translational simulation activities at Gold Coast Health and have more explicitly focused on our end-user focus in design projects.

Few examples can be found in which the IPO framework we described has been cited as the conceptual model for a published project. This may be the result of the relatively short time since our publication in which to develop and report a translational simulation activity, or it may be that our approach is better suited for operational practitioners with less scholarly focus, and hence less likely to publish their work. It may be that our efforts to balance the tensions between generic approaches and granular toolkits hasn't met readership expectations. In our efforts to address the conundrum identified in the opening section of this chapter - consistency versus diversity of methods - we may simply have added another framework to a growing list. This prompts two reflections. First, that this is how models develop: they emerge from practice, they are applied and tested, and then revised and updated or discarded. Second, that we need more than simple refinement of our methods and tools and must have a strategy for implementation.

The author team has disseminated the messages broadly. We recorded a podcast for *Simulcast*, discussing the IPO approach and guiding principles (30), and using the example of improving an ECMO service within the intensive care unit at the Alfred Hospital. The podcast has been downloaded over 1000 times. Chris Nickson authored a post summarising the article and other references related to translational simulation, for *Life in the Fastlane* (166), which is the most widely read emergency medicine reference globally. This included a 20-minute video presentation (187) of the key concepts delivered at the Australian and New Zealand Intensive Care Society (ANZICS) Annual Scientific Meeting in 2022. Andrew

Petrosoniak was interviewed in an article for Canada's Hospital News in which he described how translational simulation is "*about the direct links between simulation and patient outcomes or system priorities. It's essentially about translating learnings from the sim environment to actual patient care*" (188).

In the next subsection of this Chapter, I continue the conversational thread about the methods to operationalise translational simulation concepts but narrow the focus to the ***risks*** related to simulation delivery for translational purposes.

5.3 Developing a translational simulation safety policy (6)

Why this article at this time?

In introducing our article, we described how we "*felt compelled to develop a simulation safety policy (SSP) after reading reports of adverse events in the healthcare simulation literature, and editorials highlighting these safety risks*" (6). These risks included fake medications given to real patients, staff pre-occupied with simulation training when real patients require attention or emergency call systems activated by mistake. Conversations about the risks of simulation delivery (114, 172, 189) were not limited to translational simulation programs, nor to ISS delivery, but these contexts appeared to be where risks were most obvious. Our concern was that although safety risks were being highlighted there was little guidance on how simulation programs might develop coherent policies and procedures to avoid or mitigate them.

Dan Raemer's editorial on simulation safety (114) was published concurrently in three major healthcare simulation journals in 2018. Reading it prompted reflection on practices within our simulation service at Gold Coast Health. It also prompted me to write a post for the International Clinician Educators Network blog (31), highlighting these risks to an audience of clinician educators who I worried might miss this important editorial. The editorial included reference to the website of the Foundation for Healthcare Simulation Safety (190) that Dan Raemer established with Ann Mullen from the Center for Medical Simulation in Boston. The Foundation website offers a register of safety incidents related to healthcare simulation delivery, a comprehensive reading list, and a practical tool kit of resources, including printable 'Not for human use' labels for fake medications. One of these resources is a

simulation safety checklist I developed for our Gold Coast Health Simulation Service, also published on the ICEnet blog (32).

I recorded two Simulcast episodes on this topic. The first was recorded in October 2017 with Ann Mullen (33) in which we discussed in depth the issue of simulation safety and the Foundation for Healthcare simulation website(190) and resources. The second podcast (34) was recorded in December 2018 with Dan Raemer, following publication of his editorial. Our conversation canvassed both the unintended harms from simulation and the potentially equal harms of not using simulation as a translational tool, and this podcast has been downloaded more than 1500 times.

Recognising the significance of this issue, we (the Gold Coast Health Simulation Service, of which I am the Medical Director) developed a comprehensive simulation safety policy which was finalised in August 2020. We received multiple requests from other translational simulation programs for copies of the policy, and for information about how it was developed. It was a point of interest for most of our visiting scholars. In this context, I felt that a description of this process of policy development and lessons learned might be of benefit for the healthcare simulation community.

WHAT WAS THE MAIN CONTRIBUTION OF THE ARTICLE?

We opened the article by offering a brief review of relevant literature and published guidance for addressing simulation safety risks. We described our local experience of adverse events and 'near misses' at Gold Coast Health Simulation Service and how we had developed *"ad hoc personal systems for safety that were inconsistent across our institution*" (6). Our context as a program operating within a large, state government sponsored health service was explained, including the expectation of detailed policies and procedures to guide practice. We felt that this was a challenge faced by many programs, and that "*despite the existence of standards and resources that encourage safety, the process for development of a comprehensive SSP for translational simulation services is not clear*" (6).

We devoted a section of the article to a discussion of policy development in healthcare, and how it had informed our approach. Aware of our audience of healthcare simulation educators, we concentrated on basic issues. These included suggested frameworks for

policy development, accreditation standards, and clarification of definitions for various terms: policy, procedure, standards and protocols.

Our Gold Coast Health policy development took 18 months, and article described a timeline of the process diagrammatically. The policy development process illustrated the importance of medication safety and associated regulatory requirements, and the extensive nature of consultations required within our health system context. Our finalised policy was made available to readers as online supplementary material, and the article included a photograph of our safety signage and an image of our *in situ* simulation safety checklist.

The body of the article offered eight recommendations, drawn from our program's experience of this process and our author team's reflections:

1) Form a STEERING GROUP for development and implementation of the simulation safety policy and identify RELEVANT STAKEHOLDERS required for advice and approval.
2) Identify existing safety procedures for the health service/ educational institution that are relevant for the simulation program.
3) Incorporate simulation safety practices required in SSH accreditation processes and Raemer's 'Ten Commandments' (114).
4) Consider the nature and extent of predicted safety risks, based on reports in the literature and local experience -adverse events and near misses.
5) Prioritise medication safety and liaise with health service pharmacy representatives.
6) Effectively communicate the existence of the simulation safety policy, and the need for staff involved in simulation delivery to comply with it.
7) Enable simulation faculty to conduct safe simulation sessions that are compliant with the policy, including structured briefings, cognitive aids and environmental cues.
8) Develop a reporting process for simulation related adverse events or near misses, preferably integrated within the health service clinical adverse event reporting framework.

The article went beyond previously suggested 'tips' or 'no go criteria' described in the context of ISS to provide an integrated approach and one that would be acceptable to risk-averse healthcare institutions. It recognised the need for a strategy that recognised existing policies, e.g., those related to occupational health and safety, and integrated procedures to mitigate

risks specific to translational simulation. We concluded by re-iterating our aim: to offer guidance for a coherent approach to translational and in situ simulation safety.

WHAT WAS THE IMPACT OF THE ARTICLE ON THE FIELD?

We have improved our local practice at Gold Coast Health as result of this policy, especially as it relates to medication safety and collaboration with our pharmacy services team. Personal communications suggest it has been useful for others. There have been 4266 accesses of the article, and 5 citations at the time of writing. The conversations about safety continue in the literature, including a recent scoping review of evidence regarding the safety of *in situ* simulation (ISS) in the emergency department (191), which found that very few published ISS projects reported impacts or risks to patients.

5.4 FACULTY DEVELOPMENT FOR TRANSLATIONAL SIMULATION

WHY THIS ARTICLE AT THIS TIME

Even with clear purpose and a consistent process, translational simulation activities may not be effective if simulation practitioners lack relevant knowledge and skills for simulation design, delivery and debriefing. How are those skills acquired and developed? How do they need to be modified for simulation with a quality improvement purpose? My own experience leading an 'in-house' simulation faculty development program at Gold Coast Health was that developing these skills was a challenge for both our core simulation team and our wider faculty group who delivered simulation within the health service. I was anecdotally aware that other translational simulation programs across the world had similar challenges.

Faculty development has long been recognised as important for simulation-based *education* (192). Acquisition of foundational skills such as pre-briefing and debriefing, scenario design, and technical/ operational aspects of safe simulation delivery are supported by numerous courses, workshops and publications (192, 193). However, given the distinct purpose and processes inherent in translational simulation, knowledge and skills required by simulation practitioners might be different to those for simulation delivered within an educational context. Given the diverse methods and theoretical frameworks that translational simulation

draws on for healthcare improvement, it is unlikely that most simulation program staff will have adequate understanding or experience in these fields of practice.

In the absence of any published literature, I thought the first step was to capture a global snapshot of faculty development approaches within translational simulation programs, and to explore the influences on *content* and *learning process* within these approaches. I invited three co-authors to enrich the data analysis. Rebecca Szabo leads the Gandel Simulation Service (194). I had delivered a series of faculty development workshops for GSS as their service was being established between 2020 to 2022, and Dr Szabo and I had delivered a workshop on faculty development for translational simulation at the 27th Annual Meeting of the Society in Europe for Simulation Applied to Medicine (SESAM) in June 2022. Eve Purdy and Alex El Kheir are both emergency physicians at Gold Coast Health and had previously undertaken a Fellowship in Translational Simulation under my leadership at the GCUH. In that role, they had experienced faculty development as learners and then progressed to serving as faculty on our workshops at Gold Coast Health.

WHAT WAS THE MAIN CONTRIBUTION OF THE ARTICLE

We sought to "*explore and describe these practices—the objectives, pedagogies, and methods—in how practitioners are prepared for the design and delivery of translational simulation activities*."(7) We used a qualitative approach and collected data through semi-structured interviews. Leaders from translational simulation programs in Australia, the USA, Scotland, Ireland, Wales, Denmark, Brazil, Norway and Canada were interviewed.

Our thematic analysis of 14 interviews identified three themes: 1) Diverse content, (2) 'Home-grown', informal processes, and (3) the influence of organisational context. Even established programs are taking predominantly informal approaches to faculty development for simulation activities with a translational focus. Most programs rely on foundational knowledge and skills for simulation-based education. Leaders described (in mostly vague terms) that this was not perfectly matched with the translational purpose, but few had integrated or explicit faculty development for these additional knowledge and skills The interviews helped to generate a list of content felt to be relevant (Table 1. (*also Table 1 of the article*)), which was comprised of 'foundational' topics (e.g., scenario design, debriefing, psychological safety, and technical aspects) and more specific, translationally focused

topics (quality improvement methods, human factors, change management, project management).

Table 1. List of faculty development content topics mentioned by interview respondents.

From Brazil, V., Purdy, E., El Kheir, A. et al. **Faculty development for translational simulation: a qualitative study of current practice.** Adv Simul 8, 25 (2023). https://doi.org/10.1186/s41077-023-00265-0 (7) Reproduced under Creative Commons licence CC BY 4.0

Knowledge and skills foundational to healthcare simulation
Scenario design, Curriculum development, Writing learning objectives
Technical skills
Establishing and maintaining psychological safety, Pre-briefing, Debriefing
Program evaluation
Simulation-based assessment
Knowledge and skills specific to translational simulation
Needs analysis.
Human factors
Return on investment.
Quality improvement
Task analysis
SEIPS (Systems Engineering Initiative for Patient Safety) model
Safety II
Change management
Physical design and engineering
Design thinking
Resilience engineering
Process mapping/ process improvement

FMEA (Failure Mode Effect Analysis)

Quality improvement tools

- Aim statements and driver diagrams

- Root cause analysis / Fishbone diagrams

- PDSA (Plan Do Study) cycles

Simulation safety

System engineering

Adverse event management

Lean Six Sigma

Implementation science

More fundamentally, our study led to reflections *"…on a broader question; how do translational simulation programs build capacity? Capacity is much more than a shopping list of individual skill sets. It requires clear program objectives, effective governance and operational processes to support the achievement of those aims, and appropriately skilled simulation practitioners… programs may be well served to make intentional choices about recruitment of, and collaboration with, individuals and teams with complementary expertise."(7)* Few simulation programs have sufficient in house expertise in quality improvement, human factors or safety science to teach new faculty about these fields of practice, and so collaboration is crucial – in practice, research and faculty development. This underlines the recommendations from Davies et.al. about integration and embedding simulation within health services, including collaboration within existing operational structures for patient safety and quality improvement (180).

What was the impact of the article on the field

The article highlighted the nascent stage of faculty development within the translational simulation community but has identified some exemplar programs and provided a snapshot of the faculty development topics considered important by translational simulation program

leaders. There have been 900 accesses of the article since publication in November 2023. The work will be presented at the SESAM conference in June 2024.

More practically, this work has informed the development of a Bond University subject - Translational Simulation in Healthcare - in the Masters of Healthcare Innovation in 2023, (https://bond.edu.au/translational-simulation), for which I am the lead educator. The subject comprises six 6 online modules, 2 intensive workshops, 6 coaching groups and a series of assessments. The module content draws upon the topics identified in the study: quality improvement, patient safety, human factors, healthcare spaces, process redesign and building teams. The main assessment is a personal project, recognising the diverse contexts in which principles need to be applied and for which specific methods and tools need to be selected.

5.5 What were the next conversations?

The three articles in this Chapter focus on the 'how' of translational simulation. The conceptual reframing on *purpose* offered by the term translational simulation is not enough to realise the potential for healthcare simulation to contribute to healthcare improvement. *Process* also matters. Consistent methods and tools are helpful, whether drawn from healthcare simulation practice or other fields. But the healthcare simulation community is grappling with nascent attempts at consistent terminology and taxonomy for simulation practice that is focused on systems and processes. It may be that this focus on *process* needs to be accompanied by attention to the *implementation* of translational simulation within health services.

Establishment of the Bond Translational Simulation collaborative to foster the next academic conversations

I established the ***Translational Simulation Collaborative (TSC) (195)*** as a research centre at Bond University in 2021 to foster a community of practitioners and scholars in translational simulation. Quoting from the website, "*The Bond Translational Simulation Collaborative is an academic and operational alliance formed by Bond University and Gold Coast Health to deliver better care, improve simulation delivery techniques and develop healthcare*

practitioners who can use simulation for their everyday quality improvement." (195). The collaborative hosts visiting scholars, provides consultancy services, supports research, and collaborates with industry partners. Establishment of the TSC reflects my bias toward connecting scholarly work with practical outcomes, and toward fostering collaboration between practitioners, industry and academics. The TSC currently has commercial partnerships with health service institutions, industry partners and other academic institutions. In 2023 we hosted three Visiting Scholars, ten MD students, and three PhD candidates. We held our second annual Simulation Reconnect symposium, with over 100 attendees. The TSC was used an illustrative example of a research collaborative in an *Academic Medicine* article on the "*Purpose, Design and Promise of Medical Education Research Labs*" (35). Given the relatively small community of practice, this nexus for sharing resources and experience may advance translational simulation practice.

CHAPTER 6: CONCEPTUAL FOUNDATIONS: QUALITY IMPROVEMENT, PATIENT SAFETY

In this chapter, I continue the discussion, started in Chapter 2, about the parallel and intersecting histories of healthcare simulation and quality improvement from 1990 to the present. The emphasis in this chapter is on the intersection between these fields of practice and extending the conversations about the conceptual framing and practical contribution of healthcare simulation to improving quality in healthcare.

> "*thoughtful integration of simulation and QI as fields of practice and research has the potential to enhance the contribution of both to improving patient care." (8)*

There are three subsections in the chapter. In the first I describe an invited editorial I wrote for *BMJ Quality and Safety* about "*Connecting simulation and quality improvement*" (8). The second subsection describes a keynote presentation to an audience of healthcare improvement practitioners and researchers (9). In the longer third subsection, I discuss a book chapter written for the *Elements of Improving Quality and Safety in Healthcare* that comprised a comprehensive literature review, and discussion of the opportunities and challenges for using simulation as an improvement technique. The timeline of these publications and the presentation, together with relevant supporting scholarship, is Illustrated in Figure 12. I conclude the chapter by crystallising ongoing questions about the design and delivery of translational simulation, and about how to measure impact.

6.1 WHAT CONVERSATIONS WERE THESE PRIOR WORKS JOINING?

There were conflicting conceptualisations within the healthcare improvement practitioner community as to whether simulation was a method (196), a technique, a research 'test bed' (197, 198) or an intersecting field of practice with healthcare improvement (199). While simulation may fulfil any of these roles within different contexts, a deeper understanding of simulation as a field of practice will enable optimal alignment with improvement goals. Conversations about these varied conceptualisations were prompted by reports of simulation-based approaches to healthcare improvement, appearing in journals such as

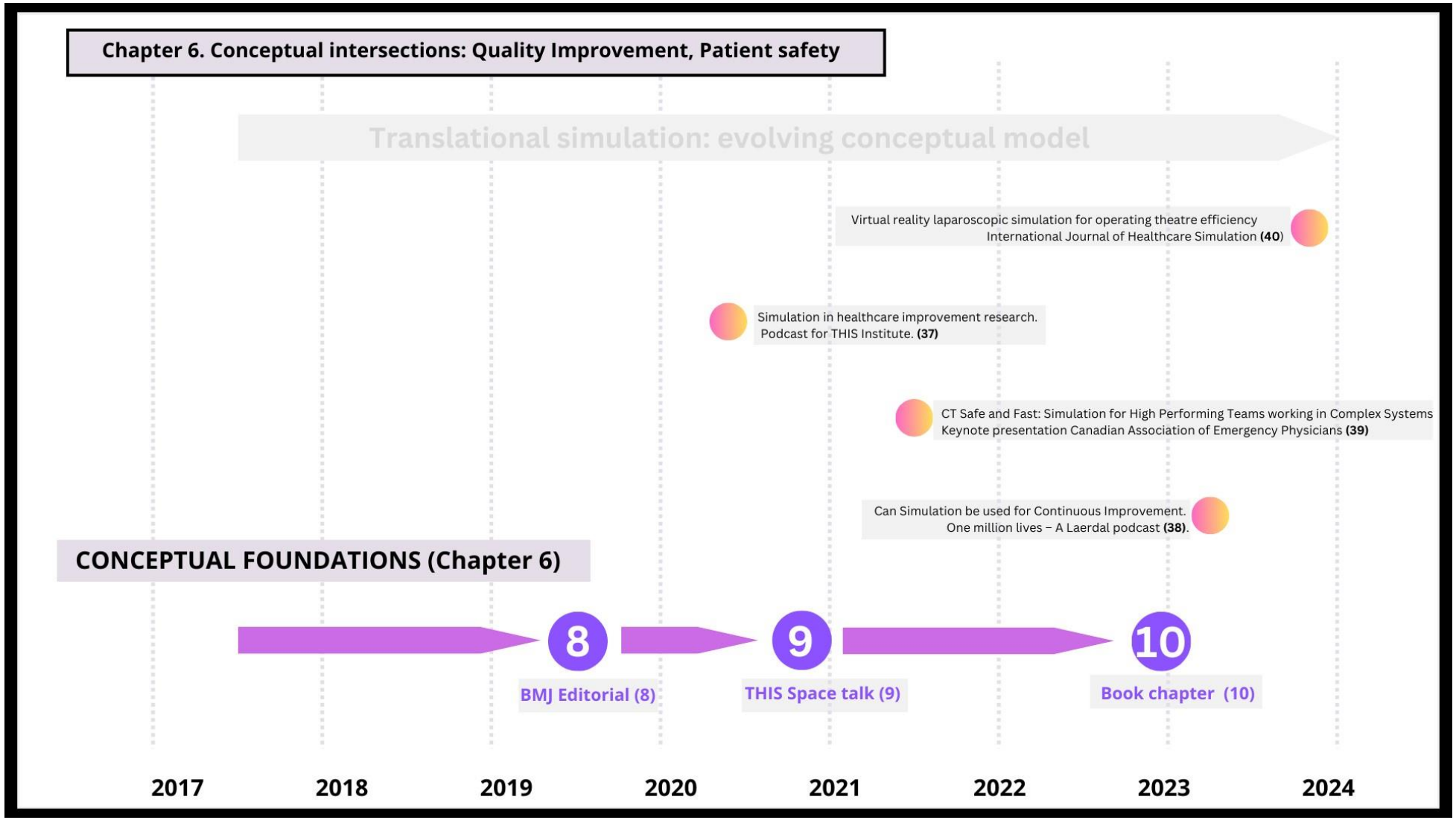

Figure 12. Published works and supporting scholarship for Chapter 6

BMJ Quality and Safety (200, 201). The methodologies described in these reports were diverse, inconsistent, and variably cognisant of accepted QI methodologies. These conversations were at an early stage within the healthcare improvement community, and were surprisingly (to me) disconnected from the parallel conversations within the healthcare simulation community (202). This scholarly disconnect risked practical consequences; healthcare simulation practice could fail to realise its promise within healthcare quality and safety through a lack of shared conceptual understanding. My editorial, keynote presentation and book chapter described in this chapter were joining conversations in the healthcare improvement community, with the aim of reducing that disconnect.

Researchers in healthcare improvement joined practitioners in the field in demonstrating interest in healthcare simulation. One example is THIS institute - a collaboration between University of Cambridge and the Health Foundation of the National Health Service (NHS) in the United Kingdom. The goal of the THIS Institute is to "create a world-leading scientific asset for the NHS about how to improve quality and safety in healthcare" (203). Through research, events and podcasts, the Institute encourages academic and practitioner conversations about how to improve quality in healthcare. Founded in 2018, THIS has sought answers to a fundamental question, described best by its Director – "*How to improve healthcare improvement—an essay by Mary Dixon-Woods*" (204). By 2019, the Institute had already reviewed and funded research that examined the role of healthcare simulation and were raising questions about its role in the quality improvement field. Funded by THIS institute, Lame published an article on using clinical simulation as a research method in the study of healthcare improvement - "*How simulation-based research can be used to study improvements to healthcare systems and processes*" (197). The authors reviewed literature about using simulation in healthcare improvement research, outlined relevant case studies, and offered suggestions for study designs (197).

In parallel with conversations about the role of healthcare simulation, traditional approaches to healthcare improvement were under discussion. The dominant *intervention* logic of healthcare improvement at this time was being critiqued and contrasted with a *context logic*. Within an intervention logic, "*a specific, bounded intervention (such as a checklist, decision-support system, or care bundle) is defined and implemented*" (205). This approach often failed to reproduce successful outcomes when the interventions were introduced into new locations or institutions. Liberati described a different paradigm when reporting an ethnographic study of a high performing maternity unit in the United Kingdom (205). She

suggested we might instead consider a 'context logic', i.e., "*identifying the features of particular environments (such as organisational structures, processes, behaviours, practices, and values) that contribute to safety*" (205). However, this proposed paradigm shift presented a challenge for the healthcare improvement community. How could these contexts be understood and shaped? I believe that the context logic was well aligned with a core element of my conceptual stance, that translational simulation encompasses a diagnostic function, exploring work environments and the people in them.

6.2 Connecting simulation and Quality Improvement: How can healthcare simulation really improve patient care? (8)

Why this article at this time?

Mary Dixon Woods invited me to write an editorial based on my work in healthcare simulation applied to improving healthcare quality. The departure point for the editorial was a study published in the same edition of the journal, in which Ajmi and colleagues reported on a simulation-based intervention that improved door-to-needle times and patient outcomes in acute ischaemic stroke (206). The work was an example of translational simulation in practice, and the editor's request was to reflect on the more fundamental issues that this published example raised. *Specifically, how might healthcare simulation connect to quality improvement initiatives? Was healthcare simulation simply a technique(s) for enabling QI initiatives, or was it an emerging methodology, with a deeper conceptual basis, that could be distilled from work in the area thus far?*

What was the editorial's main contribution?

In introducing the Editorial, I described it as a "…*reflection on the positioning of simulation-based methods within QI programmes, the role of trained simulation experts as part of QI-focused teams and the directions for future scholarly enquiry that supports integration of these fields*" (8). The editorial opened with a critique of of Ajmi et al. research article in which a simulation team successful improved time to intervention in acute stroke using a simulation-based intervention (206). I suggested that this article, and the research it

described, were typical of a *linear* approach to quality improvement. In that approach, simulation is conceptualised as an intervention, pre-post measures of performance are used as a measure of intervention effectiveness and researchers provide proof that simulation 'works' as an improvement tool. This conceptualisation in positivist paradigm may be appropriate for some QI initiatives and for some research questions. I contended, however, that *"how, why or when simulation works for improving care is a more nuanced question"(8),* and that there was alternate conceptualisations by which healthcare simulation activities could be a cause, association or even outcome of improvements in healthcare quality. Although not explicitly stated in the editorial, this contention was that the contribution of healthcare simulation to improving quality in healthcare goes well beyond simple technique, requiring the conceptual reframing I had offered in my 2017 translational simulation article (1), i.e. as a complex intervention (126).

Aware of the journal's readership of healthcare improvement researchers and practitioners, I devoted sections of the editorial to explaining the breadth of activities meant by the term 'simulation'. I suggested that the concept of effectiveness needed to be similarly broad when considering the outcomes of simulation-based interventions. I offered a description of McGaghie's framework, described in Chapter 3 of this exegesis, in which patient-oriented outcomes were "*more likely when simulation-based medical education interventions are embedded in rigorous educational and health services research programs that are thematic, sustained, and cumulative*" (41). This discussion of outcome measures was aligned with the stance taken in my foundational translational simulation article (1), i.e., that simulation activities that aim to improve quality in healthcare must have a clear and well defined target, while not being constrained by only choosing targets that are easy to measure.

The last third of the editorial was a discussion on "*how should simulation programmes and staff conceptualise their role in QI?*". A summary Box provided "*Suggestions for QI and simulation practitioners interested in closer integration of their fields*", including resources for reading, study, collaboration and engagement between practitioners in the respective fields. The editorial concluded by suggesting that simulation could work as a QI tool, but that the more nuanced questions - about how, why and when simulation 'works' - would inform how translational simulation could progress from being regarded only as a technique toward recognition as a professional practice, with intersecting theoretical foundations and multifaceted methodologies.

How did the Editorial impact the field?

The Editorial has 51 citations and 13800 downloads from the journal website. The citing articles include examples of simulation projects with a quality improvement focus, such as simulation programs supporting work practice changes during the COVID-19 pandemic. Closer review of these articles reveals that most were written by simulation practitioners, rather than healthcare improvement focused authors. For me, this suggests that the impetus for connection is more from the healthcare simulation community, still seeking to demonstrate the value of their contribution to healthcare improvement. In retrospect, missing from the editorial was a section on how healthcare improvement practitioners should conceptualise simulation within their research and practice, to prompt more conversations within that community Raising the profile of healthcare simulation as an aligned professional practice within the QI community remains to be achieved.

6.3 Simulation for the real world: Transforming healthcare teams and systems (9)

Why this presentation at this time?

As a sequalae to the BMJ Quality and Safety editorial, I was invited to be a keynote speaker for THIS Space 2020, the annual meeting of the THIS institute, and a gathering of academics and practitioners from the global healthcare improvement community. This was an opportunity to provide an in-depth explanation of healthcare simulation - methods, applications, and underpinning theories and principles - to a healthcare improvement audience. I considered the presentation as another chance to promote healthcare simulation as an aligned professional practice for healthcare improvement.

What was the presentation's main contribution?

My overarching message was that healthcare simulation is a potential game changer for improving patient care, but that it is hard to realise that potential. I suggested that we need a greater appreciation for how to integrate simulation-based activities into strategies to improve healthcare quality. Aware that I was speaking to an audience with variable experience of healthcare simulation, I used practical examples and stories to illustrate key principles. I introduced the talk with a case study. I described the challenges faced by an

emergency department team trying to safety and quickly intubate a trauma patient, and illustrated how many of these challenges were the result of complex team and system interdependencies. Traditional approaches to health professions education and simulation have prepared us poorly for these challenges or for how to improve performance in the face of them. I argued that effective use of simulation for improving quality in healthcare requires appropriate technology, effective educational strategies, and a mature understanding of systems and behaviour change.

Taking the audience through the history of healthcare simulation and its contribution to quality and safety, I described the success of simulation as an approach for the education and training of individuals and teams. However, I was clear that there remained a gap in translating this training to improvements in patient care. I suggested that simulation-based education lacked the broader perspective required for improving quality in healthcare. For example, there is little emphasis in traditional SBE on 1) barriers to translation of knowledge and skills to practice, 2) human factors such as equipment and environment 3) minimising unwarranted variation in individual practice, and 4) culture and relationships.

Aligning with Liberati's 'context logic', I posed translational simulation as ideally focused on context, not intervention (205). I returned to the case study posed at the beginning of the talk and applied a translational simulation framework to the challenge confronting the emergency team. Specifically, we can use simulation to explore the enablers and barriers of high performance in intubation of our trauma patients. We can use simulation to test better ways of working in healthcare, e.g., checklists, better equipment, better teamwork structures, better trauma room layouts. Finally, simulation can be used to embed those practices through education and training of individuals and teams. I concluded by suggesting that perhaps the most important impact of integrating simulation into healthcare improvement strategies was to send a powerful signal: a commitment to constant improvement, based on deep understanding of how work is done by frontline clinicians.

How did the presentation impact the field?

The presentation was attended by more than 200 people. Most attendees were UK-based, but with some from USA, Canada and other parts of Europe. I received several emails following the talk seeking further information on specific points. A copy of the presentation

hosted on my personal Vimeo site (9) has been accessed over 300 times since December 2020, with views from across the globe.

The keynote presentation was a prompt for wider conversations in the healthcare improvement community. As a lead-up to the event I recorded a podcast - *Simulation in healthcare improvement research (37)* - under the auspices of the THIS Institute. Our conversation on the podcast was more narrowly focused on the exploratory function of translational simulation as a tool for researchers. The discussion highlighted the sometimes-blurred boundaries between healthcare improvement *practice* and *research*, especially when using methods such as action research, with iterative cycles of investigation and change. This joined the earlier conversation started by Lame and Dixon-Woods in their article on "*Using clinical simulation to study how to improve quality and safety in healthcare*" (197).

6.4 SIMULATION AS AN IMPROVEMENT TECHNIQUE (10)

WHY THIS BOOK CHAPTER AT THIS TIME?

The conversations about how healthcare simulation should be conceptualised within healthcare improvement continued. My relationship with THIS Institute was a strong influence on my involvement in these conversations. The Institute embarked on a major project to produce a comprehensive textbook of healthcare improvement in late 2019. I was invited to write a chapter within this textbook, and subsequently invited the two co-authors of the editorial described earlier in this chapter to join me. ***Simulation as an improvement technique (10)*** is a book chapter (referred to as an 'Element' in the terminology used in the publication) in this comprehensive text on improving quality in healthcare, now named *Elements of Improving Quality and Safety in Healthcare.*

WHAT WAS THE PUBLICATION'S MAIN CONTRIBUTION?

The Element is structured into four sections.

1) A brief introduction.
2) An overview of healthcare simulation as an improvement technique, including definitions and descriptions of healthcare simulation, and a brief history of how simulation became integrated into approaches to improve quality and safety.
3) Simulation in action, which considers the mechanisms by which simulation can be applied to improving healthcare, with illustrative examples drawn from the literature.
4) Critiques of simulation, which considers current practice and scholarship through an effectiveness, efficiency and return on investment lens, and returns to the discussion about the connection between simulation and healthcare improvement as fields of practice and scholarship.

I will provide a brief summary of Sections 2,3 and 4 below: -

Section 2: Healthcare simulation as an improvement technique

The Element begins with a deconstruction of healthcare simulation as seen through Gaba's 11 dimensions of simulation (73), with illustrative hypothetical examples drawn from clinical

practice. For a readership with little experience of healthcare simulation, this section required a detailed explanation and illustrations of the techniques, modalities and aims of healthcare simulation activities. Using the example of improving performance in emergencies on a cardiac surgery ward, we provided a description of a typical translational simulation session (Figure 13**.**, *Box 1 from original Element*). This is followed by a subsection on how simulation became integrated into approaches to improve quality and safety, including the history of healthcare simulation as an educational technique and its emerging role in healthcare quality and safety.

Figure 13. **Illustration of the dimensions of simulation: Improving performance in emergencies on a cardiac surgery ward**. From Brazil V, Purdy E, Bajaj K. Simulation as an Improvement Technique. Cambridge: Cambridge University Press; 2023. (Elements of Improving Quality and Safety in Healthcare) https://doi.org/10.1017/9781009338172 (10) Reproduced under Creative Commons Attribution licence CC-BY-NC-ND 4.0

A cardiac surgery ward wants to improve its ability to respond to a rare but critical event: cardiac arrest in patients after cardiac surgery. This clinical situation requires a functioning ad hoc team, clinical decision-making that falls outside of usual cardiac arrest algorithms, and specific equipment.
Four simulation sessions are organised to take place over the course of a year, with the aim of clinical teams practising together for this critical event, and reflecting on the human factors that contribute to success or failure. A scenario is designed by the simulation delivery team – a group comprised of clinician experts and members with specific simulation technical skills and group facilitation expertise. The scenario outlines stages of the clinical encounter: initial patient deterioration 2 hours after surgery, sudden loss of cardiac output, and recovery after appropriate team interventions.

The simulation delivery team expects that the four sessions will offer a chance for iterative improvement if clinical teams identify opportunities for better teamwork or systems. In each session, staff who would be involved in such a clinical situation are organised to attend the simulation, which is conducted in a bed space in the cardiac surgical ward. Each simulation includes 10 participants from the clinical teams who would come together for this critical event (rapid response registrar and nurse, ward nurses, anaesthetics registrar, intensive care unit registrar, cardiac surgeon, intensive care unit administration clerk, and porterage staff).

Each session involves
1) a short pre-briefing for the clinical team, outlining the aims of the exercise and clarifying expectations,
2) the scenario, during which the clinical team is required to recognise the patient deterioration and respond appropriately, and
3) a debriefing discussion with the clinical team, facilitated by a member of the simulation delivery team.

The debrief includes addressing any knowledge gaps (educational outcomes) but is mostly focused on supporting the clinical team to identify opportunities for better teamwork, equipment set ups, call systems and cognitive aids. After each session, the simulation delivery team creates a report on the findings from the simulation and a debrief that is circulated to participants and to departmental leadership.

- In the first simulation, participants identify that having two different cardiac arrest trolleys on the ward leads to confusion.
- In the second simulation, the rapid response registrar voices unfamiliarity with the alterations to the cardiac arrest algorithm for patients after cardiac surgery. This provides the opportunity for the expertise of cardiac surgical ward nurses to be uncovered and amplified in the debrief.
- In the third simulation, a newly designed single cardiac arrest trolley (based on issues identified in the first simulation) is trialled.
- In the final simulation, the facilitator notices that the ward nurse gives the rapid response registrar a cue card when they arrive bedside to remind them of the differences in cardiac arrest management in this particular clinical situation. This card was designed by the ward charge nurse and a rapid response registrar after the second simulation.

Figure 13. **Illustration of the dimensions of simulation: Improving performance in emergencies on a cardiac surgery ward**. From Brazil V, Purdy E, Bajaj K. Simulation as an Improvement Technique. Cambridge: Cambridge University Press; 2023. (Elements of Improving Quality and Safety in Healthcare) https://doi.org/10.1017/9781009338172 (10) Reproduced under Creative Commons Attribution licence CC-BY-NC-ND 4.0

Section 3: Simulation in Action

The next section of the Element offers a structured literature review focused on the use of simulation for 1) exploration of work environments and/or people in them, 2) to improve quality through targeted interventions focused on clinical performance/ patient outcomes, 3) as a strategy for testing planned infrastructure and interventions, and 4) as a method for healthcare professionals to learn about quality improvement, and to embed a culture of improvement. The purpose of this section is to provide tangible examples of how simulation could be applied improving healthcare quality, through these four mechanisms.

Examples of the first approach – how simulation can be used to **explore work environments and the practices and behaviours of those in them** - includes procedural skill performance (e.g., a plastic arm that allows for intravenous cannula insertion), scenario-based immersive simulations to study team performance, simulated patient role play to review communication, and computer modelling simulation to examine patient flow through

an emergency department. This is a logical extension of using simulation as research 'test bed' used in many other fields and can be narrowly focused on the performance under examination. Shifting toward a quality improvement lens, simulations conducted within the actual care setting (ISS) can also evaluate *system* performance and identify latent conditions that pose threats to patient safety. ISS exercises become an opportunity to "*investigate and optimize human activity based on the connected layers of any setting: the embodied competences of the healthcare professionals, the social and organizational rules that guide their actions, and the material aspects of the setting*" (117). This exploration of the interconnected elements within complex systems offers opportunities for healthcare improvement within these systems. ISS is, however, immature in its methods, consistency and integration with other improvement strategies. A systematic review of studies reporting ISS activities found that '*approaches to design, delivery, and evaluation of the simulations were highly variable across studies*', and that performance measurement practices were suboptimal (163). Healthcare simulation can be used as an exploratory technique within a quality improvement strategy, but guidelines for best practice are lacking.

The second approach involves healthcare simulation projects are designed to **improve a specific clinical outcome.** The clearest examples target time-based outcomes or other easily measurable indicators, such as time to thrombolysis in stroke care (206), time for trauma patients to go to CT scan (207), resuscitation outcomes (208) teamwork in trauma (162) or success rates in paediatric intubation (161). The simulation techniques used for targeting system improvements include in situ simulation training, educationally focused simulation in dedicated facilities, procedural skills practice, and scenario-based team training. Reflecting on these published examples, we conclude that simulation is "*agnostic towards healthcare improvement frameworks*" and is frequently one part of a more comprehensive improvement strategy. This may be pragmatic and appropriate but makes it difficult to ascertain the specific impact of the simulation elements on the overall effectiveness of the approach.

The third approach involves simulation to **test planned changes to clinical processes or infrastructure**. We explained that simulation can enable evaluation of the feasibility, safety, acceptability, or effectiveness of planned changes to clinical practice or new infrastructure. This includes testing ergonomics, workflows, and human factors, and to identify latent safety threats before being introduced into the real clinical environment. We cited examples of this

work such as the ‘design thinking’ approach, used by an emergency department team to iteratively test and improve planned changes to their trauma resuscitation bay (118).

The fourth approach encompasses using simulation to help healthcare professionals **learn about and embed a culture of improvement**. Experiential learning can be used to teach adverse event management and QI techniques. One example is the *Quality Improvement Virtual Practicum: The QI Simulator,* in which health professional learners participate in a simulation that exposes them to *“patient-safety incident reporting and investigation, process mapping, plan-do-study-act cycles, run charts, intervention design, and interactions with hospital administrators”(209).* This use of simulation comes full circle; Simulation is being used as an educational technique *about* quality and safety.

Section 4: Critiques of simulation

The last section of the Element considers healthcare simulation for quality improvement “*through an effectiveness, efficiency, and return on investment lens*” (10). This section described practical considerations for and barriers to the delivery of simulation, including cost, faculty development (for simulation delivery teams), technical issues, safety risks (114, 173), and ethical considerations (77). This section returns to the discussion of connection between simulation and healthcare improvement. The connection is examined through 1) comparison of practice and scholarship in these communities, 2) review of governance relationships within healthcare institutions, and 3) a comparison of tools, terminology, and frameworks. The section closes with a discussion of return on investment (ROI) and building a business case for simulation to improve quality and safety in healthcare.

How did the Book chapter impact the field?

The impact is not yet known. The Element was published in January 2023, three years after the initial invitation to contribute. The COVID-19 pandemic presented challenges to the University of Cambridge team which arranged reviews and editing. Our author team made significant revisions in 2021 and again in 2022, in response to detailed peer reviews (by non-experts in simulation) and to reflect recently published literature. Positioned within a comprehensive series of Elements in Improving Quality and Safety in Healthcare, the piece

is likely to be read by an audience of clinicians, healthcare improvement practitioners and researchers.

6.5 WHAT WERE THE NEXT CONVERSATIONS

The Editorial, keynote presentation and Element presented in this Chapter advocate for simulation as an intersecting field of practice within healthcare improvement. This can encompass a plurality of potential conceptualisations for simulation - a method, a technique and/or a research test bed – appropriate to the context in which it is employed. A deeper understanding of healthcare simulation practice in the healthcare improvement community is, however, required for simulation to achieve its full potential in this context; from descriptions of project exemplars towards building consensus on theory and principles to guide practice. Key questions remain unanswered: *When and how is simulation the right method to address a particular issue? Which design factors might influence success? How should effectiveness be measured? How should potential unintended consequences be mitigated?* The next chapter considers the emerging guidance for answering these questions, including two of my publications that contribute to this conversation.

CHAPTER 7: TRANSLATIONAL SIMULATION REVISITED

The final article in this exegesis provides a capstone contribution - ***Translational Simulation Revisited: An evolving conceptual model for the contribution of simulation to healthcare quality and safety*** (11).

> *"Reflect on current translational simulation practice and scholarship,.. and offer a further elaborated conceptual model based on its use to date*" (11)

In this chapter, I describe the rationale for the article and the discussion of *purpose, process* and *conceptual foundations* within the translational simulation conceptual framing. A revised conceptual model is offered in the article and reproduced here. Heavily influenced by my work on this exegesis, the revised model and article content are closely aligned with the exegesis structure and key messages. This conversation naturally segues into the final Discussion in Chapter 8.

7.1 WHY THIS ARTICLE AT THIS TIME?

In preparing this integrative exegesis of my work in translational simulation over the last seven years I have reflected on how my original conceptual framing has been applied and developed in practice. This critical reflection on my work and on the work of other scholars and practitioners has illustrated strengths and limitations of the original framing. This prompted me to revise that framing in the hope this might have benefits for health service leaders, healthcare simulation practitioners and scholars. Given the contributions of my supervision team to these reflections, I invited Gabriel Reedy to join me as a co-author to enrich the perspectives offered. In addition to being my supervisor, Professor Reedy is an experienced healthcare simulation scholar and Editor in Chief of *Advances in Simulation,* a healthcare simulation journal in which some of these academic conversations have been published.

In writing the article, a reflecting on the 'why' of a revised conceptual model is important, i.e., *How and who does it help?* For simulation practitioners, clearer framing may provide a

common language, help articulate program mission, vision and scope, and provide guidance for embedding simulation within health services(180). For health services, clearer framing may highlight the value of simulation to address organisation and system objectives. It might guide decisions about resource allocation and health service operational and governance structures to support simulation. For scholars in the healthcare simulation community, greater clarity addresses calls for "*explicitly integrat[ing] theory as a conceptual and framing device within our work to inform research design and analysis*" (75). Given the increasing use of healthcare simulation for improving healthcare quality and safety, a revised conceptual framing appeared to be a timely contribution.

7.2 WHAT IS THE ARTICLE'S MAIN CONTRIBUTION

Over the last seven years, translational simulation – as a conceptual framing for the contribution of healthcare simulation to healthcare quality and safety - has been applied in diverse contexts. As our departure point for the article, we reviewed literature citing my 2017 translational simulation article, and additional publications with similar scope and aims. Table 2, (*Table 1 in the article*) provides an overview of these publications. Supporting health services during the COVID-19 pandemic was a dominant example of translational simulation in practice, given the timing of this reflection from 2017-2023. Other examples included simulation for hospital relocation, testing clinical pathways and shaping culture and teamwork in healthcare settings. Other citing literature included conceptual discussions and review articles.

Table 2. Exploring translational simulation in practice - examples

From Table 1 in Brazil V, Reedy, G Translational Simulation Revisited: An evolving conceptual model for the contribution of simulation to healthcare quality and safety. Adv Simul 9(1):16 https://doi.org/10.1186/s41077-024-00291-6 (11) Reproduced under Creative Commons Attribution licence CC-BY-NC-ND 4.0

Application	**Examples**
Responding to COVID-19	• Modified guidelines and processes for cardiac arrest, airway management, maternity care, patient triage when healthcare resources overwhelmed. • Testing novel devices for 'COVID safe' procedures.

Testing Clinical processes	• Optimizing airway emergency cart design. • Reducing time to intervention for stroke and myocardial infarction patients. • Reducing time to transfer to the operating theatre. • Improved multidisciplinary response to paediatric anaphylaxis.
Designing physical infrastructure	• New building design • Human centred device/ equipment design
Building teams, shaping culture and relationships	• Major trauma care, operating theatre teams, maternity emergencies • Identifying 'latent social threats'. • Building rituals for team-based performance reflection.
Supporting healthcare improvement	• Exploring and shaping context of care • Research test bed

We found alternate terminologies and conceptual framings offered in the academic conversations about what I have termed 'translational simulation'. These terminologies include *in situ* simulation (ISS) (170), systems testing (112), systems integration (121), 'sim QI' and transformative simulation (210). These nomenclatures, and relevant publications, were discussed in Chapter 5 of this exegesis, in examining the implementation strategies and simulation methodologies used by translational simulation programs. Diverse terminologies are neither surprising nor necessarily problematic in emerging and evolving fields of practice. It was, however, a prompt for us to provide a helpful clarification for readers – "*in our use of the term translational simulation, we mean a conceptual framing, rather than a technique, taxonomy or label. We embrace and encourage ongoing work toward consistency in terminology, and view that as an important part of an evolving conceptual model."* (11)

We offered a synthesis of concepts identified in these publications: "A *clear identification of simulation purpose, an articulation of the simulation process, and an engagement with the conceptual foundations of translational simulation practice*" (11). In identifying these concepts, we were sensitised by the evolving structure and content of this exegesis. In turn, the critical review of this literature has informed the presentation and explication of articles presented in this exegesis. We crystallised our reflections on these concepts in a graphical

representation of a revised conceptual framing with three core elements: purpose, process and conceptual foundations. (Figure 14, *Figure 1 in the article*). Our description of that revised conceptual model is reproduced here:

> "***Purpose*** *remains central to translational simulation: exploring and improving healthcare environments, systems and teams. Translational simulation* ***process*** *is illustrated in two layers - broad frameworks, subsequently expanded to more specific tools and methods. This offers a level of practical detail to guide practitioners toward effective translational simulation design and implementation, while not being limited to a contextually bound 'prescription'. Expanded theoretical and* ***conceptual foundations*** *on which the conceptual model draws are included: safety science, system engineering, complex adaptive systems, team science, experiential learning and implementation science. Education - individual, team and organisational learning - is embraced as an important element of our comprehensive framing for simulation contributing to healthcare improvement."(11)*

7.3 WHAT WERE THE NEXT CONVERSATIONS

We concluded the article with an important statement – "*Like all conceptual and theoretical models, translational simulation remains an incomplete framing for how simulation contributes to healthcare quality and safety*."(11). I expect that there will be two main influences on the ongoing development of the conceptual model. The first is practical. As the simulation community and health services explore optimal ways to apply simulation toward quality and safety goals, the issues of *purpose* and *process* will continue to be tested and refined. The second is more theoretical. Most of the published literature on the conceptual intersections we described in the article emanate from the simulation community. As (we hope) the intersections are explored and developed, stronger theoretical lenses from quality improvement, safety science and other fields will more profoundly influence the perspectives of those continuing to build the conceptual framing of translational simulation.

The impact of the article has already been significant. Since publication, I have presented the content in a keynote presentation at the Society for Simulation in Europe (SESAM) meeting in June 2024. The publication has been selected for presentation in August at the Association of Medical Educators in Europe (AMEE) in Basel, Switzerland, as one of four publications recognised as top contributions in healthcare simulation over the last 2 years. In July 2024, I presented this work at the ASPiH (Association for Simulated Practice in Healthcare) Journal Club (online/ UK), and at the Scottish Simulation and Patient Safety Summit (Edinburgh/ online).

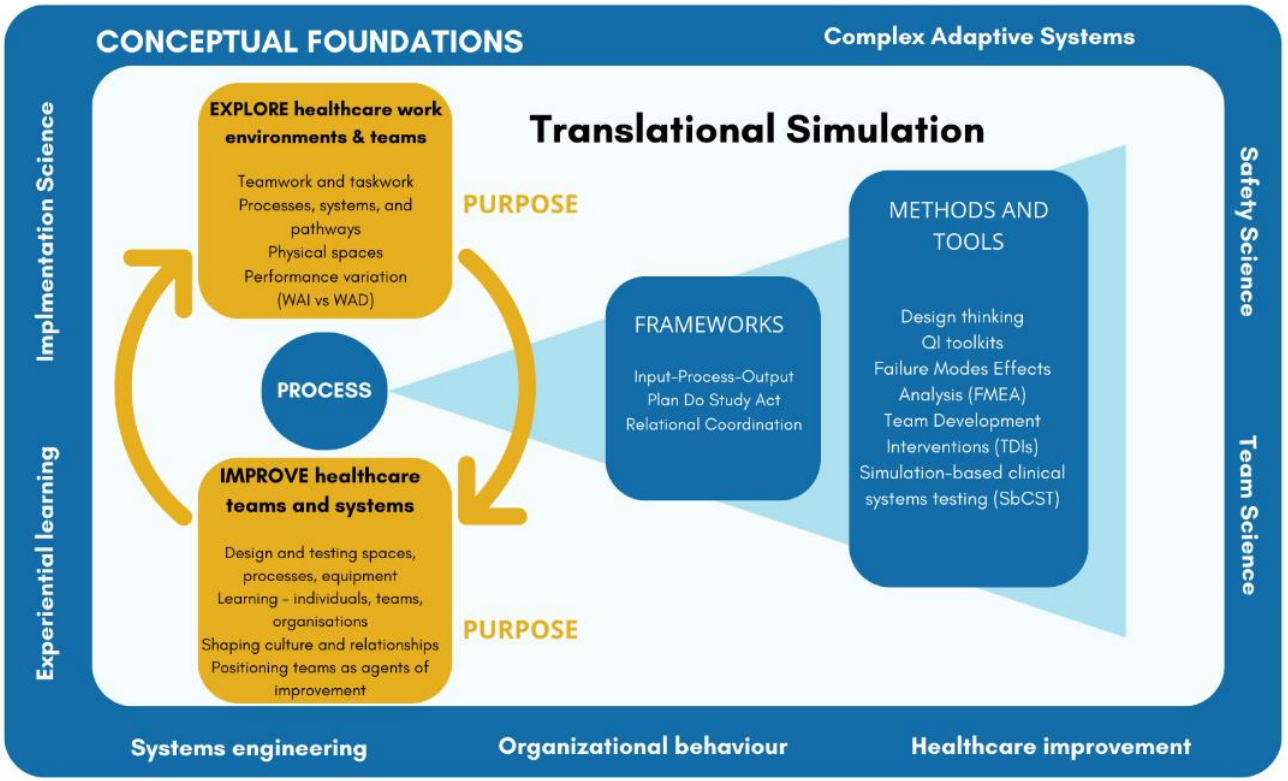

Figure 14. Translational Simulation revisited. From Brazil V, Reedy, G Translational Simulation Revisited: An evolving conceptual model for the contribution of simulation to healthcare quality and safety. Advances in Simulation From Brazil, V., Reedy, G. Translational simulation revisited: an evolving conceptual model for the contribution of simulation to healthcare quality and safety. *Adv Simul* **9**, 16 (2024). (11) https://doi.org/10.1186/s41077-024-00291-6 Reproduced under Creative Commons licence CC BY 4.0

CHAPTER 8: DISCUSSION

In describing and exploring translational simulation through the prior works described in this exegesis, I have offered a clearer conceptual framing for how healthcare simulation may contribute to improving healthcare quality and safety. This exegesis has provided the context in which this new framing arose (Chapter 2), my original description of translational simulation (Chapter 3) and practical examples of applying simulation for translational purpose (Chapter 4). I have then explored the challenges of process, i.e., program implementation and matching methods and tools to translational simulation objectives (Chapter 5). I have discussed the conceptual intersections of theory and practice in healthcare simulation and healthcare improvement (Chapters 6). The penultimate chapter offered capstone reflections and a revised conceptual model for translational simulation (Chapter 7).

This final Discussion Chapter has two parts. First, to revisit the professional identities, research orientation and reflexivity described in Chapter 1, I offer a broad reflection on the scholarly work explored in this exegesis and on my progress as a scholar. The second part is forward looking in which I explore two ongoing academic conversations that are important for practitioners and scholars seeking to use simulation to support healthcare quality and safety outcomes.

8.1 MY SCHOLARSHIP JOURNEY

Research paradigms and perspectives are inevitably shaped by professional roles and identities. The 11 prior works presented in this exegesis are scholarly outputs that reflect my various roles and perspectives as operational leader of a hospital-based simulation program, a clinician and an academic. They are pragmatic in outlook and reflect a desire to support practitioners seeking to improve healthcare quality and safety using simulation. Within this paradigm, the methods used within the works are diverse. They draw upon qualitative, quantitative and action research methodologies, as appropriate for the context, research question and/or objectives. This diversity reflects a research journey that is broad in scope and closely connected with operational realities of my simulation practice. Conceptual

frameworks such as Relational Coordination (146) have oriented elements of my work, especially that which relates to team-based translational simulation activities. Frameworks from quality improvement, such as ‘Plan-Do-Study-Act’ (102) and the Input-Process-Output model (5), have increasingly influenced my perspectives. Concepts from implementation science (211) have reinforced principles developed intuitively in my simulation practice, e.g., as a ‘complex intervention’, translational simulation should be a strategy, not an event. Sifting through the connections between these theoretical and conceptual models has supported more disciplined approach to my operational practice and facilitated research collaboration with practitioners in other fields.

Academic collaboration has been important in my research journey. Collaboration with co-authors of my published works has extended my methodological expertise and broadened my exposure to diverse contexts in which simulation may contribute to improving quality and safety in healthcare. These co-authors have included clinicians, academics from other disciplines, collaborators from various institutions and practitioners engaged in translational simulation practice. My supervisors for the writing of this exegesis have prompted further reflection on theory and practice in healthcare simulation and shaped my future scholarly directions.

These collaborations illuminate an additional element of my research journey, that of research team leadership. Successful research practice in 2023 requires more than an understanding of research paradigms, methodologies and tools. It requires skills in leadership and influence. For many of the published works in this exegesis, I have led groups collaborating on translational simulation delivery, stakeholder engagement, funding, ethical review applications, data collection and analysis and manuscript preparation. The establishment of the Translational Simulation Collaborative as a research centre at Bond University has required those skills and others in navigating complex organisational structures and processes. As a nascent conceptual model and field of practice, translational simulation will only evolve through these collaborative efforts across disciplines and institutions.

8.2 THE NEXT CONVERSATIONS?

What are the priorities if we are to realise the promise of translational simulation for improving healthcare quality and safety? My perspective on this question has been sharpened by documenting my professional journey in this exegesis. The rest of this discussion will focus on three academic conversations relevant to future practice and scholarship in translational simulation. In each subsection, I offer a critical appraisal of my contribution to the conversation and situate that within the broader discourse.

8.2.1 THE CONCEPTUAL FRAMING FOR HOW HEALTHCARE SIMULATION CONTRIBUTES TO IMPROVING HEALTHCARE QUALITY AND SAFETY REMAINS INCOMPLETE.

My original article on translational simulation (1) advocated a refocus on the *purpose* of simulation activities, against the tide of nomenclature relating to process, location and technique. But this discussion had limitations. First, under explored in my article were the theoretical underpinnings of simulation practice, and those of intersecting fields of practice, including quality improvement, complex adaptive systems, communities of practice, systems modelling, experiential learning, and organisational learning. Figure 4 from my article (p 25 of this exegesis) offered a model for what to *do* in translational simulation - diagnose, test, and improve processes and systems – but the article was less helpful for understanding the theoretical basis for this work. Subsequent publications - mine and others (170, 178, 197, 212) - have extended the conversation, but the bias toward action and technique within the healthcare simulation community is powerful. This bias has meant that theoretical perspectives are not always thoughtfully integrated into research or practice (75).

Second, an unintended consequence of my work may be creation of a false dichotomy between ‘educational sim’ and ‘translational sim’. Anecdotally (and ironically), the unhelpful debate about the superiority of the place of simulation (*in situ* or sim lab) has been replicated in unhelpful speculation about whether to label simulation activities as educational or translational. While I understand that such labelling may be necessary in some contexts (e.g., monthly reporting of activity for a simulation program), its runs counter to the more nuanced conceptual framing that I believe is required. Healthcare simulation focused on *educational* outcomes remains a dominant application within simulation practice. This is a significant contributor to quality and safety outcomes, albeit via the mechanism of improving

individual and team knowledge and skills and is an important element within any conceptual model for translational simulation.

Revisiting the conceptual framing for translational simulation (11), as described in Chapter 7, offered a chance to address some of these gaps and to strengthen elements that have been found to be robust over seven years of applying translational simulation to practice.

8.2.2 The implementation - recognition, adoption and integration - of translational simulation within healthcare improvement is still at a nascent stage.

Widespread adoption of translational (or 'systems-focused' or 'QI focused' or 'systems-integrated) simulation practices within healthcare institutions remains elusive. Using an implementation science lens (213), this would prompt reflection on whether this was an ***intervention failure****, i.e.,* translational simulation does not 'work', or an ***implementation failure****, i.e.,* we have failed to identify and address enablers and barriers to embedding translational simulation within healthcare institutions. It may be both. This conversation was started in Chapter 5, in the discussion of translational simulation process: implementation, design and delivery.

The integration of simulation into healthcare improvement practice is complex and contextual. If translational simulation is viewed as a *complex intervention*, as suggested in my original article (1, 41), then linear approaches to design and to evaluating success may not be enough. Prompted by more recent reading and discussion with the supervisors for this exegesis, I have reflected on the practice of translational simulation through an implementation science (IS) (214) lens. Implementation science is "*study of methods to promote the systematic uptake of evidence-based clinical treatments and practices and organisational and management interventions into routine practice."* (211). McGaghie connected the concept of implementation science to simulation based medical education (SBME) in researching SBME effectiveness (123). The IS lens considers the enablers and barriers - contexts, behaviours, and practices - that affect the uptake of translational simulation into routine use. 'Implementation outcomes' such as acceptability, adoption, appropriateness, feasibility, fidelity, cost and sustainability (213) are critically important for simulation programs within health services (180, 181), in conjunction with measurable clinical outcomes. Attention to these implementation outcomes may be what distinguishes

successful translational simulation programs, rather than the specific frameworks and methods used in their process.

This highlights two parallel issues for further work. First, as an *intervention*, *albeit* a complex service intervention, translational simulation programs need more consistent methods, techniques and terminology if they are to optimally address healthcare challenges, and if they are to be evaluated effectively. Practitioners need guidance for effective design, delivery and data collection. That guidance should be adaptable to specific context, but consistent in foundational principles. Our article, *Translational Simulation: from description to action,* (166) was a step in this direction as is my ongoing work leading the Bond University Translational Simulation Collaborative (195), fostering a community of practice in this area.

Second, successful *implementation* of translational simulation requires greater understanding of those factors that enable or inhibit adoption, acceptability, sustainability, return on investment and other implementation outcomes (213). This challenge typifies a broader discourse on the evaluation of healthcare simulation activities (215), including calls for a shift from purely educationally focused evaluation (e.g. Kirkpatrick's model (216)) toward multi-faceted approaches such as outcome logic models (217). Conducted through an implementation science lens, thoughtful exploration of successes and failures in translational simulation programs could lead to better guidance for practitioners and scholars. Findings from this work could guide those seeking to position translational simulation programs (operationally) within their institutions (180), and for those seeking to position translational simulation as a practice in the conceptual models for healthcare improvement.

8.2.3 TRANSLATIONAL SIMULATION MAY POSITIVELY INFLUENCE HEALTHCARE QUALITY IMPROVEMENT AND PATIENT SAFETY PRACTICE WITHIN HEALTHCARE INSTITUTIONS

Simulation practitioners are frequently frustrated with outdated approaches to quality and safety that operate in healthcare institutions. Many health services remain solely focused on Systems I thinking in patient safety, *i.e.* trying to avoid all errors through analysis of adverse events, and demanding practitioners' compliance with ever increasing numbers of policies and procedures. Likewise, as discussed in Chapter 2, quality improvement initiatives have only rarely improved quality in healthcare (204). 'QI' interventions are commonly rolled out without regard to existing barriers or enablers of performance, and often lack sustainability

or scalability (204). What if, instead, the practices that underpin translational simulation were to positively influence the mindsets of quality and safety practitioners in health services? What if translational simulation activities did more than simply reflect existing quality and safety paradigms and practices, but rather, proactively shaped them. What if translational simulation led the way toward embracing complexity, Safety II approaches, and enabling teams to co-create improvement at the frontline of care. Such influence may be aspirational, but could be the most significant impact of translational simulation on the quality of healthcare.

How can translational simulation practitioners achieve this aspiration? I suggest this is already happening, albeit at a nascent stage. Our simulation design and delivery choices send powerful signals that can positively influence our healthcare institutions and the people in them (61, 144, 218). For example, choosing to use simulation to test and refine checklists signals our commitment to supporting healthcare professionals to do their work better, and their involvement in that process. Choosing to engage interdisciplinary teams with clinical, porterage and admin staff in our simulations signals our understanding of the complexity and interdependence of healthcare teamwork. Choosing to conduct simulation debriefing conversations that promote psychological safety sends powerful signals about our support for teams to take interpersonal risks in the service of organisational learning (218). Choosing to collaborate with experts in organisational behaviour, safety science and team science illustrates how productive those collaborations could be if extended further into healthcare institutions. These choices represent a weighty responsibility but also a magnificent opportunity.

8.3 Concluding remarks

In defining, exploring and applying translational simulation, I have offered a conceptual reframing of the potential contribution of healthcare simulation to healthcare quality and safety. This integrative exegesis of my published works on translational simulation from 2017-2023 explores that conceptual reframing, including a description of the context in which these works were produced, a reflection on my contribution to the academic conversations and a proposed path for future research and practice,

"*[translational simulation] terminology, with an attendant clarity of focus, offers an exponential impact for healthcare simulation to be used effectively as part of comprehensive health service improvement strategies*."(1)

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