The Importance of Organizational Readiness for Change for Implementing Clinical Practice Standards in Indonesian Obstetric Facilities

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

The Faculty of Graduate and Postdoctoral Studies

(Population and Public Health)

The University of British Columbia
(Vancouver)

December 2021

The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, the dissertation entitled:

The Importance of Organizational Readiness for Change for Implementing Clinical Practice Standards in Indonesian Obstetric Facilities

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Abstract

Background

Quality improvement initiatives require collective and coordinated actions from multiple members of a health care organization. Preparing health workers prior to implementation by assessing their organizational readiness for change (ORC) may be effective for ensuring greater implementation success. Although common in other fields, measuring readiness in health organizations is less common, especially in lower- and middle-income countries (LMIC). This study aims to assess ORC in multiple Indonesian hospitals prior to implementation of a maternal and newborn quality improvement program.

Methods

The Organizational Readiness for Change Assessment (ORCA) measurement tool based on the Promoting Action on Research in Health Services (PARIHS) was adapted to the Indonesian context, then internal reliability and factor structure of the primary scales was examined: *evidence, context, and facilitation*. The Indonesian version of the instrument was administered to respondents in hospitals prior to engagement in program implementation (*n*=36). Then linear regression analyses were conducted to examine associations between hospital level ORC scores and multiple outcomes of program implementation success, including performance of maternal and newborn clinical standards and provision of related services while adjusting for education level, clinical experience, and leadership experience.

Results

Cronbach α for the three scales was 0.72, 0.94, 0.97, respectively; confirmatory factor analysis showed good fit for models including items on each of the three scales. The ORCA context scale was positively associated with performance of two maternal clinical standards. A higher ORCA context score was associated with greater implementation of active management of the third stage of labor after one and two implementation quarters (β = 27.35, 95%CI 1.27, 53.44; β = 27.71, 95%CI 3.29, 41.59). A higher ORCA context score was also associated with greater implementation of management of severe pre-eclampsia/eclampsia after two and three implementation quarters (β= 37.46, 95%CI 13.52, 61.41; β=33.31, 95%CI 8.68, 57.94).

Conclusion

This study confirmed the reliability and validity of the ORCA instrument in a middle-income country and added evidence for the utility of assessing ORC prior to quality improvement initiatives in healthcare environments. Health care organizations in LMICs may improve the likelihood of success by addressing ORC prior to program implementation.

Lay Summary

Many known evidence-based practices do not reach patients in Low- and Middle-Income Countries (LMIC) because health care organizations fail to make practice changes. In this dissertation, I ask whether *Organizational Readiness for Change* (ORC) among Indonesian maternity care workers determines a successful practice change. In order to study ORC among Indonesian health staff, I adapted a survey to the local context and measured factors of ORC among staff in hospitals. All of the staff respondents in my study received a peer-to-peer mentoring intervention for implementing clinical standards as part of the Expanding Maternal and Neonatal Survival program following measurement of ORC. My findings suggest that the Indonesian ORC survey is reliably understood by maternity care workers. A comparison of ORC scores among survey respondents with successful implementation of clinical standards in participating hospitals revealed a positive association between elements of ORC and improved clinical standard performance.

Preface

This dissertation is an original intellectual product of the author, Christian Laugen. The fieldwork reported in chapter 3-5 was covered by UBC Behavioral Research Ethics Board Certificate number H14-02951, and by approval from the Universitas Padjadjaran Health Research Ethics Committee in Bandung, West Java, Indonesia (No. Reg. 0615070660).

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List of Abbreviations

BEmONC	Basic Emergency Obstetric and Newborn Care
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
EBA	Evidence Based Assessment
EBP	Evidence-based Practice
EMAS	Expanding Maternal and Neonatal Survival
HIC	High Income Country
JHPIEGO	Johns Hopkins Program for International Education in Gynecology and Obstetrics, an affiliate of Johns Hopkins University
LMIC	Low and Middle-Income Countries
$MgSO_4$	Magnesium Sulfate
MOH	Ministry of Health
ORC	Organizational Readiness for Change
ORCA	Organizational Readiness for Change Assessment
PARIHS	Promoting Action on Research Implementation in Health Services
PE/E	Pre-eclampsia / Eclampsia
QIC	Quality Improvement Coordinator
RDQA	Routine Data Quality Assessment
RMSEA	Root Mean Square of Approximation
SRMR	Standard Root Mean Square Residual

Acknowledgments

The completion of this dissertation would not have been possible without the support and mentorship of numerous individuals. First, I would like to express my sincere gratitude to my advisor Patti Janssen who patiently served as a guide and mentor over years of work across continents and life events. Your endless commitment to my learning and writing has motivated me to reach many milestones, especially this one. To my committee members Charles Larson and Charlyn Black who also stuck with me during this unusually long journey and saw me to the finish line. Your feedback and contributions to this work is sincerely appreciated. I would like to thank the members of my PhD examination committee, Peter Berman, Maura MacPhee, and Roxana Geoffrion, whose contribution strengthened this dissertation. I am also grateful to my external examiner Christian Helfrich whose area expertise identified valuable additions to my dissertation. Additional faculty members that positively influenced my learning and contributed to this work both directly and indirectly include Louise Masse, Mike Marin, Mieke Koehoorn, K.S. Joseph, Jennifer Hutcheon, Gillian Hanley, and Sarka Lisonkova.

To complete the field work portion of this research in Indonesia a number of people opened doors, created connections, and generally supported this work with sincere altruism. I am grateful for the friendship and mentorship from Ibu Meiwita Budiharsana, Peter Heywood, and Ibu Nita Nasution. The sponsorship and support from the Public Health Department at *Universitas Padjadjaran* was possible because of Ibu Elsa Pudji Setiawati who helped me to navigate the research environment across three Javanese provinces. To the friends and fellow students I met in Bandung including Panji Fortuna Hadisoemarto, Sri Yusnita Irda Sari, and Lukman Hilfi – *terima kasih atas segala bantuan.*

To the devoted people I met from the EMAS program who graciously helped create this research opportunity including Anne Hyre, Maya Tholandi, Ali Zazri, and Ibu Dwirani Amelia. I am thankful for all of the feedback and help from Pak Agus Rahmanto and others at the *Budi Kemuliaan* Maternal Hospital. In the field I was aided by countless individuals from the EMAS offices in West Java, Central Java, and East Java who graciously volunteered their time and support to offer feedback, coordinate logistics, and make sure I arrived safely, including Pak Djoko Soetikno, Pak Dedy Sutangsa, Ibu Delia Shanty, Pak Didiek Hadiprabowo, Ibu Zaima Ima, Ibu Devi Malahayati, Ibu Lita Mayasari, Ibu Dwi Puspaningsih, Pak Ping Nugrawira, Pak Hartanto Hardjono, Pak Ady Sarwanto, Ibu Lies Agustin, Pak Eko Hariawan. I am also indebted to all of the individual health care workers – midwives, nurses, physicians, and others – at the 37 different hospitals across *Java* who voluntarily completed my research questionnaire and to the hospital leadership who facilitated my visits and research.

To the fellow students that I met and persevered with along this journey at UBC, I know this would not have been possible without the camaraderie that we shared, the insight that you provided, and the perseverance that you instilled in me - Joseph Puyat, Stephen Pan, Gareth Mercer, Putu Duff, Angeli Rawat, Celeste Bickford, Sarah Munro, Rachel Mckay, Beth Hensler, Amy Slogrove, Amy Schneeberg, Alden Blair, Kate Jongbloed, and Giulia Muraca-Muir.

Finally, I have no words to describe the endless and unconditional support that I received from my family – on both sides of the Pacific Ocean. To my father and mother who provided assistance to

me and my own emerging family along the way to make this all possible, to my sister and Mike who mentored me through this period, and to my brother and Zoe who blazed this trail before me and passed on advice and encouragement. I was blessed with my two sons, Aditya and Hanif, who enriched my life through this period. To my faithful wife, Rina, who persevered by my side and endured countless trials until we completed this achievement together. To all your family in Indonesia – especially Datuk and Nyai – who believed in me even when my own wavered. I thank God for the all the people who helped make this possible and for my success.

Chapter 1: Introduction

1.1 Translating Evidence into Practice

The translation of research findings into practice is an essential part of improving the quality of health care services. It is imperative that decisions on patient care and services provided by health care workers are based on evidence to ensure the greatest likelihood of positive health outcomes. Encouraging health workers to implement new practices or changes in practice when new evidence is established from health research, however, is a challenging endeavor. There are both individual and organizational factors that make translating new evidence-based research into corresponding clinical practice a complex process. From an organizational management perspective, these factors combine to make implementing new changes in health care organizations unique compared to organizations from other industries or fields.

Reviews of the most common implementation strategies now recognize that successful implementation of changes to clinical practice are influenced not only by individuals, but also by organizational factors (1). For example, organizational culture, leadership, the capacity to supervise, and structures to monitor performance make up important factors in the health care setting where implementation takes place. Health care organizations with cultures that value organizational learning, patient feedback, as well as decentralized decision-making are more receptive to practice change (2). Likewise, when leadership is transformational rather than "command and control", and performance evaluations involve routine measurement with feedback, the likelihood of successful implementation is higher (3).

Health care organizations are notoriously difficult environments for implementing new practices. Implementation failure, defined as using a practice innovation less frequently, less consistently, or less assiduously to realize potential benefits, is particularly prevalent in health care organizations compared to other industries (4). This is in part explained by health care organizations being made up of several individuals that need to collaborate with one another to provide comprehensive patient care. Each one contributes specialized training and expertise, but there are factors associated with individual health care workers that make the environment unique for implementation as well. For example, medical staff aim to provide patients with the best possible care, but also to avoid any unnecessary risks. Medical staff by nature of their training aim to avoid doing any harm to patients. Implementing new practices, however, may challenge existing behaviors and demand health care workers to follow guidelines that are unfamiliar to them and this is associated with a possibility of failure (4).

From the management perspective, managers in health care environments do not always carry the same authority to enforce new clinical practice as their equivalents in other fields (4). Health professionals frequently report to others in the same specialty. Compared to workers in other industries, they also wield more discretion regarding a novel practice due to their clinical discretion, that is, their own decision making based on their medical knowledge and accumulated experience. While managers may need to ensure that guidelines were followed among their staff, managers may not possess the same expertise or credentials. Different credentials can also create hierarchies that become barriers to healthy collaboration for implementing practice guidelines. When hierarchies prevent staff from questioning the views of others or discourage providing feedback with the goal of problem solving and improving care, these informal

structures challenge the learning environment that contributes to successful implementation of new practices and guidelines. These lessons related to the individual attributes of organizational management in health care suggest that solutions to the challenges for implementing new clinical practices will be found by addressing the organizational aspects of health facilities where care is delivered (4,5).

In response to these challenges, one of the goals of implementation research is to examine approaches that "promote the systematic uptake of research findings and other evidence-based practices into routine practice, and hence, to improve the quality and effectiveness of health services." (6) There is an abundance of reviewed strategies to help members of health care organizations implement new practices (7); but a disproportionate number of studies are conducted in high-income countries (HIC), in settings that are considered resource-rich (8). There is also some discord in the conclusions of studies conducted in high-income countries compared to those of lower-income countries. For example, there is evidence that combining more than one strategy (i.e. clinical training plus supervision) is more effective for improving health worker performance in some lower-resource settings (9). Strategies and interventions that are successful in HICs may not be feasible or appropriate in LMICs due to limited funding or local factors that affect implementation (10).

The healthcare settings of lower and middle-income countries (LMIC) are in equal if not greater need of initiatives to implement evidence-based practices as compared to high-income countries. In maternal and child health, evidence exists for care strategies to prevent much of the mortality that continues in lower and middle-income countries. This amenable mortality, that is the mortality that could be avoided with the successful delivery of existing knowledge and

technology, is unsurprisingly highest in country settings with lower incomes and fewer resources (11). The corresponding pattern of unequal distribution of health services was first described as the inverse care law that states the "availability of good medical care tends to vary inversely with the need for it in the population served"(12) . Conducting implementation research in LMICs and low-resource settings is an important strategy to facilitate translation of evidence into clinical practice in these settings and close this gap in quality care.

This thesis examines organizational readiness for change among maternity care workers in a middle-income country to learn whether high versus low readiness affects successful implementation of a maternal and newborn health quality improvement program. This research addresses a gap in implementation research in LMICs, more specifically in Indonesia where organizational readiness in health facilities has not been studied. Therefore, the outcomes of the research contribute evidence toward strategies for implementing new evidence-based practice into health care organizations.

1.2 Organizational Readiness for Change

The incorporation of new evidence-based practice changes into a healthcare environment is challenging for several reasons discussed above. One primary challenge is that a new evidence-based practice (EBP) requires organization members to change their behavior or adopt new practices into existing ones. Lewin (1951) described this initial step in an organization as "unfreezing" because members must demonstrate flexibility and a willingness to change from previously accepted behaviors and practices (13). The individual recognition that change is needed and the motivation among organization members to accept and implement steps involved in practice change are reflected in a concept known as readiness for change (14). The

collective readiness for change among individuals in the same organization contributes to an organizational level readiness for change. Organizational Readiness for Change (ORC) is described as a construct that is multi-level, encompassing both individuals and an organization; and it is multi-faceted, describing both the motivation for change among organizational members as well as the collective capability to implement the change (15,16).

A 2010 survey of more than 2,500 executives from around the world reported that organizations that assess their change readiness prior to implementing the change are 2.4 times more likely to succeed in a change effort compared to those that neglect this step (17). While the above survey collected responses from organizations outside of health care, assessments of organizational readiness in health care organizations have the potential to inform implementation processes to address barriers to implementing new practices (18–24). Health services researchers, however, have only recently begun theorizing about and developing measures for organizational readiness for change (15). Further, in LMICs, organizational readiness is even less commonly measured, and use of theoretical constructs and measurement tools is largely absent (15,25).

The use of empirical measurements of organizational readiness for change is increasing. To date, organizational readiness for change has been investigated as a pre-implementation measure for interventions introduced in the areas of chronic disease management, primary care, and drug abuse treatment (22–24,26). Notably absent from this literature are studies that investigate the level of organizational readiness for change in LMICs in relation to maternal and newborn health quality of care improvement (15,25).

1.3 The Indonesian Health Care Context

Indonesia stretches across an archipelago divided administratively into 33 provinces. The current population is more than 237 million, making it the fourth most populous country in the world (27). Due to the island geography of the country, Indonesia has an average population density of more than 124 persons per square kilometer.

Following decentralization of the government in 2001, district government bodies became responsible for management of health services. The central government and Ministry of Health (MOH), however, retained power over key decisions and policies such as setting local agendas for planning, setting minimum standards in clinical care, and to a large degree, management of government health workers (28,29). Primary health centers (Puskesmas) cover approximately 30,000 people per facility and deliver primary care including maternal and child health services. Primary health centers are supplied and financed by local district governments, though the central government continues to influence staffing decisions. These health centers are staffed by at least one physician, 3-4 midwives, 5-6 nurses, and support personnel; however these numbers can vary depending on the geographic location with some centers lacking a physician. As of 2012, the number of primary health centers across the country rose to more than 9,500 centers with approximately 33% providing inpatient services.

Basic Emergency Obstetric and Neonatal Care (BEONC) is offered at more than 2,500 centers and 76% of these offer inpatient services. These services include providing parenteral oxytocin, antibiotics and sedatives, conducting curettage for incomplete abortion, performing manual removal of the placenta, and assisting a vaginal delivery with vacuum/forceps extraction. According to an analysis of the readiness of public health facilities to provide maternal health

services in Indonesia, the supply of essential uterotonic drugs and diagnostic tests for pre-eclampsia/eclampsia vary across provinces and with urban and rural locations. (WB 2014).

The Primary Health Centers are referral points for district and provincial level hospitals. These include general and specialty care facilities as well as private hospital facilities. Currently the number of public hospitals in Indonesia is greater than 1,500 with approximately 300 special care facilities. The number of private hospitals has surpassed 540 with an estimated 175 special care facilities (27). Comprehensive Emergency Obstetric and Neonatal Care (CEONC) is offered at approximately 410 general hospitals, slightly less than the government's target of 444 for 2012. Comprehensive level care includes all the basic services with the addition of cesarean delivery and blood transfusions.

The private health sector in Indonesia already provided one-half of all health services in 2010 and this number has likely grown (30). The dual practice of health professions in both public and private capacities is believed to contribute to many of Indonesia's health improvements. A significant proportion of all maternal and neonatal health service provision also comes from the private sector (31). This is especially true for the island of Java, where utilization of maternal health services is higher than other provinces. Among women who delivered in the five years preceding the 2017 Indonesian Demographic and Health Survey from the provinces on the Java Island, a quarter delivered in general and maternal hospitals in West Java (26.2%), and more than a third of women delivered in these facilities in Central Java (36.6%), and East Java (35.5%) (32). In all three provinces, however, among women who delivered in hospitals, more women delivered in private facilities than in public facilities.

Indonesia has recently achieved middle-income status as a result of substantial economic growth over the past 25 years, yet important indicators of the country's maternal and newborn health do not align with these improvements. In contrast with all of its Southeast Asian neighbors, Indonesia's maternal and neonatal mortality remain alarmingly high with estimates of 359 maternal deaths per 100,000 live births for 2012 (33) and 305 in 2017 (34). Estimates for neonatal deaths were 15 per 1000 live births in 2017 (34). These outcomes are in spite of the fact that Indonesian mothers are increasingly accessing trained health workers and facilities during pregnancy and childbirth. As of 2012, 87.8% of pregnant women attended four antenatal visits prior to delivery, nearly two-thirds of mothers in Indonesia delivered in a health facility (63.5%), and more than three-fourths of women delivered with a medically trained health worker (83.7%) (33). This increase in the use of maternal health services allows examination of the quality of the care that mothers and infants receive in facilities, particularly in emergency situations. Ensuring that evidence-based practices, particularly clinical standards, are implemented effectively by maternity care workers in LMICs like Indonesia is an accepted strategy for improving maternal and newborn health outcomes (35,36). As the number of schools and new graduates increased since decentralization, concerns over training for health care professionals, especially midwifery and nursing have been raised in Indonesia; recommendations were made to establish competency and education standards as well as a regulatory body for nurses and midwives (28).

1.4 Expanding Maternal and Neonatal Survival

Between 2011-17, the Expanding Maternal and Neonatal Survival (EMAS) program was implemented in Indonesia to address quality improvement of emergency obstetric and neonatal

services in health facilities across six provinces. Four challenges were identified in hospitals and referral centers that were the focus of the program: high case-fatality rates in emergency facilities, unclear referral procedures, lack of accountability for maternal and newborn deaths, and poor data collection and management (37). The EMAS program was implemented by Jhpiego, an affiliate organization with Johns Hopkins that specializes in improving health services for women and families, in partnership with Budi Kemuliaan Maternal and Child Hospital (LKBK – the oldest and largest private maternity hospital in Indonesia). The LKBK organization, recognized as a local center of excellent care, served as an example for facilities by demonstrating high standards of clinical governance and service provision. A high standard of clinical governance as required by the EMAS program was defined as having "concepts of shared accountability for sustaining and improving service quality and using data for decision-making" (37). The program implemented several interventions under two objectives: improve the quality of emergency obstetric and neonatal services through high-impact, life-saving interventions; and increase the efficiency and effectiveness of referral systems (37).

During the six-year program period, there were 314,649 deliveries in 101 program-assisted facilities. The overall case fatality rate (CFR) from any maternal complications showed a significant reduction by 50% on average across the three phases of the program (IRR 0.50; 95% confidence interval [CI], 0.42–0.61) (38). The CFR decreased on average from 5.4 at the start of program monitoring to 2.6 at program end, while controlling for differences in province, type of hospitals (private and public), and the EMAS program phases (38). A significant reduction (21%) was also observed in the very early neonatal mortality rate from 4.8 to 3.3 (IRR 0.79; 95% CI, 0.65–0.96) during the EMAS program period (38).

EMAS quality improvement interventions targeted self-monitoring and accountability among participating health workers through peer-to-peer mentoring, routine data collection, data-informed decision making, and assessments of facility readiness against optimal performance standards. A comparison of before and after differences in direct clinical observations scores of EMAS facilities with non-intervention facilities showed improvements in three clinical areas. Selected methods of labor monitoring, newborn resuscitation readiness (equipment for resuscitation is prepared), and infection prevention practices all showed greater improvement over the study period than non-intervention facilities (39).

The research investigates the utility of assessing Organizational Readiness for Change among maternity care workers in hospitals prior to their implementation of clinical practice standards through EMAS program activities. Figure 1.1 provides a general outline of the research components including data sources, data collection steps, and connections with the EMAS Program. The timing of this study coincides with the EMAS program to allow for a comparison of levels of ORC among maternity care workers who are implementing similar practice standards in multiple hospitals. Knowledge of the EMAS Program was a product of prior maternal health work-experience in Indonesia and a continued interest in factors that impact maternal health in the country. Initial discussions between the doctoral candidate and EMAS representatives from the monitoring and evaluation division led to development of the research opportunity related to organizational context of the health facilities participating in the program. The research objective evolved to address the association between ORC measured prior to program implementation and the successful implementation of program objectives – in this context the successful implementation of clinical practice standards in hospitals participating in the EMAS program.

1.5 Research Objectives

This dissertation research was designed to address a gap in the current understanding of organizational readiness for change in health care settings in LMICs. The research was conducted in Indonesia to take advantage of an ongoing implementation change – the EMAS Program – that was administered in multiple hospitals within a short period of time. The specific research objectives are described below along with the corresponding chapters where they are discussed in greater detail.

Research Objective 1 *Evaluate the Organizational Readiness for Change Assessment (ORCA) in an Indonesian health care context.* (Chapter 3)

In reviewing literature related to implementation research, I encountered few studies that attempt to measure ORC, or aspects of ORC, in LMIC settings (40–42); ORC measurement tools have largely been tested and used among health care settings in High-income countries. The first research objective addresses this gap in ORC measurement tools that have been tested with a sample in an LMIC setting.

Research Objective 2 *Investigate the association between Organizational Readiness for Change measured among Indonesian maternity care workers prior to EMAS program implementation and the successful implementation of maternal clinical practice standards in hospitals participating in the EMAS program.* (Chapter 4)

Research Objective 3 *Investigate the association between Organizational Readiness for Change measured among maternity care workers prior to EMAS program implementation and the successful implementation of neonatal clinical practice standards.* (Chapter 5)

The second and third research objectives evaluate the association between ORC measured among health care workers prior to an organizational change and implementation success. Similar to the research on the development of ORC measurement instruments, a majority of studies that explore determinants of ORC and the potential impacts on health care organizations are also conducted in high income countries (19,43–45).

1.6 Dissertation Outline

Chapter 1 provides a general introduction to the concept of organizational readiness for change, the background of this dissertation research and the research setting. A description of the research objectives and an outline of the dissertation is included.

Chapter 2 provides a brief review of organizational readiness to change literature, frameworks, and instruments. Here I describe the current ORC research that has been conducted in LMICs and within the field of maternal and child health. This is followed by a discussion on the choice of the Organizational Readiness to Change Assessment (ORCA) tool to align with the EMAS program interventions.

Chapter 3 follows with a report on the translation and adaptation of the ORCA tool to the Indonesian context. The psychometric analysis and corresponding evidence that result from testing the tool with Indonesian health care workers are reported in support of the Indonesian version of the ORCA tool. Limitations with the tool that will require further revisions are noted.

Chapter 4 advances to an analysis of ORCA scores from respondents aggregated by health facility. Evidence of agreement between respondents of the same facility along with interrater reliability is assessed and reported. Next, aggregated ORCA scores from each health facility are analyzed with EMAS clinical assessment data to assess associations between organizational readiness for change and the successful achievement of maternal clinical practice guidelines.

Chapter 5 examines another analysis of association between ORCA scores and two neonatal clinical standards. An analysis of association between the neonatal service data that correspond with the clinical standards and ORCA scores is also reported.

Chapter 6 provides a discussion of the main findings across each of the research chapters above (3-5). The implications of the research as well as strengths and limitations are discussed, and finally, recommendations for future research are presented.

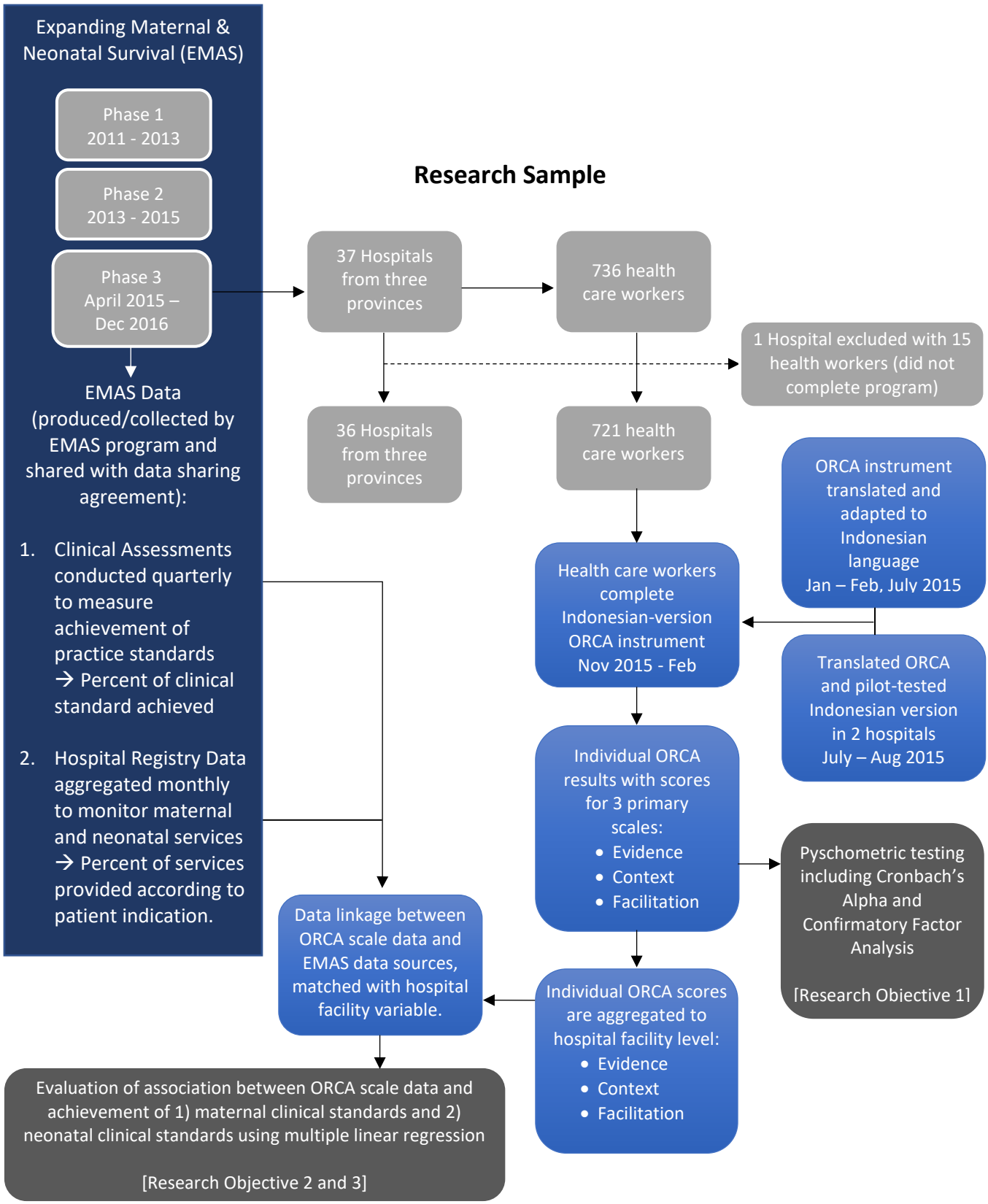

Figure 1.1 Overview of Data Sources, Data Collection and Analsis, and Approximate Dates

Chapter 2: Literature Review: Organizational Readiness for Change Conceptual Frameworks and Instruments

This literature review attempts to situate the research on ORC within the greater fields of implementation science and knowledge translation. The section begins with a background on the concept of organizational readiness, starting with a theoretical basis. Next, a discussion of current conceptual frameworks for organizational readiness is presented with support from studies from developed settings and developing settings. Finally, representative organizational readiness measurement instruments are compared, and the section concludes with a discussion of instrument selection for the current dissertation thesis.

The approach for this literature review drew on systematic review methods, however it was not exhaustive across multiple databases and grey literature. A broad search was conducted with terms related to organizational readiness, organizational change, organizational culture, innovation readiness, developing countries, low-income countries, low-resource settings, and newborn and maternal health services. Databases searched included PubMed, CINAHL, Web of Science. At the time of conducting these searches, multiple existing systematic reviews on organizational readiness for change and relevant instruments were accessed to inform the background and design of this study (15,25,46).

2.1 Knowledge translation and organizational readiness for change

The translation of new research evidence into practice can be a significant undertaking. In health care, there is a significant delay between the generation of research findings and the implementation of new practices based on these findings (4,47). Health care organizations continually face new challenges that require change in order to maintain performance and

efficiency, incorporate new technologies, or adapt to new policies and regulations. In health care, innovation may lead to organizational change in order to reduce costs, increase quality and responsiveness, reduce variation in practice, and increase access to services (48). When faced with organizational change circumstances, individuals will contribute to the success of an organizational change or they may create resistance, potentially leading to a failed effort. Since nearly half of all failures to implement organizational changes can be traced back to a lack of readiness (49), it is not surprising that organizational readiness is viewed as a necessary precursor for a successful organizational change to occur (15). This thesis seeks to generate evidence to understand the effectiveness of strategic initiatives for the implementation of innovations and organizational changes that could lead to improved health outcomes in a setting that has not been previously studied to date.

2.2 Development of Readiness for Change

In this thesis, an organizational change is defined as any intentional modification to an organization through composition, structure, or behavior that has an objective of improving the effectiveness of the organization (15). In health care settings, organizational changes require cooperation from individual health care workers to adopt new practices, guidelines, or standards and implement them effectively. The preparation phase prior to an organizational change is a valuable time to assess the readiness of individuals and the organization as a whole for the impending change. Several change experts have discussed this period and the resulting construct that has emerged is Organizational Readiness for Change.

Kurt Lewin, an early behavioral theorist and change expert, developed a 3-stage model of change that describes a very fundamental process that organizations pass through consisting of

unfreezing, change, and refreezing (13). During the initial stage of unfreezing, organizational members are asked to challenge the current mindset of the organization and develop sufficient motivation in support of an organizational change. Previously, change experts viewed this initial period only through a lens of resistance to the change (50). Managers, for example, engaged in efforts to identify and reduce resistance to an organizational change. Over time, however, experts began to recognize a readiness construct that was separate from resistance (14,51). Several of the strategies identified for reducing resistance, for example, could also be used to increase readiness. Educating individuals about the change, involving individuals in the planning, and providing facilitation and support to individuals are some of the constructive strategies that were used to reduce resistance (50). The construct of readiness for change, in contrast to resistance, provides a proactive mindset and accommodates the roles of facilitators, opinion leaders, and champions to support the organizational change as implementation proceeds (14).

Before proceeding with the positive aspects of readiness to change, however, it is important to acknowledge that resistance to change on the part of employees or staff may come from rational and reasonable factors. If organizational change is recommended by leadership to achieve goals that do not align with the individual goals of managers or employees, then resistance to change can be expected (52). Management techniques to promote organizational change and improve performance measures have been studied in other industries to such an extent that the behavioral factors associated with new methods are well accepted (53,54)(Staw 200, Abrahamson 1996).

The construct of readiness for change is most salient during the period of “unfreezing”, or specifically, the period after a decision to adopt a change has been made but before

implementation takes place. One of the key components for cultivating readiness proactively is a “message of discrepancy”, described by Armenakis et al. (1993) as information that describes the current organizational situation, a more appropriate organizational state, and the reasons behind the implied change. A successful message creates motivation among members to contribute to a change effort through information that makes the change necessary and provides evidence of the efficacy among members to carry out the change (14). Change leaders, including influential staff members and change champions, help to cultivate motivation among members by communicating reasons why the status quo is no longer sufficient. The reasons could relate to the need to improve outcomes, a changing environment that demands new methods, or the need to reduce costs. Ensuring that members are committed to a change may require understanding individual priorities within a health care organization. A study evaluating organizational readiness for change characteristics reported evidence in support of tailoring communication about a strategic change to those affected. The Ontario-based study found different perceptions on organizational aspects of the rehabilitation hospital between leaders and staff members suggesting that an effective change message should resonate with the needs of those involved (19).

Focusing on the field of substance abuse treatment, Simpson proposed a model of organizational change using four steps to implement practice innovations. Acknowledging that organizational factors are influencing a change process, Simpson proposed that there is an initial period of exposure to an innovation and related evidence; this is followed by a period of adoption where experimentation with a new practice begins; implementation involves fully testing an

innovation; and practice is the final period where an organization begins to institutionalize a practice with sustainable measures (55). Lehman et al. (2002) then developed an assessment of ORC for translating new practices in substance abuse treatment based on Simpson's program change model that targets the following domains: motivation, institutional resources, staff attributes, organizational climate, and practitioner access and utilization of training. The motivational domain that Lehman measures in this ORC instrument incorporates the idea of a "message of discrepancy" through perceived need and pressure for change (26). Drawing on therapeutic treatments for substance abuse, the development of the Simpson's change model was influenced by an understanding that front-line providers may act as key figures for implementing new practice changes. It is important that these providers understand empirical support for a practice innovation, observe the new practice, confirm advantages over existing practices, and finally play a role in planning the implementation (56).

Holt et al. (2007) continue to develop the construct of organizational readiness for change through a review of measurement instruments and come to the conclusion that readiness is a "comprehensive attitude". Four distinguishable components influence the readiness of an organization and consist of change content, change process, change context, and the individual characteristics of those involved in the change. Collectively, this attitude among organizational members determines the cognitive and emotional motivation to alter the status quo (57). Furthermore, Holt and colleagues propose that the "state" of ORC is one aspect of a greater organizational system, and that individual levels of readiness will vary over time, or even during the course of an intervention (51). Therefore, organizational leaders and change agents need to be aware that fluctuations among individual readiness levels are possible. Therefore, individual

readiness is a modifiable factor that can be influenced by change agents to prevent change efforts from failing.

Weiner et al. (2008) synthesized another review of organizational change literature and further refined the concept of organizational readiness for change. Recognizing the abundance of instrument development to measure organizational readiness for change that was taking place across several fields of study, Weiner drew on studies from several types of organizations in addition to health services including education, business, and government services. Weiner et al. concluded that the existing studies contributed an abundance of terminology to describe ORC, and this was creating inconsistency and ambiguity of the terms and language between studies. Conceptual definitions of ORC were presented among less than half of the studies reviewed (45%). Drawing on the conclusions of his review, Weiner proposed a theory of ORC as a two-dimensional and multi-level construct.

Weiner theorized that ORC is a two-dimensional construct consisting of a psychological component equal to the motivation to implement a change, and a capability component consisting of confidence and skills related to the ability to implement the change. Structural factors and resources are given consideration in Weiner's theory, though these elements are thought to impact the perceptions of individuals as they make judgements about their collective efficacy to implement a change (16). When members of an organization are both ready and committed to implement a complex intervention, the effort will require coordination and cooperation across wards, units, or departments. Therefore, Weiner proposes that it is necessary to assess organizational level determinants and outcomes, such as individual perceptions of collective readiness.

Furthermore, according to Weiner's theory, both the commitment and efficacy are "change-specific", meaning that individuals draw conclusions by thinking about a specific change. Even though an organization may have attributes among members that create a receptive atmosphere for change, this does not confirm member commitment toward an organizational change. Weiner also theorizes that organizational members' commitment and efficacy are shaped through the value they hold for a specific organizational change; and the values that motivate different individuals need not be homogeneous to create substantial commitment. Strong evidence, a manager's support, or peer support might all be reasons for individual members of an organization to value an impending organizational change. Weiner concludes that organizational readiness is dependent on whether strong commitment toward the change is created, rather than the underlying reasons (16).

The Promoting Action on Research Implementation in Health Services (PARIHS) framework was developed by the Royal College of Nursing Institute in the United Kingdom in an attempt to explain the complexity of the change processes that surround implementing research-based practices (2). This framework was the result of accumulated knowledge and experience working with clinicians on implementation strategies that include setting clinical standards, introducing audit and feedback, and changing patient services (3). Three important elements emerged from this accumulated knowledge and experience that determine effective implementation: evidence, context, and facilitation.

Evidence is composed of four subcomponents that include (1) research evidence from published sources; (2) evidence from clinical and professional experience; (3) evidence from patient experiences; and (4) evidence from local data/information (2). The proposition is that

implementation is most successful when research evidence is rigorous and conclusive, clinical experience reflects high levels of consensus, patient preferences are accepted as valid input for decision making; and local data is systematically collected and evaluated (2,3).

The context, or setting, describes where the proposed change is implemented and consists of three subcomponents that include (1) organizational culture, (2) leadership, and (3) evaluation (2). Organizational culture can be described as the values, beliefs, and attitudes shared by members of the organization (58). The characteristics of a "learning organization" are desired for facilitating change effectively, and these include decentralized decision making, a shared vision, and value for individual contributions (59). Leadership refers to the kind of control and decision making that exists, as well as the effectiveness of teamwork and organizational structures. Evaluation describes how performance is measured and whether feedback in an organization is provided to health workers.

The last core element of the PARIHS framework is facilitation. This refers to enabling the implementation of evidence into practice. Kitson et al. describe facilitation as "a technique by which one person makes things easier for others" (20, p.152). Important components of this element consist of the facilitator's purpose, role, and skills – matching these to the situation creates valuable facilitation. This suggests that appropriate facilitation comes from a person who is flexible and able to adapt and respond to changing needs (59). Two aspects of the facilitation element are unique to the PARIHS framework compared to other multi-faceted interventions. First, the role of a facilitator should be to enable (as opposed to do for someone) using critical reflection and counseling; second, two-way communication is implied through responsive and interactive facilitation (58).

ORC has been described and assessed as a general characteristic of an organization, or in association with a specific change. Whereas Lehman and Simpson (above) describe ORC as a general state for an organization (26), other authors propose that ORC should be assessed in relation to a specific organizational change. For example, in the conceptual definition proposed by Holt et al. (2007), the content and the process of change are factors that are unique to the organization and the change or innovation being implemented. Individuals influence the level of ORC by their attitudes toward the change, which in turn reflect their motivation to participate and contribute to the implementation process. Weiner's view, that maintaining the view that ORC should refer to a specific change in contrast, helps to distinguish the ORC construct from similar ideas of organizational culture or climate that contribute to ORC but are more general to the organization (15).

While ORC is now considered a necessary "precursor" to successful implementation in high-resource settings, ORC is also a construct that must be maintained throughout the period of an innovation to ensure successful implementation (60). A similar conclusion was drawn from an evaluation study that examined organizational readiness following a hospital redevelopment with major physical and operational shifts in a major Canadian city between 2012-13. ORC was assessed among hospital staff at four time points with two prior to the move and two following the redevelopment. ORC fluctuated over the course of the redevelopment process and authors observed improved employee outcomes associated with greater ORC (61). The fluctuating quality of ORC means that organizations should not be determined as "ready" or "not", but rather along a dimension of ORC. This also suggests that ORC is not a static measure, but that measurements of ORC over a period of implementation may result in different levels of readiness. This allows

organizational deficits to be identified in association with the level of readiness, and in turn, support can be targeted to improve the level of ORC and implementation outcomes (60).

To further clarify the concept of ORC, Attieh et al. (2013) reviewed ten ORC theories, models, and frameworks that fall within the healthcare field and completed conceptual mapping to draw connections between concepts, dimensions, and sub-dimensions. Similar to earlier reviews of ORC in the literature, Attieh et al. (2013) noted the amount of diversity in the terminology and determinants used to study ORC. Unlike other reviews however, the conceptual mapping exercise had the objective to draw on similarities between the ORC models. The authors identified five core concepts across the ten models that include organizational dynamics, change process, innovation readiness, institutional readiness, and personal readiness. The conceptual mapping and core concepts provide further evidence of the multi-dimensional nature of the ORC construct. However, the five core concepts are drawn from models that originate in either the U.S.A. or UK and have been empirically tested only in health care settings from high-income countries (25).

The complexity of health care environments where innovations are expected to translate into new practices leads to a nonlinear and iterative process of implementation (48). These conditions have led to the conclusion that innovations within healthcare organizations possess an element of unpredictability (48). Similar conclusions have been drawn for quality improvement processes in maternal, newborn, and child health where the intervention itself can be complex, involve several actors, multiple variables, and different contexts (62). It is not surprising then, that recent literature on dissemination and implementation of innovations

remains plagued with inconsistency in the definitions of constructs and corresponding operationalization of terms (63).

In a recent review of literature on organizational characteristics that impact implementation of innovations, Allen and colleagues identified 76 studies, of which half took place in a health care setting, but only 45% cited a theory or conceptual model to guide the investigation. Approximately the same number of studies (46%) provided psychometric information about the organizational measures. These observations led the authors to conclude that future dissemination and implementation research would benefit from greater attention to the theoretical framework from which a measure is derived, and standardizing and validating measures (63). This would provide more clarity among strategies for implementing innovations and organizational changes in the health care setting.

2.3 Measures of organizational readiness

The relatively recent theorizing of ORC and the corresponding conceptual models are reflected in the myriad of measurement instruments that are currently in use. A growing number of reviews of instruments to measure organizational readiness for change have been published; but some limitations exist. First, many instruments lack an underlying framework or conceptual definition for ORC. There is also variation in terminology for concepts related to ORC. In spite of this, there is general consensus that similar constructs are being referred to by instruments that have been reviewed (15,25). Armenakis et al. (1993) describe "Readiness for change" as "organizational members' beliefs, attitudes, and intentions regarding the extent to which changes were needed and the organization's capacity to make those changes." Holt et al. (2007) refer to ORC as a "comprehensive attitude" influenced by the change content, the change process

being implemented, the change environment, and the personal attributes of individuals. Other terms used to describe the ORC construct include 'capacity for change,' 'implementation readiness,' 'willingness, beliefs, state readiness/team readiness,' and 'innovation readiness' (25). These are some of the constructs that have been used for the development of measurement instruments.

Organizational readiness for change is now regarded as a "critical precursor" for the implementation of complex programs in health care environments (15) The number of available instruments to measure organizational readiness is growing, but conceptualization of this concept in the healthcare environment is a nascent field of study (16,64). Available instruments to assess organizational readiness for change are still under development, often with limited psychometric evidence.

One recent systematic review of published instruments to measure ORC found that only modest progress was made in tool development during the five years prior with many instruments still lacking complete psychometric testing, measures of reliability and validity determined by the Standards for Education and Psychological Testing (65). The review also revealed that the majority of instruments lack this foundation. Although all of the reviewed instruments were developed to address changes in a healthcare environment, they were all developed in resource-rich settings in developed countries.

A more recent review of ORC assessment tools strived to evaluate reliability and validity again, but the authors went to a greater extent than previous attempts by rating the level of evidence or psychometric quality of readiness tools (Weiner 2020). Not only source articles of ORC assessment tools were selected; authors reviewed all subsequent uses of the assessment

tool available. Psychometric quality was independently evaluated using evidence-based assessment (EBA) criteria (66). Among 183 articles selected for the review, 76 measures of ORC are used; but only 13% of the articles focused on settings from middle- and low-income countries (67). This review finds limited psychometric evidence, consistent with earlier reviews. Authors examined predictive validity information more closely in this review and found that very few assessment tools have been used to predict adoption (11%) or implementation (9%) of an organizational change. Instead, studies focused on measuring ORC of an organization or a related aspect such as comparing ORC between groups. The lack of evidence among ORC assessment tools for predictive validity represents a significant gap in current research, especially given the assumption that ORC may determine levels of implementation success for organizational change.

Finally, one smaller review of ORC measurement tools focusing on substance misuse treatment programs found evidence for predicting innovation adoption, but the author's conclusions are tempered by the heterogeneity of the studies, the diversity of the study results, and the low level of hierarchical evidence despite all coming from a relatively focused health area (68). The authors conducted a systematic review in accordance with PRISMA guidelines, however, the final review sample consisted of 14 studies that used only one ORC measurement tool. The reviewed studies focused mainly on early adoption processes for organizational change, but only one reported on the sustained integration of a change into practice. This review highlights the current challenges of comparing ORC measurement results between studies, drawing confident conclusions, and addressing deficiencies in ORC once identified.

Taking into consideration the current limitations among measurement tools for assessing ORC, especially with application in a developing country setting to assess a complex intervention,

I reviewed a small selection of existing tools from the prominent theories of ORC above that could be adapted for my study setting. Instruments were selected while conducting the literature search above. From instruments that were found through the literature search, I examined those that were theory-based in light of five factors. First, instruments should be developed with the support of an underlying theoretical framework and clearly describe the construct for organizational readiness for change. Secondly the level of measurement needs to reflect not only individual readiness, but also the collective readiness of the healthcare organization. Next, the instrument should reflect an organization's ORC in reference to both organizational change and as a general state of affairs. Fourth, knowing that survey questionnaires require extra time on the part of health care workers to complete, the length (number of items) is also considered. Finally, consideration is given to how well the components of the construct and measurement tool align with the different components of the EMAS intervention and contextual factors in the Indonesian research setting. EMAS represents a complex intervention that emphasizes evidence-based practices in maternal and newborn service standards. The EMAS intervention is designed with a mentoring approach with open communication and feedback between hospital staff and change agents. Key aspects of multiple prominent instruments are discussed below with respect to these criteria.

2.3.1 *Organizational Readiness for Implementing Change*

The Organizational Readiness for Implementing Change (ORIC) instrument developed by Shea et al (2014) is based on Weiner's theory of organizational readiness for change and is one of the simplest and shortest instruments (16). The developers of the instrument conceptualize

organizational readiness for change as both a multi-level and multi-faceted construct, in line with Weiner's theory. The ORIC takes a multi-faceted approach with items that measure two integral dimensions of the theory, change commitment and change efficacy. The commitment and efficacy refer to the organizational member's willingness and ability to implement an organizational change (16). Through a series of studies, researchers provided validity and reliability for the ORIC, structural validity via confirmatory factor analysis, and construct validity (69). Respondents for the psychometric testing were drawn from a convenience sample of undergraduate, masters, and doctoral students from one university. Student respondents, not actual employees, were asked to hypothesize about hospital situations presented to them. Actual employees may have more experience that influences responses to the items. The items of the ORIC were constructed to refer to collective commitment and efficacy, and they lack reference to a specific organizational change.

2.3.2 *Readiness for Organizational Change Instrument*

Holt et al. (2007) published a Readiness for Organizational Change instrument in 2007. After synthesizing a conceptual framework, the authors decided on a model comprised of four factors: the change content, the change process, the internal context, and individual attributes (57). This led to a construct definition of organizational readiness as a comprehensive attitude that is simultaneously influenced by each of the four factors (57). The measurement tool is directed at individuals to assess both cognitive and emotional investment toward a change effort. Initially, 59 items were included to represent each of the four factors, but after evaluating several psychometric results the final item list included 25 items. Holt's Readiness for Organizational Change instrument was first tested with a sample of respondents from a U.S. government

organization that worked with the Department of Defense. Pyschometric testing from this first sample supported the four-factor structure, and internal consistency was satisfactory for three of the four factors (Cronbach $\alpha > 0.7$) and near satisfactory on the individual attribute factor (Cronbach $\alpha = 0.66$). Holt et al. also assessed convergent and predictive validity by testing the ability of readiness-for-change factors to distinguish between two types of respondents (change planning participants and non-participants), and then to predict job satisfaction, affective commitment, and turn-over intentions. A second sample of respondents from a private information technology organization provided further psychometric support for the instrument, but with a similar limitation for internal consistency for the individual attribute factor.(57).

2.3.3 *Texas Christian University Organizational Readiness for Change instrument*

The Texas Christian University (TCU) Organizational Readiness for Change instrument developed by Lehman in 2002 is based on Simpson's process model for program change (above) when new technologies or knowledge are introduced to a program (26). The instrument was developed with a focus on drug treatment and health services. The instrument is made up of 115 items across 18 subscales that fall into four major areas. These major categories include motivation for change, institutional resources, personality attributes of the staff, and organizational climate. The developers of this instrument intended to measure members' shared perceptions of organizational readiness. Nonetheless, they also acknowledge that this instrument is measuring general factors. Lehman et al. (2002) explained that the four factors that describe organizational readiness for change are necessary but not always sufficient for change to occur, further suggesting that other factors may influence whether a change is implemented.

By other factors, this could mean the relevance of the change to the organization or institutional support to sustain a change effort (26).

This instrument has been validated in different organizations related to drug treatment services and more recently with counselors in correctional programs. Psychometric parameters support the four-factor structure, but internal consistency for the 18 scales has not always reached a satisfactory threshold of 0.7. (70,71)

2.3.4 *Organizational Readiness for Change Assessment*

The Organizational Readiness for Change Assessment (ORCA) instrument was developed by researchers in the Ischemic Heart Disease Quality Enhancement Research Initiative, part of a larger national initiative in the United States Department of Veterans Affairs Office of Research and Development. The ORCA instrument is based on the PARIHS framework and is a structured survey that assesses organizational readiness to implement a specific evidence-based clinical practice (72). The instrument is intended to provide an overall indication of the likelihood of successful implementation at baseline, and to assess changes over time (72).

The ORCA instrument is a self-administered questionnaire that consists of three primary scales, Evidence, Context, and Facilitation, further divided into 19 subscales that correspond to the core elements and subcomponents of the PARIHS framework (Figure 2.1) (72). There are 77 items that are scored on a 1 to 5 Likert scale where 1 = strongly disagree and 5 = strongly agree. Scoring involves dividing the total score on each primary scale by the number of items on the scale resulting in a scale score value of 1 to 5. This survey is intended for clinical and support staff involved in implementation of an evidence-based practice.

The three primary scales measure agreement of health care workers on evidence for the change in practice to be implemented, the organizational culture including leadership where the change will be implemented, and the facilitation mechanism for implementation. The first item on the evidence scale asks respondents to consider a statement about the practice change in order to measure discrepancy between respondents' interpretation of the current practice and a more ideal practice – in other words a performance gap (64). The context scale is designed to measure concepts of leadership and staff culture, and perceptions on resources. The facilitation scale includes items that measure perceptions on the mechanisms to be used for facilitating the practice change.

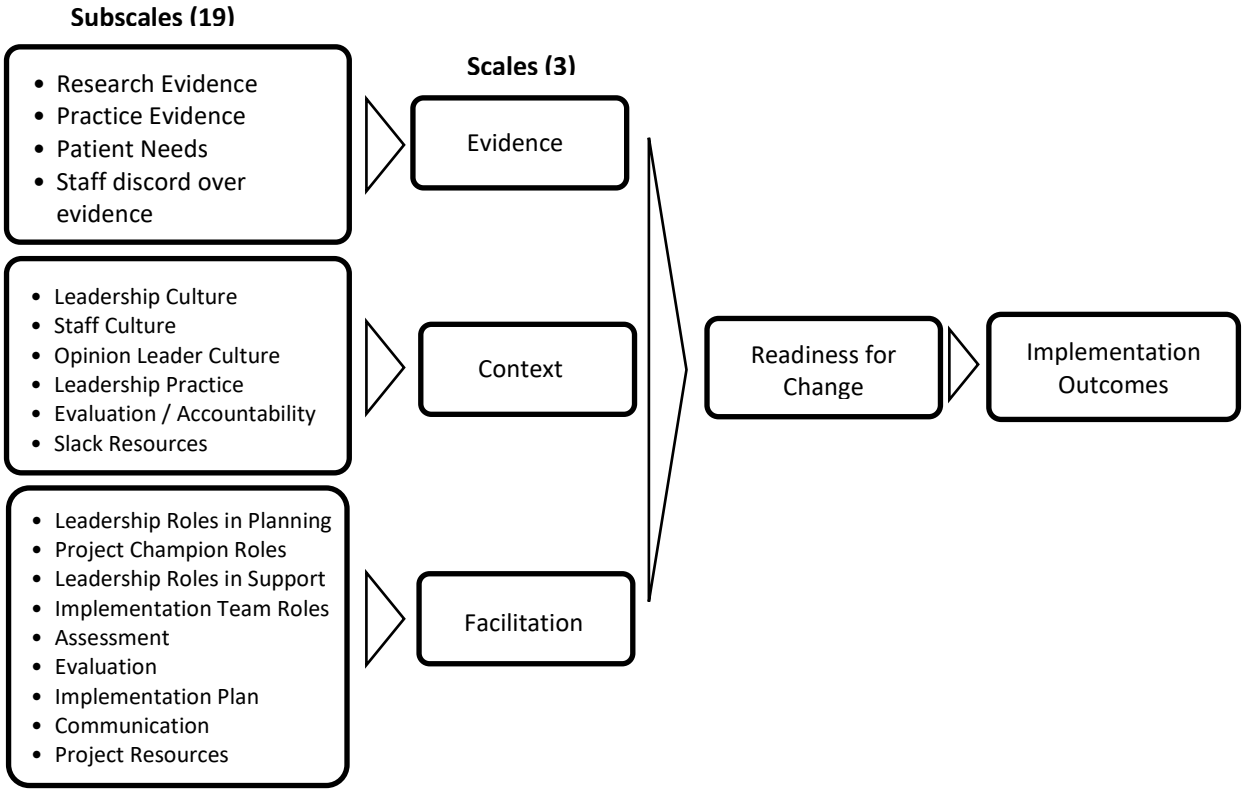

Figure 2.1 Organizational Readiness for Change Assessment (ORCA) based on Promoting Action on Research Implementation in Health Services (PARIHS) framework

2.3.5 *Summary: Choosing an Organizational Readiness for Change Instrument to pilot in a LMIC setting.*

All of the measurement instruments reviewed for this thesis research were developed from a theoretical framework, and a conceptual definition of organizational readiness for change can be ascertained from each one. All of the instruments rely on individual respondents for data collection, and an organizational level measurement is possible by aggregating individual responses. The aim of the measurement tools, whether to organizational readiness for a specific change, or as a general state of affairs is more nuanced. The items that make up the ORIC instrument are simple and few (12 items), and the language targets a specific change. The Readiness for Organizational Change instrument has slightly more items (25 items), and also targets a prospective change in the language of the instrument. The TCU Organizational Readiness for Change instrument is the longest questionnaire (125 items) and targets a general concept of readiness at the organizational level. Finally, the ORCA is of medium length (77 items), and the assessment tool uses a combination of items to capture both general readiness and change-specific readiness (58).

The ORCA instrument, based on the PARiHS framework was chosen for this research because it met the criteria described above and for the following alignment with the EMAS program. In order to reduce maternal and neonatal mortality, the EMAS program introduces evidence-based clinical standards that are based on accepted evidence among Indonesian and International stakeholders. The emphasis on evidence-based standards is thought to align with the Evidence scale of the ORCA instrument. The program places emphasis on evaluating patient

preferences by implementing new feedback channels. The systematic monitoring and evaluation of local data through dashboard indicators and audits are instituted to inform health workers in EMAS facilities on the quality of care being delivered and motivate them to take action wherever suboptimal performance is recorded (37).

Organizational culture of health care teams is a central focus of the EMAS program and aligns well with the context scale of the ORCA instrument. Governance standards are instituted to monitor practice and identify problems, find solutions, and make necessary changes. One of the central goals of EMAS is to have an impact on the organizational culture of hospital facilities so that members are accountable and patient safety is prioritized (37). The ORCA instrument offers multiple items that measure aspects of organizational culture and climate, including leadership culture and practice, influence of opinion leaders and champions, and interaction between staff. Another novel characteristic of the organizational culture section of the ORCA instrument is that items are designed to measure aspects of change in general; this helps to identify important implementation barriers that apply to the specific change effort or to clinical practices in general (58).

The characteristics of the ORCA facilitation scale are highly emphasized in the mentoring process of the EMAS program. This scale encompasses more items than the other instruments comparatively for this subject. On-the-job mentoring and facilitative supervision are used by EMAS personnel to help staff implement clinical standards (73). Feedback is also a central component and provided continuously throughout the mentoring activities. These techniques are also meant to open communication so that maternity care workers may inquire and consult on challenging cases when necessary.

The full ORCA instrument has not been adapted to a health care context outside of North America, and challenges with understanding items, construct validity, and predictive validity are possible when using this instrument in a middle-income health care setting. The Indonesian Java provinces where this instrument will be administered, however, represent the most affluent and most densely populated areas with the highest level of infrastructure. Availability of obstetricians is skewed and these physicians are most numerous on the island of Java. Measures of facility readiness that include equipment, medicine, and diagnostic tests for basic maternal health services are highest among government-funded primary care centers and public hospitals in the Java provinces (WB 2014). Measures of provider readiness in terms of the components that are included in the ORCA questionnaire, however, may play an important role in the quality of maternal care beyond the basic readiness indicators. One of the few studies that have adapted part of the ORCA instrument to a LMIC health setting found that sub-elements of organizational context were relevant in the Ugandan health care setting (Bergstrom 2015). The authors concluded that organizational factors identified with the aid of the PARiHS framework were of importance to health systems beyond the context of the study.

I chose to adapt and administer the ORCA instrument in this research study as a result of the strong alignment between the underlying conceptual framework that was used to develop the instrument and the mentoring goals of the EMAS intervention discussed above. The length of the ORCA instrument (77 items) is considerable, but I deemed it appropriate for the number of aspects that are covered in each scale. The context scale of this instrument includes items that refer to readiness as a general organizational trait, but can help to identify implementation barriers specific to an intervention. The ORCA instrument measures organizational readiness in

such a way that it can be aggregated to a facility level and analyzed with other hospital level factors. Finally, by adapting the ORCA instrument to the Indonesian health context the study will build on a small but conclusive body of literature investigating the measurement of ORC in health care contexts outside of North America by using this PARiHS-based instrument.

Chapter 3: Psychometric properties of the Organizational Readiness for Change Assessment in an Indonesian Health Care Setting

3.1 Introduction

As discussed in the previous chapters, the instruments that are currently available to measure organizational readiness for change are at various stages of development, are not always based on a conceptual framework, and many of them have limited evidence from psychometric testing. For example, the Organizational Readiness for Change Assessment (ORCA) has undergone some psychometric testing with health workers from Veteran's Affairs programs, but it is still recommended to re-examine the instrument before it is administered with a new population (74). Much of the current research on ORC has taken place in developed country settings, leaving a significant gap for measuring ORC in healthcare organizations in developing countries. In addition to the need for greater psychometric evidence for ORC measurement tools, another barrier to advancing the study of ORC in some countries is translating and adapting instruments to local language and cultures. The goal of this chapter is to describe the translation and cultural adaptation of the ORCA tool for the Indonesian health care context, and then report the psychometrics properties of the ORCA tool with a population of Indonesian health care workers in three provinces on the Java Island.

3.2 Methods

3.2.1 *Translation and Adaptation from English to Indonesian*

In order to translate and adapt the ORCA questionnaire from English to Indonesian, I followed the general steps outlined by the WHO to ensure an accurate adaptation of the instrument in the target language (75). The ORCA questionnaire was forward-translated followed by a discussion between translators and researchers, then back-translated followed by a second discussion between translators and researchers. Next, a panel of health workers in Indonesia reviewed the questionnaire; the questionnaire was pre-tested in two hospital environments, and a selection of cognitive interviews was conducted. Forward translation was completed by two graduate students whose mother tongue is Indonesian; back translation was completed by two additional Indonesian graduate students fluent in English. Discussions took place after each translation step between researchers and translators to resolve confusing and troublesome words and phrases. The final Indonesian translated version was then shared with a panel of obstetric health care workers at Lembaga Kesehatan Budi Kemuliaan, a maternal hospital in Indonesia. Following review by panel members, additional adaptations were made to items to improve accuracy, clarity, and simplicity before any pre-testing. The revised Indonesian draft was then pre-tested for reliability at two Indonesian hospitals among health care workers directly involved in the EMAS program. The comprehensibility of the items was tested with respondents that agreed to cognitive interviews, including two health workers from the emergency ward, two from the post-natal ward, and one from neonatology. The interviewer facilitated a discussion of items pre-selected to test the respondents understanding of wording and concepts after respondents completed the questionnaire. Respondents were invited to express their own

opinions and discuss any confusion or problems they encountered while completing the questionnaire. Feedback from interview respondents was considered and adaptations were made to the questionnaire accordingly.

3.2.2 *Validation Survey*

Data collection for the psychometric analysis of the ORCA instrument from Indonesian health care workers was completed in person with paper hard copies of the questionnaire. In 2015, Indonesian hospitals participating in the third and final phase of the EMAS program were contacted for inclusion in the sample. At a selected hospital, health workers directly involved with the implementation of the EMAS program were invited to take part in the study. A field researcher explained the background and goals of the study to all participants prior to administering the ORCA questionnaire. Participants were provided with an informed consent letter, and consent was assumed if the questionnaire was completed. Study participants included physicians (general practitioners and specialists), midwives, nurses, and support staff.

The study was approved by the Research Ethics Board at the University of British Columbia and at Universitas Padjadjaran in West Java, Indonesia.

3.2.3 *Assessment of Psychometric Properties of the ORCA*

The psychometric properties of the ORCA instrument in the Indonesian health context were assessed in two parts. Initially, ORCA data was examined for data quality, internal consistency for each sub-scale, and inter-item correlation for each sub-scale. I assessed the quality of the data by measuring the mean, median, extent of missing responses, as well as floor and ceiling effects. Floor and ceiling effects describe the proportion of responses that reach the end of the likert scales (a “1” or a “5” on a 5-point scale). The internal consistency for each sub-

scale was assessed with Cronbach's α and the item-rest correlation. These two measures were used to assess psychometric properties of the ORCA instrument in previous pilot tests (58). A value of 0.7 was considered the minimum alpha value for each sub-scale (74) and a minimum value of 0.2 was considered acceptable for the item-rest correlation of each sub-scale (58). I assessed the effects of dropping an individual item from a sub-scale based on the Cronbach's α value and the item-rest correlation.

Next, the internal factorial structure of the ORCA instrument was assessed using the confirmatory factor analysis (CFA). The 3-scale structure or the ORCA (Evidence, Context, and Facilitation) was determined in a previous study using results from an exploratory factor analysis (58). The goal of the current CFA analysis was to confirm that correlations between variables from the Indonesian context were explained by the same three domains. I specified a basic model using a maximum likelihood method, where an item was linked to its domain with unspecified correlation between domains. Assumptions of the maximum likelihood method appeared to be met with the current data including a large sample size, indicators measured on continuous scale, and an approximate normal distribution of indicator data. To assess the model fit, I examined five different indices of goodness-of-fit that are available for this purpose.

Chi-square goodness-of-fit assesses the difference between the covariance matrix of the sample and the fitted models. A null hypothesis suggests that the model does not fit the data, whereas an insignificant result suggests good model fit. The chi-square test is limited by three factors: 1) a rigid hypothesis that the two matrices are equivalent, 2) assumption that the data are chi-square distributed, and 3) the test statistic is inflated by sample size (76).

The Standard Root Mean Square Residual (SRMR) is another measure of absolute fit (similar to chi-square) and attempts to measure the discrepancy in the correlations of the sample and the fitted models. The values of SRMR range from 0.0 – 1.0 with 0.0 indicating perfect model fit.

The Root Mean Square Error of Approximation (RMSEA) is a population-based estimate, less sensitive to sample size, and measures the degree of fit per degree of freedom of the model. Therefore, models with fewer freely estimated parameters show better fit. Values less than 0.05 suggest very good fit, 0.05-0.08 suggest good fit, and values above 0.10 suggest poor fit.

Comparative Fit index (CFI) compares the fit of the estimated model with that of a null model. Values for this test range from 0.0-1.0 and acceptable models fall between 0.90-0.95 and models with good fit above 0.95.

Statistical analyses for internal consistency and confirmatory factor analysis were completed with STATA version 16 (College Station, TX: StataCorp LLC).

Table 3.1 Organizational Readiness to Change Assessment (ORCA) Items

Scale	Sub-Scale	Items
Evidence	Research	The proposed practice changes or guideline implementation:
		Are supported by successful implementation at other health facilities.
		Should be effective, based on current scientific knowledge.
		Are(is) experimental, but may improve patient outcomes.
		Likely won't make much difference in patient outcomes.
	Clinical	The proposed practice changes or guideline implementation:
	Experiences	Are support by clinical experience with patients.
		Conform to the opinions of clinical experts in this setting.
		Have not been attempted in this clinical setting.
	Patient	The proposed practice changes or guideline implementation:
	Preferences	Have been well-accepted by patients in a pilot study.
		Are consistent with clinical practices that have been accepted by patients.
		Take into consideration the needs and preferences of patients.
		Appear to have more advantages than disadvantages for patients.
Context	Leadership Culture	Senior leadership/clinical management in your organization:
		Reward clinical innovation and creativity to improve patient care.
		Solicit opinions of clinical staff regarding decisions about patient care.
		Seek ways to improve patient education and increase patient participation in treatment.
	Measurement	Senior leadership/Clinical management in your organization:
		Provide staff with information on performance measures and guidelines.
		Establish clear goals for patient care processes and outcomes.
		Provide staff members with feedback/data on effects of clinical decisions.
		Hold staff members accountable for achieving results.
	Leadership	Senior leadership/Clinical management in your organization:
		Provide effective management for continuous improvement of patient care.
		Clearly define areas of responsibility and authority for clinical managers and staff.
		Promote team building to solve clinical care problems.
		Promote communication among clinical services and units.
	Staff Culture	Staff members in your organization:
		Have a sense of personal responsibility for improving patient care and outcomes.
		Cooperate to maintain and improve effectiveness of patient care.

		Are willing to innovate and/or experiment to improve clinical procedures. Are receptive to change in clinical processes.
	Opinion Leaders	Opinion leaders in your organization: Believe that the current practice patterns can be improved. Encourage and support changes in practice patterns to improve patient care. Are willing to try new clinical protocols. Work cooperatively with senior leadership/clinical management to make appropriate changes.
	Resources	In general in my organization, when there is agreement that change needs to happen: We have the necessary support in terms of budget or financial resources. We have the necessary support in terms of training. We have the necessary support in terms of facilities. We have the necessary support in terms of staffing.
Facilitation	Leaders' Practices	Senior leadership/clinical management will: propose a project that is appropriate and feasible. provide clear goals for improvement in patient care. establish a project schedule and deliverables. designate a clinical champion(s) for the project.
	Clinical Champion	The Project Clinical Champion: Accepts responsibility for the success of this project. Has the authority to carry out the implementation. Is considered a clinical opinion leader. Works well with the intervention team and providers.
	Leadership Implementation Roles	Senior Leadership/Clinical management/staff opinion leaders: Agree on the goals for this intervention. Will be informed and involved in the intervention. Agree on adequate resources to accomplish the intervention. Set a high priority on the success of the intervention.
	Implementation Team Roles	The implementation team members: Share responsibility for the success of this project. Have clearly defined roles and responsibilities. Have release time or can accomplish intervention tasks within their regular work load. Have staff support and other resources required for the project.

	Implementation Plan	The implementation plan for this intervention: Identifies specific roles and responsibilities. Clearly describes tasks and timelines. Includes appropriate provider/patient education and mentoring from specialists. Acknowledges staff input and opinions.
	Project Communication	Communication will be maintained through: Regular project meetings with the project champion and team members. Involvement of quality management staff in project planning and implementation. Regular feedback to clinical management on progress of project activities and resource Needs. Regular feedback to clinicians on effects of practice changes on patient care/outcomes.
	Assessment	Progress of the project will be measured by: Collecting feedback from patients regarding proposed/implemented changes. Collecting feedback from staff regarding proposed/implemented changes. Developing and distributing regular performance measures to clinical staff. Providing a forum for presentation/discussion of results and implications for continued improvements.
	Project Resources	The following are available to make the selected plan work: Staff incentives. Equipment and materials. Patient awareness/need. Provider buy-in. Intervention team. Evaluation protocol.
	Project Evaluation	Plans for evaluation and improvement of this intervention include: Periodic outcome measurement. Staff participation/satisfaction survey. Patient satisfaction survey. Dissemination plan for performance measures. Review of results by clinical leadership.

3.3 Results

Two independent translators completed the forward translation of the ORCA from English to Bahasa Indonesia. During the first review meeting, the translators and researcher concluded that the resulting translations were in close agreement conceptually with small differences in some terminology that were still semantically similar. Nonetheless, some key terminology was highlighted due to the lack of precise equivalent in Bahasa Indonesia. For example, the terms "evidence-based", "clinical experts", "opinion leaders", "champion" (as in clinical) resulted in multiple possibilities that were proposed and discussed at later rounds of discussion with clinical experts in Indonesia. It is common for technical terms from the English language to be adopted into Bahasa Indonesia where existing terminology does not yet exist or where the direct translation creates phrases that are cumbersome. Reviewing the items one by one resulted in a new Bahasa Indonesia version with agreement between translators and researcher on any difficult terminology.

Two additional translators completed the back-translation into English from Bahasa Indonesia and again highlighted awkward words and phrases, as well as confusing terminology. For example, an Indonesian word was chosen for "implementation" to distinguish from other synonyms that could be translated as "execution". It was suggested to reformat the introductory phrase of each set of items into a question to help guide the respondents. Where translators felt English terminology was already commonly used in Indonesia, the terms were placed in parentheses after the equivalent in Bahasa Indonesia (i.e. "(feedback)"). Through the review meeting with translators 3 and 4 to discuss the accurate English concepts and terminology, more appropriate language was also agreed upon for the final Bahasa Indonesian version.

Finally, the expert panel of medical staff in Jakarta reviewed this revised version in Bahasa Indonesia and edited each item further, adding terminology and phrases that were commonly used by health workers in Indonesia where appropriate. This resulted in several additional changes to wording, for example, the Bahasa Indonesian equivalents for "quality improvement Initiative" were chosen over "practice change" throughout the questionnaire to help relate to health workers involved in the EMAS program. The reference to randomized-controlled studies (RCTs) was replaced due to health workers unfamiliarity with the significance of this type of research.

3.3.1 *Survey Participants*

A total of 736 participants completed questionnaires from 37 hospitals across three Indonesian provinces. The participants from one private hospital (n=15) were excluded because the health facility did not complete the EMAS program. I included a total of 721 health workers from 36 hospitals in the final sample. The mean age of the survey participants was 35.2 years (SD 9.5) and the majority were female (79.7%). Among the facilities where participants worked, 53.3% of facilities were considered private with the remainder being public facilities. The majority of health workers surveyed had a 3-year diploma (56.9%), many had a 4-year degree (32.1%), and others had graduate degrees (Masters/PhD) (7.3%) or had completed a high school equivalent (1.0%). Approximately half of the health workers surveyed had less than 10 years of clinical experience (50.5%) (Table 3.3).

3.3.2 *Item Analysis*

The item distribution was analyzed by sub-scale. Sub-scales 3 and 4 showed even distribution, but questions 1 and 2 and the remainder of the sub-scales were left skewed. The

item response was high and missing responses were below 8% for all sub-scales. Higher missing responses occurred for the final three sub-scales (18, 19, and 20), which could indicate respondent fatigue. Floor effects were minimal (0 – 0.27%) and ceiling effects ranged between 0.82 – 9.92% for nearly all items and sub-scales. The single exception was for question 1 that was elevated at 26.34%.

Cronbach's alpha for scale reliability of the three scales in this Indonesian health worker sample were 0.72 for Evidence, 0.94 for Context, and 0.97 for Facilitation. Cronbach's alpha for the different sub-scales ranged from 0.34 for the clinical experience sub-scale on the evidence scale to 0.92 for project implementation resources sub-scale on the facilitation scale.

The reliability of the test for this sample failed to meet the stated threshold of 0.7 on two sub-scales under the evidence scale. Cronbach's alpha was initially 0.39 for the research evidence sub-scale and the item-rest correlation for item 3c (is still experimental, but may improve patient outcomes) was 0.077, neither value reaching the respective threshold. Upon removing item 3c, the Cronbach's alpha reached 0.46 for the remaining three items on the sub-scale, and the item-rest correlations were all above 0.2.

Results from the clinical practice experience sub-scale (Items 4 a-c) among Indonesian health workers achieve an alpha value of 0.34. The item-rest correlation of item 4c (the quality improvement program has not been previously attempted in this facility) was lowest at 0.10. Removing item 4c has an effect of increasing the alpha value to 0.62, however, there are also only two remaining items in the scale.

3.3.3 *Factor Analysis*

The Confirmatory Factor Analysis (CFA) was conducted using Stata 16 (College Station, TX: StataCorp LLC). I chose to conduct CFA because the ORCA instrument has previously been tested in a N. American context, and I was interested in confirming three a priori models consisting of latent variables for each of the scales Evidence, Context, and Facilitation and the relevant sub-scales (58). Initial attempts with multi-level latent variables failed to converge. The models reported here consist of a single-level of latent variables representing subscales for each ORCA element. The CFA factor loadings for the evidence sub-scales varied between 0.18 – 0.79. Factor loadings for context sub-scales had a range between 0.56 – 0.90. Factor loadings for the facilitation sub-scales were between 0.65 – 0.86. Initial factor models showed poor loadings on 4c (the quality improvement program has not been attempted in this clinical setting). Removing this item from the Evidence sub-scale improved the overall model fit (Table 3.6). The indices for model fit using RMSEA suggest good fit for the evidence scale (0.046), and reasonably good fit for the context scale (0.064) and for the facilitation scale (0.066). CFI and SRMR indices for each of the three scales also suggest satisfactory – good model fit (Table 3.6). Chi-squared indices were all significant, which does not suggest good fit for any of the scale models, however this was expected with the large sample size of respondents (n=721).

3.4 Discussion

This study set out to translate and adapt the Organizational Readiness for Change Assessment into an Indonesian health context through a cross-cultural and systematic procedure. The face and content validity of the translated instrument were assessed during its development by Indonesian health workers familiar with the organizational change program (EMAS), and

through cognitive interviews with health worker respondents. I obtained a large sample and high response rate as a result of administering the instrument directly to health worker respondents involved with EMAS.

The Indonesian version of the ORCA with the sample of maternal and newborn health workers showed some statistical support for the three core elements of the PARiHS framework (evidence, context, and facilitation). Response distributions for the majority of items showed acceptable floor and ceiling effects that indicate an acceptable range of response options. The internal consistency (Cronbach's alpha) was above the conventional threshold (0.7) for the three scales (evidence, context, and facilitation), and nearly all sub-scales. Assessments of the 3-scale internal structure of the instrument through confirmatory factor analysis showed reasonably good model fit for the three scales.

My analysis revealed some issues of concern that suggest a need for further refinement and testing of this questionnaire in the Indonesian context, particularly with the subscales of the evidence domain. The internal consistency (Cronbach's alpha) for two of the evidence subscales (research evidence and practice experience) failed to reach an acceptable threshold of 0.7. The low factor loadings from individual items in the same evidence subscales following CFA analysis indicate that some items might not be related to the subscale. These items may need to be revised for future administration of the instrument.

The internal consistency for the overall evidence scale with Indonesian health care workers in this sample was fair, despite the results of the two subscales noted above. The internal consistency of a scale as measured by Cronbach's alpha is intended to reflect how the items relate to one another to measure the construct of interest. A low alpha value therefore may indicate

that items are related to more than one construct and not just the one intended for measure (i.e. not uni-dimensional). It may also suggest that an item does not accurately contribute to measure a construct. Alpha values are also sensitive to the number of items in the scale as well as the sample size of respondents. Increases in these parameters can artificially inflate the alpha value (77). Conversely, too few items in a scale may negatively impact the internal constancy.

The research evidence subscale consists of four items that ask respondents to rate the organizational change (EMAS program) based on the level of evidence from current research. While the first two items, 3a (changes are supported by results from other locations) and 3b (should be effective, based on current organizational management knowledge) require respondents to think about current research evidence, the second two items, 3c (are experimental, but may improve patient outcomes) and 3d (implementation likely won't make much difference in patient outcomes), ask respondents to make a prediction about the impact of the change program on health outcomes. The low alpha level for this subscale is similar to that found with samples from the Veteran's Affairs interventions in the U.S. (58). The authors proposed that there could be conceptual differences in these items: while the first two items ask respondents to assess a current evidence state, the latter two items ask respondents to make a prediction. The low CFA factor loadings for items 3c and 3d combined with low inter-item correlations (<0.3) suggest these items were not strongly related to the other items in the subscale, nor the research evidence construct.

The practice experience subscale consists of three items that ask respondents to reflect on current support for the change program from other clinicians, including thought leaders (4b) in providing services in hospital facilities. The third item (4c) asked respondents whether the

change program has been attempted previously in the hospital, to which I expected consensus since the EMAS program was being implemented for the first time. Inter-item correlations among these items were poor, and the factor loading for item 4c suggest that this item did not relate to the subscale for this health worker sample.

This sample of Indonesian health workers provides greater support for the context and facilitation scale as described through the internal reliability and CFA results. The Context scale consists of subscales that ask respondents to provide perspectives on organizational culture related to leadership, staff, and opinion leaders, as well as evaluation practices and availability of resources. Prior studies have identified organizational factors that were significantly related to implementation of system changes in a dental care organization (45), implementation of hepatitis prevention services (20), and the implementation of efforts to improve neonatal health and survival (40).

I recognize there are certain limitations with this study, beginning with the generalizability of the results from this health worker sample. The ORCA instrument was carefully adapted to the Indonesian health context and administered to a sample of health workers that all work in maternal and newborn health services. This may limit the generalizability of the results beyond Indonesia and similar health service environments. However, the sample of hospitals used in this study represents both public and private facilities, with perspectives from several different health workers. At each hospital, I asked a variety of health workers to complete the ORCA instrument while in each other's presence. This may have contributed to social desirability bias since nurses, midwives, and physicians were responding to items that in some cases referred to their seniors who may have been present. I controlled for this by ensuring responses would be kept

confidential, used only for research purposes, and keeping questionnaires anonymous. However, the response patterns (e.g., lack of extreme values) that I found in the ORCA questionnaire data may be a result of social desirability bias. Another potential limitation of this study is related to the nature of the organizational change used to validate the ORCA instrument. The EMAS program is made up of multiple evidence-based practice changes relating to emergency obstetric service delivery. It is conceivable that health workers would have distinct responses for evidence, context, and facilitation for each of the practice changes they participated in. In this study, I used the ORCA instrument to assess all of the practice changes together, using one evidence statement at the beginning of the instrument to refer to the EMAS program in its entirety. However, as noted by the original developers of the ORCA, the potential measurement error from this response pattern would likely result in inflated variance levels within scales and therefore bias results toward the null (58). This was not observed in the data.

To my knowledge, this is the first study to translate and validate an instrument for measuring ORC in an Indonesian health care context. The psychometric data for the translated version of the ORCA instrument were generally acceptable for this Indonesian health worker population. The study revealed important issues with the current version of the ORCA instrument, most notably the evidence subscales where items failed to meet thresholds for internal consistency. Future work can build on these results by evaluating the content of the items on these subscales and how the items relate to the research evidence and practice experience constructs.

Table 3.2 Descriptive Statistics for Indonesian Health Worker Sample for ORCA Validation.

	Demographic Characteristic	n (%)
Gender	Female	568 (78.8)
	Male	146 (20.1)
	Missing	7 (1.0)
Age	20-24	67 (9.3)
	25-29	158 (21.9)
	30-34	137 (19.0)
	35-39	114 (15.8)
	40-44	82 (11.4)
	45-49	58 (8.0)
	50-54	41 (5.7)
	55-59	13 (1.8)
	60-64	4 (0.6)
	>= 65	7 (1.0)
	Missing	40 (5.6)
Highest Education	High School	6 (0.8)
	3-year diploma	407 (56.5)
	4-year diploma/university	235 (32.6)
	Masters/PhD	53 (7.4)
	Missing	20 (2.8)
Clinical Experience	0-4 (yrs)	182 (25.2)
	5-9	182 (25.2)
	10-14	100 (13.9)
	15-19	87 (12.1)
	20-24	67 (9.3)
	25-29	30 (4.2)
	>30	29 (4.0)
	Missing	44 (6.1)
Leadership Experience	0-4 (yrs)	97 (13.5)
	5-9	52 (7.2)
	10-14	14 (1.9)
	15-19	19 (2.6)
	>20	9 (1.3)
	No Experience	491 (68.1)
	Missing	39 (5.4)

Table 3.3 Data quality for ORCA instrument in an Indonesian sample of health workers (n=721).

Scale	Item	n	Mean (SD)	Median	Missing (%)	Floor (%)	Ceiling (%)	Cronbach's alpha
Evidence		654	3.77 (0.33)	3.75	68 (9.24)	0	0.42	0.72
	1	686	4.08 (0.70)	4.00	35 (4.85)	0.41	23.72	--
	2	698	3.84 (0.66)	4.00	23 (3.19)	0.27	9.92	--
	3a,b,d	700	3.58 (0.38)	3.50	21 (2.85)	0	0.82	0.46
	4a-c	699	3.69 (0.46)	3.67	22 (2.99)	0	1.39	0.34
	5a-d	711	3.99 (0.46)	4.00	10 (1.39)	0	4.30	0.72
Context		667	3.90 (0.46)	3.96	54 (7.49)	0	0.83	0.94
	6a-c	715	3.86 (0.64)	4.00	6 (0.83)	0.28	5.55	0.82
	7a-d	697	3.88 (0.60)	4.00	24 (3.33)	0.14	4.02	0.85
	8a-d	690	3.93 (0.62)	4.00	31 (4.30)	0	6.80	0.88
	9a-d	711	4.00 (0.51)	4.00	10 (1.39)	0	7.21	0.87
	10a-d	717	4.02 (0.50)	4.00	4 (0.55)	0	7.49	0.84
	11a-d	705	3.74 (0.64)	4.00	16 (2.22)	0.27	5.27	0.85
Facilitation		585	3.93 (0.42)	4.00	136 (18.86)		0.83	0.97
	12a-d	713	3.92 (0.53)	4.00	8 (1.11)	0	5.55	0.87
	13a-d	715	3.88 (0.50)	4.00	6 (0.83)	0	5.13	0.85
	14a-d	706	3.91 (0.49)	4.00	15 (2.08)	0	4.02	0.83
	15a-d	706	3.97 (0.52)	4.00	15 (2.08)	0.14	6.38	0.87
	16a-c	695	3.94 (0.49)	4.00	26 (3.61)	0	5.41	0.84
	17a-d	693	3.84 (0.60)	4.00	33 (4.48)	0	6.25	0.89
	18a-d	669	3.85 (0.54)	4.00	52 (7.21)	0.14	4.30	0.86
	19a-f	670	3.98 (0.56)	4.00	51 (7.07)	0	9.71	0.92
	20a-e	669	3.91 (0.51)	4.00	52 (7.21)	0	4.85	0.89

Table 3.4 Results of the Confirmatory Factor Analysis showing the standardized factor loadings and standardized residuals for each sub-scale and item when modelled with its own scale.

Scale	Standardized Factor Loadings
Evidence Scale	
Staff discord over evidence	
Q1	0.74
Q2	0.79
Research Evidence	
Q3a	0.53
Q3b	0.75
Q3c	0.18
Q3d	0.36
Clinical Experience	
Q4a	0.76
Q4b	0.64
Patient Needs	
Q5a	0.58
Q5b	0.75
Q5c	0.62
Q5d	0.55
Context Scale	
Leadership Culture	0.73
Q6a	0.80
Q6b	0.81
Q6c	
Staff Culture	0.82
Q7a	0.83
Q7b	0.86
Q7c	0.56
Q7d	
Leadership Practice	0.69
Q8a	0.80
Q8b	0.90
Q8c	0.84
Q8d	
Evaluation / Accountability	0.85
Q9a	0.86
Q9b	0.73
Q9c	0.74
Q9d	
Opinion Leaders	0.72
Q10a	0.81
Q10b	0.77
Q10c	0.75
Q10d	
General Resources	0.80
Q11a	0.85
Q11b	0.86
Q11c	0.62

Q11d	
Facilitation Scale	
Leader Practices	
Q12a	0.82
Q12b	0.84
Q12c	0.82
Q12d	0.65
Clinical Champion	
Q13a	0.80
Q13b	0.86
Q13c	0.67
Q13d	0.75
Leadership Implementation Roles	
Q14a	0.68
Q14b	0.82
Q14c	0.80
Q14d	0.68
Implementation Team Roles	
Q15a	0.76
Q15b	0.82
Q15c	0.74
Q15d	0.81
Implementation Plan	
Q16a	0.79
Q16b	0.83
Q16c	0.76
Project Communication	
Q17a	0.75
Q17b	0.80
Q17c	0.86
Q17d	0.83
Project Progress Tracking	
Q18a	0.75
Q18b	0.80
Q18c	0.81
Q18d	0.72
Project Resources and Context	
Q19a	0.75
Q19b	0.85
Q19c	0.84
Q19d	0.83
Q19e	0.82
Q19f	0.84
Project Evaluation	
Q20a	0.75
Q20b	0.76
Q20c	0.74
Q20d	0.83
Q20e	0.83

Table 3.5 Confirmatory Factor Analysis model statistics for ORCA in an Indonesian sample of health workers.

ORCA Scale	χ^2	*df*	*p*	RMSEA	CFI	SRMR
Evidence Scale: Statement Assessment (2) + Existing evidence (4) + Practice Exp. (2) + Patient Needs (4)	114.8	48	<0.001	0.046 [0.035, 0.057]	0.97	0.03
Context Scale: Leadership culture (3) + Eval/Acct (4) + Leadership practice (4) + Staff culture (4) + Opinion leader culture (4) + Resources (4)	797.7	215	<0.001	0.064 [0.059, 0.069]	0.94	0.04
Facilitation Scale: Leadership roles in planning (4) + Project champion (4) + Leadership roles in support (4) + Implementation team roles (4) + Implementation plan (4) + Communication (4) +Assessment (4) + Project resources (6) + Evaluation (5)	2421.8	629	<0.001	0.066 [0.063, 0.068]	0.90	0.04

Chapter 4: Analysis of association between Organizational Readiness for Change Scores and Achievement of Maternal Clinical Standards

4.1 Introduction

This research study examines the association of the three scales from the Indonesian-adapted ORCA instrument (Evidence, Context, and Facilitation) described in chapter three with successful implementation of maternal clinical standards measured by observational assessments by EMAS program personnel using standard monitoring tools. The association is evaluated at four time points (quarters) over the course of the study period. The EMAS Program took place in Indonesia from 2011 to 2017, and program implementation was staggered over three phases during that period. This study presents an analysis of program monitoring data from the third and final phase of the EMAS program from April 2015 to December 2016.

4.2 Methods

4.2.1 *Design*

This study assesses whether a higher level of organizational readiness for change, indicated by a higher score on the ORCA scales, is predictive of increased implementation of routine labor and childbirth practices and management of emergency complications according to clinical standards and evidence-based practices following completion of a peer-to-peer mentoring intervention during the third phase of the EMAS program in Indonesia.

4.2.2 *Study Sites*

I approached all the hospitals from the third phase of the EMAS program. Hospitals were located in the three following Indonesian provinces: East Java, Central Java, and West Java. EMAS program hospitals were located in districts identified based on the greatest number of pregnant

women and the highest maternal and newborn mortality. Within a district, EMAS selected a hospital to participate in the program if the facility was accredited, a positive working relationship existed between facility directors and local government officials, social insurance schemes were implemented, and the hospital had autonomy over its budget. Hospitals selected for EMAS program implementation were well equipped, there were sufficient number of trained health care workers available, and midwives, general physicians, and obstetricians were all trained in normal delivery, basic emergency obstetric and newborn care (BEmONC), and comprehensive emergency obstetric and newborn care (CEmONC) (37). All classes of hospital accreditation were included in the sample (A, B, C, and D). The hospital accreditation class is an indication of the number of specialty and sub-specialty services available, where class A hospitals offer specialty and a wide array of sub-specialties and also act as the top referral facilities.

4.2.3 *Measures*

The ORCA questionnaire was adapted to the Indonesian health context through translation and cultural adaptation. Validation and psychometric analysis were examined prior to proceeding with analysis. All three primary scales of the ORCA were used (see Table 3.1, chapter 3); these included the Evidence scale, the Context scale, and the Facilitation scale. The Evidence scale includes five items that ask respondents to rate the evidence for the EMAS intervention. These items are divided into subscales that (i) compare the perceptions of hospital health care workers and leadership regarding the strength of research evidence for the intervention, (ii) measure perceptions of evidence supported by prior clinical experience, and (iii) ask for opinions about intervention evidence aligning with patient needs.

The items on the context scale are divided into six subscales that ask respondents about factors that contribute to organizational culture in their facility. These include (1) leadership culture such as whether leadership is open to staff innovation and opinions; (2) evaluation and accountability meaning clear performance goals and regular feedback between leadership and staff; (3) leadership practice such as clearly defining roles and promoting team building; (4) staff culture meaning sense of responsibility, presence of cooperation, and acceptance for change; (5) opinion leader culture meaning the role of informal leadership in shaping service quality and change; (6) and the availability of institutional resources to support organizational change.

The items on the facilitation scale are divided into nine subscales that ask respondents about how the current intervention is being implemented at their health facility. These include (1) leadership characteristics in planning such as providing clarity in projects and goals; (2) the role of clinical champions to assume and exercise authority for the success of an intervention; (3) senior leadership roles in support through prioritizing the intervention and involvement in it; (4) implementation team member roles such as clear roles, responsibilities, and sufficient time resources; (5) the implementation plan meaning task division and support appropriate with education and skills; (6) methods of communication such as regular meetings and channels for feedback between staff and leadership; (7) intervention assessments meaning regular support for collection and analysis of feedback from patients and staff; (8) whether intervention resources are available such as equipment, protocols, and incentives; (9) and mechanisms of evaluation such as regular satisfaction surveys for patients and staff as well as review by senior leadership.

Study participants indicated their level of agreement to all 77 items on the Indonesian version of the ORCA instrument using a 5-point likert-type scale (1 = strongly disagree; 5 = strongly agree). Individual mean scores for each scale (evidence, context, and facilitation) were estimated from the scale items. Individual mean scores were then aggregated per scale within each hospital to produce one facility score for each ORCA scale per hospital.

4.2.4 *Questionnaire respondents*

ORCA scale data was collected once at each hospital in the fourth quarter of 2015 or the first quarter of 2016. Within each hospital that we approached, organizational readiness for change was measured using the Indonesian version of the ORCA questionnaire described in the psychometric analysis in chapter 3. Study subjects completing the ORCA questionnaire included health care workers from those areas of the hospital that participated in the EMAS program (labor and delivery room and emergency room). A field researcher explained the background and goals of the study, including the purpose of the ORCA questionnaire prior to its administration. Participants were provided with a letter describing the study and the meaning of informed consent, and consent was assumed if the questionnaire was completed. At each hospital, the sample of respondents included physicians (general practitioners and specialists), midwives, nurses, and support staff that had a functional role in one of the wards where program implementation took place. If a respondent did not complete at least 50% of the items, then the questionnaire was excluded from the analysis.

4.2.5 *EMAS Mentoring Intervention and Clinical Standard Assessments*

The EMAS program engaged in peer-to-peer mentoring between hospitals and mentor teams as a primary approach to improve service quality, clinical governance, and accountability at hospitals and referral centers (37). Mentoring teams introduced standards of good care and practice in maternal and newborn health while focusing on accountability, communication, and on-going learning. The mentoring activities followed a systematic schedule that included two types of visits. First, mentee hospital staff visited and observed mentor hospitals with high quality services. Second, mentoring teams engaged mentees in their own hospitals through coaching, assessments, and the development of action plans to meet standards of good care. The mentoring approach emphasized improved performance, motivation among high-performers to become mentors, and sustainability through the connections that were developed between personnel and facilities that could be relied upon after the program ended (37). EMAS conducted peer-to-peer mentoring in all three phases of the program, however the composition of mentoring teams evolved as hospitals from the first phase showed improved performance. In phase one of the program, mentoring teams were deployed entirely from the LKBK facility. In phase two and phase three, mentoring teams were drawn from high-performing phase one hospitals in addition to LKBK.

Clinical standards for routine labor and childbirth practices and management of emergency complications were used to guide the EMAS peer-to-peer mentoring approach. These clinical standards align with the Indonesian Ministry of Health national clinical guidelines to define and measure facility readiness for the prevention of select maternal and newborn complications. The clinical standards cover six maternal and seven newborn clinical practices,

two standards cover management components to emphasize functionality of clinical governance systems and one additional standard covers infection prevention.

EMAS developed monitoring tools to assess health care workers compliance with clinical standards (Table. 4.1). Each monitoring tool is associated with a measurable outcome that can be observed and scored yes/no. For medical chart review items, assessors marked a score yes/no if the information was documented in the chart. The total score for each monitoring tool represents the proportion of achieved criteria (whether observed in practice or found in medical charts). A summary of components for each monitoring tool is shown in Table 4.2.

Table 4.1 Monitoring tools for evaluation of clinical standards.

Maternal Care	Neonatal
Tool 1. Emergency Response	Tool 1. Emergency Response
Tool 2. Active Management of the Third Stage of Labor for Prevention of Postpartum Hemorrhage	Tool 2. Neonatal Resuscitation
Tool 3. Management of Postpartum Hemorrhage	Tool 3. Management of Newborn Sepsis
Tool 4. Pre-eclampsia /Eclampsia Management	Tool 4. Administration of Antenatal Steroids
Tool 5. Management of Maternal Sepsis and Severe Infection	Tool 5. Early and exclusive breast feeding
Tool 6. Management of Obstructed Labor	Tool 6. Kangaroo Mother care
Clinical Governance	Tool 7. Neonatal Low Birth Weight
Tool 1. Audits and Dashboard Indicators	Infection Prevention
Tool 2. Patient Feedback	Tool 1. Basic Infection Prevention

EMAS program personnel, including obstetric specialists and departments heads, used the monitoring tools to conduct the clinical assessments through observations of clinical practices and chart reviews. Assessments took place in all areas where maternal and newborn care is provided including observation rooms, delivery rooms, postpartum and perinatology rooms, operating rooms, emergency rooms and any relevant sterile areas. During phase three,

EMAS conducted clinical assessments in each participating hospital starting in April 2015 and then at quarterly intervals thereafter until the program end date (December 2016).

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Table 4.2 Maternal monitoring tools used by EMAS program to measure compliance with clinical standards.

Monitoring Tool for Clinical Standard 1: Obstetric Emergency Response in Hospitals	**Monitoring Tool for Clinical Standard 2: Active Management of the Third Stage to Prevent Postpartum Hemorrhage in Hospitals**	**Monitoring Tool for Clinical Standard 3: Postpartum Hemorrhage Management in Hospitals**	**Monitoring Tool for Clinical Standard 4: Management of Severe Preeclampsia/Eclampsia in Hospitals**	**Monitoring Tool for Clinical Standard 5: Management of Maternal Sepsis and Severe Infection in Hospitals**	**Monitoring Tool for Clinical Standard 6: Management of Obstructed Labor in Hospitals**
Emergency team ready to manage pregnant or postpartum woman with life-threatening condition	Medical record documentation	Medical record documentation	Medical record documentation	Medical record documentation	Complete and accurate partograph are available to monitor all women in labor
Instruments and equipment for emergency management available and ready for use	Standard Operational Procedure (SOP) in health facility	Health facility has a blood bank with blood supply for transfusion	Appropriate drugs and equipment are always available at the health facility	Antibiotics for management of sepsis puerperalis are available in the health facility	Health facility has a Standard Operational Procedure (SOP) for labor management using partograph
Emergency trolley checked regularly	Instruments and equipment are available and ready-to-use and kept appropriately	Standard Operational Procedure (SOP) in health facility	Magnesium sulphate is the first choice of therapy to prevent and manage seizure in severe preeclampsia/eclampsia	Standard Operational Procedure (SOP) in health facility	Algorithm/job aid for partograph use is clearly visible in the delivery room of the hospital
Algorithm/job-aid for obstetric emergency posted and clearly visible.	Uterotonic (Oxytocin) prepared in an appropriate dose before delivery	Health facility performs audit for all postpartum hemorrhage with high morbidity or mortality	Standard Operational Procedure (SOP) in health facility	Health facility has a Standard Operational Procedure (SOP) for prophylactic antibiotics in the following situations:	Medical records document appropriate management for all c-section cases

				Women with rupture of membrane >/= 18 hours Women undergo C-section	
Unit/room schedules and performs routine drill for obstetric emergency	Health facility has an applicable system for assessing necessary clinical skills	Health facility has an applicable system for assessing necessary clinical skills	Health facility provides technical updates on diagnosis and management of severe preeclampsia/eclampsia	Health facility provides technical updates on diagnosis and management of maternal infection	Health facility has the capacity to do safe c-section
	Health care workers at the health facility are competent to demonstrate the active management of the third stage	Health care workers at the health facility are competent to demonstrate the management of postpartum hemorrhage	Facility reviews all severe preeclampsia/eclampsia cases related to high morbidity and mortality	Facility audits all postpartum/post-abortion infection cases with high morbidity and mortality	Competent health provider is present to provide essential care to neonates and resuscitation in each c-section
			Health facility has an applicable system for assessing necessary clinical skills		Strict observation is performed to all post-c-section cases in the recovery room
			Health care workers at the health facility are competent to demonstrate the management of severe preeclampsia/eclampsia		Health facility performs audit for all obstructed labor cases that relate to high morbidity and mortality

During phase 3, EMAS conducted clinical assessments in each participating hospital starting in April 2015 and then at quarterly intervals thereafter until the program end date (December 2016). EMAS program personnel, including obstetric specialists and departments heads, used the monitoring tools to conduct the clinical assessments using observation of clinical practices and chart reviews. Assessments took place in all areas where maternal and newborn care is provided including observation rooms, delivery rooms, postpartum and perinatology rooms, operating rooms, emergency rooms and any relevant sterile areas. The proportion of achieved criteria (whether observed or found in medical charts) was recorded in percent (%) for each monitoring tool. I considered baseline clinical assessment scores above 80% as an indication that health care workers were already compliant with clinical standards. Therefore, hospitals were excluded from further analysis if baseline clinical assessment scores were equal to or greater than 80% for a clinical standard.

To estimate implementation success, I use the total score on each EMAS clinical assessment monitoring tool following each quarter beginning with the first quarter of 2016 and ending with the fourth quarter of 2016. The clinical assessment score from the fourth quarter of 2015 is used as a baseline measure to adjust for differences among hospitals. Most hospitals in the study began the peer-to-peer mentoring activities at the beginning of Phase 3, in April 2015, but due to expansion of the EMAS program to additional districts, implementation was delayed in some hospitals; as a result, initiation of mentoring activities and clinical assessments varied across hospitals.

While current theory for organizational readiness for change suggests that the appropriate time for assessing ORC is prior to the start of implementation, this was not always

feasible due to limited research resources. Therefore, administration of the ORCA questionnaire also varied based on the location of the health facility and the time needed to complete local research regulatory processes. I controlled for EMAS mentoring activities and clinical assessments that took place prior to the ORCA questionnaire assessment (yes/no) in our analysis..

4.2.6 *Interrater Agreement & Interrater Reliability*

At each hospital, data collection with the ORCA questionnaire was completed per individual with the intent of aggregating scores to the organizational (hospital) level. Consistent with other multi-level and organizational research, I estimated the inter-rater reliability and inter-rater agreement of ORCA scores to justify aggregating from an individual level to one score per scale for each hospital. I used two complimentary methods that include the index r_{wg} and intraclass correlation coefficients (ICC1 and ICC2). The index r_{wg} is an indicator of inter-rater agreement within groups that is used to justify aggregation of individual data to a group-level mean. This index compares the observed variance among the responses within a group to an expected variance if responses were made at random. The following formula is used to compute the value for r_{wg}, where J is the number of items included in the scale, s_{xj}^2 is the mean observed variance for all of the raters over all the items on the scale, and σ_E^2 is the expected variance if all of the raters responded completely at random.

$$r_{WG(J)} = \frac{J\left(1 - \frac{s_{xj}^2}{\sigma_E^2}\right)}{J\left(1 - \frac{s_{xj}^2}{\sigma_E^2}\right) + \frac{s_{xj}^2}{\sigma_E^2}}$$

Following current practice, I compared the observed variance to a rectangular or equal opportunity distribution (for a 5-point scale, $\sigma^2_E = 2.0$). Current practice uses a r_{wg} value of 0.7 and above to justify aggregation (78–80). I measured the r_{wg} index for the ORCA scale scores of individual health workers using each hospital as a group level.

The intraclass correlation coefficients are indications of group-level variance. The first intraclass correlation coefficient, ICC(1), describes the proportion of variance in the scale that may be attributed to group-membership, or in this case hospital-membership (81). meaning the amount of variance among individual level scores that is explained by a group-level mean score (78). The ICC(2) is a measure of reliability for group-level means. The ICC(2) is a function of ICC(1) but also group size, so it is possible to have high ICC(2) values even where ICC(1) values are low. Both intraclass correlation coefficients are calculated using a one-way random effects ANOVA where in this case, the hospitals are treated as the random effect. These indices describe relative consistency (reliability) and absolute consensus (agreement) between individual responses. ICC(1) and ICC(2) are calculated using the following formulas where *MSB* = Mean Square Between; *MSW* = Mean Square Within; and *N* = number of Individuals in the group.

$$ICC(1) = \frac{MSB - MSW}{MSB + (N-1)MSB}$$

$$ICC(2) = \frac{MSB - MSW}{MSB}$$

4.2.7 *Association between ORCA scores and Clinical Assessment Scores*

Descriptive statistics were generated for demographics and the ORCA scales at each hospital. I generated multiple linear regression models to examine the association between each ORCA scale (Evidence, Context, Facilitation) and each clinical standard at four time points (quarters). The clinical assessment scores at each quarter in 2016 (quarter 1 – quarter 4) from each clinical standard assessment were regressed as a dependent continuous variable on each of the ORCA scale scores. Baseline clinical assessment scores were used to control for initial differences in scores between hospital facilities. For each clinical standard that was assessed with an EMAS monitoring tool, I used four scores coinciding with the four quarters in the study period. Four facility-level covariates were assessed in each model that included the mean education level of the health workers, the average number of normal (vaginal) deliveries per month, the mean clinical experience of health workers in years, and the mean leadership experience of health workers in years. In addition, I controlled for mentoring activities and clinical assessments that took place in hospitals before the baseline ORCA measure was taken. Covariates were removed through backward selection if a p-value for a Wald statistic was greater than 0.05. Robust standard errors were used with all linear regression models to account for heteroscedasticity. Covariance between variables was assessed by making sure variance inflation factors remained less than 2.0 for covariates in the linear models. The predicted clinical assessment score at each of the four quarters for each clinical standard in association with each ORCA scale score was examined, and I report the coefficients (β) and 95% confidence intervals, as well as R^2 values for the evidence, context, and facilitation scales in each model.

4.3 Results

I approached 37 hospital facilities that were all participating in the third phase of the EMAS program. Following data collection, one hospital was excluded due to not completing the EMAS program, and this left a final sample of 36 hospitals (Figure 1.1). The hospitals were located in three provinces, namely Central Java (44%), East Java (25%), and West Java (31%) (Table 4.3). The sample included hospitals of all four classes A, B, C, and D with the majority of hospitals accredited as class B and C (92%). According to administration type, the sample included slightly more private hospitals (53%) than public hospitals. The number of childbirth deliveries at each hospital was reported on a monthly basis during the program period. An average number of births per month is reported for each facility in Table 4.3. The average number of births per month during this period varied with the size of the facility, from 19 at the smallest facility to 354 at the largest facility.

4.3.1 *Baseline ORCA Score*

I administered the ORCA questionnaire instrument during the fourth quarter of 2015. The respondents for the ORCA questionnaire included health care workers participating in the EMAS program mentoring activities at each hospital. The number of respondents varied between 14-34 within hospitals. I reached a total of 721 health care workers across all 36 hospitals. After removing questionnaires from respondents that were less than 50% complete, the final sample of respondents was 716. The majority of respondents were female (79.5%) and completed a 3-year diploma in nursing or midwifery (55.6%). Approximately one-fifth (21.1%) completed a 4-year diploma/university degree in nursing or medicine. Among the respondents of each hospital

the sample included the following professions: nurses (38.4%), midwives (41.4%), general physicians (11.6%), specialists (4.7%), and management or administrative staff (3.9%).

The mean ORCA scores for the three scales and each hospital facility are shown in figures 4.1-3. Individual responses are aggregated to the facility level for each scale (evidence, context, and facilitation). All of the ORCA aggregated facility scores are above the midrange (2.5 on a 5-point scale) (Table 4.3). Across all hospitals from the provinces of East Java, Central Java, and West Java, aggregated mean scores for the evidence scale range from 3.5 – 4.0, the context scale from 3.1 – 4.3, and the facilitation scale from 3.1 – 4.2 (Table 4.3). The mean ORCA scores across all the facilities are 3.77 (SD = 0.13) for the evidence scale, 3.88 (SD = 0.27) for the context scale, and 3.90 (SD = 0.23) for the facilitation scale.

The results of the interrater agreement and interrater reliability indices are described in Table 4.5. Values for r_{wg} are shown for each ORCA scale based on the mean observed variance for the items in each scale compared to a null distribution. All values fell above the accepted threshold of 0.7 to support aggregation to a group-level (81). ICC(1) values suggest only a small amount of individual level variability is attributed to group-membership (hospital), but ICC(2) values suggest that group means are moderately reliable and differentiated from one another.

Table 4.3 Hospital demographics and aggregated mean ORCA scores at baseline (quarter 4, 2015).

Site No.	Prov.	Normal Deliveries / Month	Questionnaire Respondents (n = 635)	Years of experience (Mean (SD))	Facility Class	Organizational Readiness for Change Assessment (ORCA) Mean Hospital Scores*		
						Evidence	Context	Facilitation
01	WJ	191	30	5.13 (2.81)	C	3.71 (0.33)	3.86 (0.39)	3.98 (0.25)
02	WJ	72	14	4.56 (4.43)	C	3.62 (0.34)	3.75 (0.25)	3.80 (0.21)
03	WJ	108	28	21.9 (13.63)	B	3.81 (0.40)	4.11 (0.40)	4.03 (0.44)
04	WJ	78	18	11.44 (6.54)	C	3.73 (0.27)	3.88 (0.36)	3.88 (0.24)
05	WJ	354	22	13.38 (9.11)	B	3.79 (0.33)	3.93 (0.47)	4.03 (0.36)
06	WJ	19	17	9.31 (11.76)	D	3.73 (0.42)	3.67 (0.54)	3.94 (0.45)
07	WJ	191	18	7.08 (5.15)	B	3.81 (0.21)	3.91 (0.39)	3.78 (0.27)
08	WJ	19	16	7.87 (6.07)	C	3.85 (0.26)	3.89 (0.23)	3.86 (0.24)
09	WJ	105	19	7.48 (7.32)	C	3.64 (0.24)	3.85 (0.20)	3.93 (0.34)
10	WJ	188	34	14.82 (6.98)	B	3.85 (0.34)	4.00 (0.44)	4.04 (0.38)
11	WJ	185	17	8.91 (7.48)	B	3.67 (0.19)	3.53 (0.38)	3.86 (0.19)
12	CJ	34	20	20.30 (9.11)	C	3.75 (0.22)	4.22 (0.35)	4.04 (0.35)
13	CJ	264	24	10.00 (8.06)	C	3.78 (0.19)	4.28 (0.25)	4.05 (0.12)
14	CJ	103	21	8.29 (4.92)	C	3.90 (0.13)	4.01 (0.25)	3.99 (0.16)
15	CJ	243	20	10.7 (8.26)	B	4.00 (0.34)	4.11 (0.53)	4.17 (0.57)
16	CJ	136	21	7.5 (6.57)	B	3.74 (0.36)	3.66 (0.39)	3.84 (0.24)
17	CJ	112	20	12.18 (7.84)	C	3.85 (0.19)	3.23 (0.48)	3.42 (0.28)
18	CJ	201	18	7.97 (6.51)	C	3.81 (0.26)	3.87 (0.39)	3.92 (0.15)
19	CJ	108	19	6.21 (5.15)	C	3.85 (0.36)	4.05 (0.24)	4.01 (0.39)
20	CJ	129	19	8.06 (8.16)	C	3.62 (0.30)	4.01 (0.25)	3.96 (0.28)
21	CJ	105	23	15.27 (7.57)	C	3.80 (0.21)	4.03 (0.30)	4.04 (0.21)
22	CJ	82	22	9.36 (4.50)	A	3.72 (0.33)	4.04 (0.26)	4.01 (0.26)
23	CJ	51	18	7.51 (7.91)	C	3.82 (0.11)	3.85 (0.33)	4.01 (0.18)
24	CJ	121	22	15.36 (7.99)	C	3.90 (0.40)	4.22 (0.36)	4.23 (0.42)
25	CJ	136	12	11.27 (8.96)	C	3.85 (0.42)	3.93 (0.25)	3.97 (0.38)
26	CJ	79	26	6.00 (5.72)	C	3.49 (0.47)	3.14 (0.55)	3.10 (0.58)
27	CJ	207	24	13.95 (8.41)	B	3.73 (0.24)	4.07 (0.47)	4.01 (0.29)
28	EJ	84	15	9.79 (10.57)	D	3.64 (0.48)	3.52 (0.51)	3.71 (0.64)
29	EJ	28	17	9.18 (10.02)	C	3.77 (0.31)	3.99 (0.41)	4.12 (0.41)
30	EJ	--	21	6.46 (5.24)	D	3.79 (0.33)	3.76 (0.52)	3.81 (0.50)
31	EJ	155	15	19.29 (8.52)	B	3.99 (0.34)	4.02 (0.38)	4.12 (0.43)
32	EJ	68	15	18.79 (5.73)	C	3.98 (0.40)	3.64 (0.48)	3.70 (0.70)
33	EJ	41	18	8.06 (5.73)	C	3.68 (0.26)	3.89 (0.29)	3.83 (0.32)
34	EJ	122	17	17.77 (9.33)	B	3.77 (0.20)	4.01 (0.27)	3.96 (0.21)
35	EJ	120	22	6.24 (3.22)	C	3.74 (0.17)	4.18 (0.32)	4.07 (0.29)
36	EJ	95	18	14.74 (6.21)	D	3.99 (0.40)	4.20 (0.45)	4.08 (0.43)

* ORCA scores are aggregated from health care workers at hospital (standard deviations).
WJ = West Java, CJ = Central Java, EJ = East Java

Table.4.4 Interrater Agreement (IRA) and Reliability (IRR) Indicies for the ORCA scales estimated.

IRA & IRR Indices	ORCA Scale		
	Evidence	**Context**	**Facilitation**
r_{wg} (range)	0.91 to 0.99	0.95 to 0.99	0.94 to 0.99
ICC(1)	0.07	0.29	0.26
ICC(2)	0.57	0.89	0.85

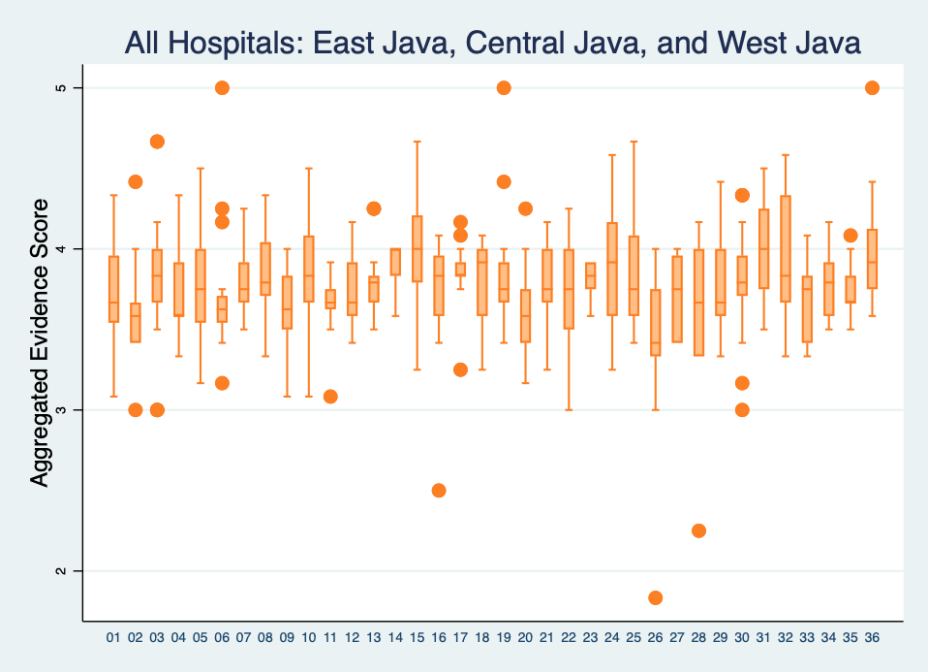

Figure 4.1 Mean evidence scores (ORCA) by EMAS facility measured at quarter four, 2015.

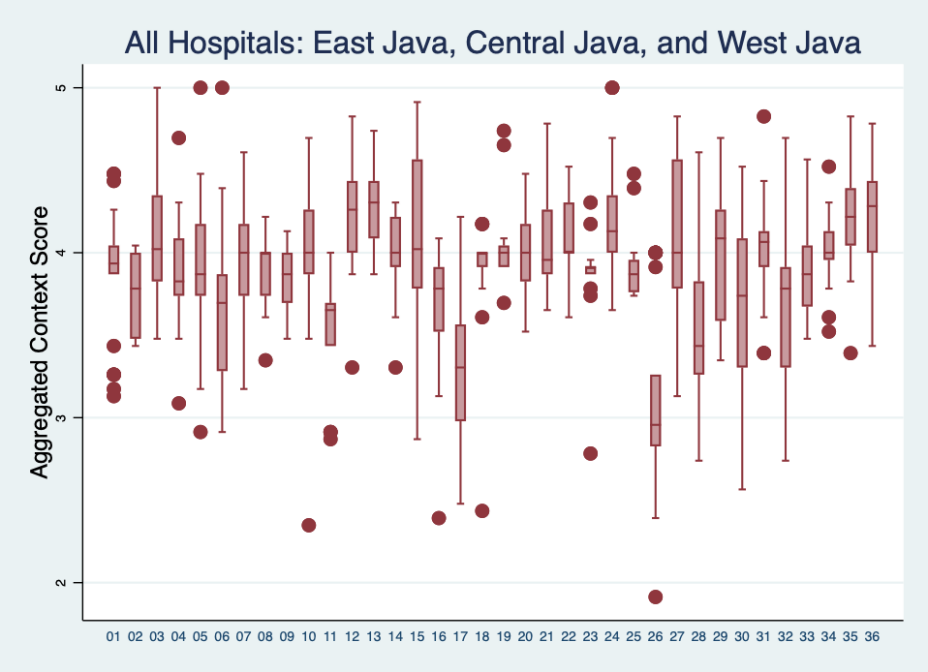

Figure 4.2 Mean context scores (ORCA) by EMAS facility measured at quarter four, 2015.

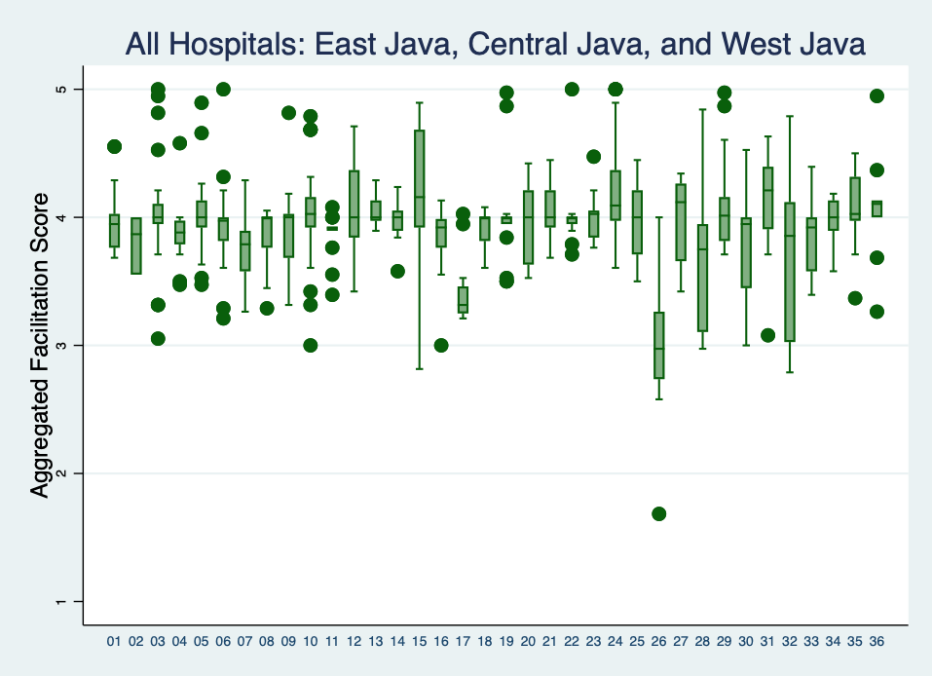

Figure 4.3 Mean facilitation scores (ORCA) by EMAS facility measured at quarter four, 2015.

4.3.2 *EMAS Maternal Clinical Standard Assessments*

Beginning with the fourth quarter of 2015 and ending with the fourth quarter of 2016, the EMAS program conducted quarterly clinical standard assessments using the EMAS monitoring tools to measure compliance with maternal clinical standards in hospitals. The mean scores for all hospitals are shown in Table 4.4. Mean maternal clinical standard assessment scores increased incrementally over the study period for all maternal clinical standards. The mean assessment score for the first clinical standard to manage obstetric emergency responses increased by nearly 50 percentage points to 79.44 by the fourth quarter of 2016. The mean assessment score for the fifth clinical standard to manage maternal sepsis and severe infection increased by 40 percentage points to 90.89. Standard deviations decreased over the course of the study period. Hospitals were already achieving high mean assessment scores on two clinical standards, active management of the third stage of labor (standard 2) and management of severe preeclampsia/eclampsia (standard 4) at the baseline measurement. Many of the hospitals in the sample achieved 100% by the final assessment for standard two and four.

Table 4.5 Mean Maternal Clinical Standard Assessment Scores from EMAS hospitals*Error! Use the Home tab to apply 0 to the text that you want to appear here.*

Maternal Clinical Standard measured with EMAS monitoring tools	**Mean Assessment Score at Hospitals % achieved (standard deviation)**				
	Baseline (n = 33)	**Quarter 1 (n = 34)**	**Quarter 2 (n = 35)**	**Quarter 3 (n = 36)**	**Quarter 4 (n = 36)**
No. 1 Obstetric Emergency Response	32.73 (34.21)	52.35 (33.03)	72.57 (25.71)	76.11 (25.22)	79.44 (28.88)
No. 2 Active Management of the Third Stage to Prevent Postpartum Hemorrhage	77.03 (21.07)	81.35 (24.52)	93.39 (12.23)	93.50 (11.43)	97.67 (7.09)
No. 3 Postpartum Hemorrhage Management	44.00 (27.38)	57.59 (25.66)	69.77 (21.50)	71.42 (20.43)	81.69 (13.12)
No. 4 Management of Severe Preeclampsia/Eclampsia	63.50 (24.29)	73.32 (25.61)	83.28 (18.06)	85.56 (19.87)	93.28 (11.04)
No. 5 Management of Maternal Sepsis and Severe Infection	49.00 (23.65)	67.15 (25.40)	81.17 (19.30)	83.06 (18.38)	90.89 (14.83)
No. 6 Management of Obstructed Labor	28.88 (23.62)	46.65 (27.45)	51.69 (26.22)	57.08 (21.41)	65.94 (11.65)

4.3.3 *Multiple Linear Regression*

The multiple linear regression coefficients indicate the extent that ORCA scales predict the successful implementation of maternal clinical standards are presented in Table 4.05 – 4.10. The EMAS clinical standard assessment scores, measured in percent of standards achieved by health care workers at each hospital after each quarter, were entered as a continuous outcome variable. I examined the association between each primary ORCA scale and successful implementation of the six maternal clinical standards. The regression coefficients describe the predicted change in implementation of maternal clinical standards in association with a change in each ORCA scale (evidence, context, and facilitation). Specifically, for every 1-point change in the mean facility score of the ORCA scale, implementation of the clinical standard is expected to change by a value equal to the regression coefficient (β) at the respective time point. The covariates assessed in the linear models failed to meet the $p<0.05$ threshold and were

sequentially removed. The variable to control for EMAS mentoring activities prior to the ORCA questionnaire remained in all models.

The ORCA evidence scale significantly predicted the implementation of obstetric emergency response in hospitals (clinical standard 1) after the second quarter of program mentoring activities (F(df)= 7.67 (3,22); p=0.001). The prediction from the ORCA evidence scale (β=89.19*; R^2* =0.38) indicates that 38% of the variance in implementation of obstetric emergency response is explained by the model. The ORCA context scale significantly predicted greater implementation of more than one clinical standard. ORCA context scores are associated with greater implementation of active management of the third stage of labor in hospitals (clinical standard 2) after the first quarter of program mentoring activities (F(df)= 5.04 (3,11); p=0.019). The coefficient for the context scale in the model (β = 27.35; R^2 = 0.62) is associated with a moderate effect size indicating that 62% of the variance in implementation of clinical standard 2 is explained. The context scale also predicted greater implementation of the management of severe preeclampsia and eclampsia after two quarters of program mentoring (F(df) = 5.83(3,19); p = 0.005) and after three quarters of program mentoring (F(df) = 6.72(3,19); p = 0.003). The ORCA context scale coefficients after two quarters (β = 37.46; R^2=0.43) and three quarters (β = 33.81; R^2=0.38) indicate that 43% and 38% of the variance of implementation is explained by the respective models. The ORCA context scale also predicts greater implementation of the management of obstructed labor in hospitals after two quarters of program mentoring (F(df) = 10.69 (3,29); p < 0.001). The regression coefficient for the context scale (β = 32.80; R^2 = 0.40) indicates that 40% of the variance is explained by the model. None of the linear models indicate

a significant contribution from the facilitation scale of the ORCA instrument for predicting greater implementation of the maternal clinical standards.

Table 4.6 Predicting Implementation of Obstetric Emergency Response in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	27	26	26	27
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	-24.61 (-109.71, 60.48)[2]	89.19**[4] (9.05, 169.33)	82.84* (-16.03, 181.71)	72.00* (-25.43, 43.55)
R-squared for model[3]	0.32	0.38	0.17	0.20
Context scale	19.68 (-8.46, 47.81)	19.78 (-9.08, 48.65)	14.25 (-18.71, 47.22)	-3.17 (-38.81, 32.48)
R-squared for model	0.34	0.29	0.08	0.13
Facilitation scale	18.69 (-21.48, 58.86)	3.43 (-26.64, 33.49)	0.84 (-39.36, 41.05)	-12.61 (-50.68, 25.45)
R-squared for model	0.33	0.25	0.06	0.12

[1] At each quarter during 2016, the outcome variable Implementation of Obstetric Emergency Response in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 4.7 Predicting Implementation of Active Management of the Third Stage to Prevent Postpartum Hemorrhage in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	15	15	15	15
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	20.13 (-60.83, 101.09)[2]	34.99 (-27.06, 97.04)	16.42 (-44.89, 77.74)	2.44 (-33.72, 38.61)
R-squared for model[3]	0.55	0.09	0.15	0.09
Context scale	27.35**[4] (1.27, 53.44)	27.71** (-3.29, 41.59)	9.94 (-17.24, 37.13)	-.858 (-14.06, 15.78)
R-squared for model	0.62	0.28	0.17	0.09
Facilitation scale	28.307 (-6.20, 62.81)	12.43** (0.47, 24.40)	-4.34 (-24.32, 15.64)	-4.27 (-14.16, 5.61)
R-squared for model	0.62	0.06	0.14	0.06

[1] At each quarter during 2016, the outcome variable Implementation of Active Management of the Third Stage to Prevent Postpartum Hemorrhage in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 4.8 Predicting Implementation of Postpartum Hemorrhage Management in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	28	27	28	28
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	17.07 (-37.75, 71.89)[2]	5.91 (-43.33, 55.14)	28.43 (-33.19, 90.05)	9.06 (-25.43, 43.55)
R-squared for model[3]	0.35	0.14	0.11	0.03
Context scale	20.76*[4] (-1.01, 42.54)	19.15 (-3.29, 41.59)	27.90* (-0.54, 56.33)	9.82 (-5.64, 25.28)
R-squared for model	0.40	0.20	0.23	0.08
Facilitation scale	15.55 (-19.42, 50.51)	-0.80 (-30.32 28.72)	9.72 (-30.20, 49.64)	3.98 (-7.48, 15.44)
R-squared for model	0.46	0.16	0.10	0.06

[1] At each quarter during 2016, the outcome variable Implementation of Postpartum Hemorrhage Management in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 4.9 Predicting Implementation of Management of Severe Preeclampsia/Eclampsia in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	23	23	23	23
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	-30.44 (-103.07, 42.18)[2]	36.04 (-40.81, 112.89)	37.55 (-50.16, 125.26)	0.33 (-52.40, 53.07)
R-squared for model[3]	0.66	0.23	0.28	0.12
Context scale	17.78*[4] (-0.83, 36.38)	37.46** (13.52, 61.41)	33.31** (8.68, 57.94)	15.19* (-2.71, 33.09)
R-squared for model	0.72	0.43	0.38	0.20
Facilitation scale	15.26 (-16.22, 46.74)	21.06 (-17.22, 59.33)	34.096 (-9.92, 78.12)	2.60 (-20.59, 25.80)
R-squared for model	0.70	0.24	0.31	0.12

[1] At each quarter during 2016, the outcome Implementation of Management of Severe Preeclampsia/Eclampsia in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 4.10 Predicting Implementation of Management of Maternal Sepsis and Severe Infection in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	27	27	27	27
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	6.77 (-59.72, 73.26)[2]	30.68 (-24.04, 85.40)	30.15 (-31.99, 92.29)	16.46 (-30.95, 63.87)
R-squared for model[3]	0.18	0.12	0.10	0.08
Context scale	22.41*[4] (-2.96, 47.77)	29.04** (2.32, 55.75)	29.12 (-8.59, 66.83)	16.89 (-4.68, 38.45)
R-squared for model	0.24	0.23	0.22	0.14
Facilitation scale	13.32 (-12.31, 38.96)	16.12 (-6.53, 38.76)	13.56 (-24.92,52.05)	1.69 (-14.86, 18.24)
R-squared for model	0.20	0.12	0.10	0.07

[1] At each quarter during 2016, the outcome Implementation Management of Maternal Sepsis and Severe Infection in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 4.11 Predicting Implementation of Management of Obstructed Labor in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	33	33	33	33
ORCA Instrument Scores at baseline[1]	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Evidence scale	4.79 (-50.42, 60.00)[2]	35.04 (-23.29, 93.38)	10.15 (-42.04, 62.33)	-7.82 (-39.96, 24.32)
R-squared for model[3]	0.43	0.32	0.37	0.19
Context scale	21.92*[4] (-1.22, 45.07)	32.80 (10.72, 54.89)	5.18 (-11.46, 21.82)	7.31 (-6.70, 21.33)
R-squared for model	0.47	0.40	0.37	0.21
Facilitation scale	20.34 (-10.24, 50.92)	19.91 (-4.21, 44.03)	-1.79 (-18.00, 14.42)	0.41 (-14.34, 15.15)
R-squared for model	0.46	0.33	0.37	0.19

[1] At each quarter during 2016, the outcome Implementation Management of Obstructed Labor in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in achieved score for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

4.4 Discussion

The objective of this study is to assess the associations between Organizational Readiness for Change Assessment (ORCA) scale scores (Evidence, Context, and Facilitation) and the implementation of clinical standards across four timepoints after implementation of EMAS program mentoring activities in maternity wards of study hospitals in Indonesia. I hypothesized that higher baseline scores on the ORCA scales for evidence, context, and facilitation, would predict greater implementation of maternal clinical standards in Indonesian hospital maternity wards. All 36 hospitals measured with the ORCA instrument scored moderately high on the three primary scales (evidence, context, and facilitation). Assessments conducted by the EMAS program showed that the mean score for compliance with maternal clinical standards increased over the study period for all six maternal clinical standards. Greater implementation of specific maternal clinical standards is positively associated with higher scores on the ORCA evidence scale and the context scale. Higher scores on the evidence scale of the ORCA instrument are reported in association with greater implementation of obstetric emergency response practices after two quarters of mentoring. Higher scores on the context scale are significantly associated with greater implementation of four maternal clinical standards that include active management of the third stage of labor, management of preeclampsia and eclampsia, management of maternal sepsis and severe infection, and management of obstructed labor.

Greater implementation of the six maternal clinical standards is seen across the hospitals included in this analysis, however, only greater implementation of obstetric emergency response clinical standards shows a significant relationship with higher scores on the ORCA evidence scale. In the PARIHS framework, the evidence scale is a measure of the health care workers' evaluation

of current scientific evidence supporting the practice changes, evaluation of clinical experiences with patients from other health care facilities, and evaluation of how well the practice changes meet the needs and preferences of patients in their own facility (2,58). The six maternal clinical standards promoted through the EMAS program are unlikely new to most of the health care workers at the EMAS hospitals since these were based on existing national standards (37). The health care workers in the study hospitals are likely to understand their patients' needs and preferences and therefore should be capable of appraising the clinical standards against these needs and preferences. However, the practice of evaluating current scientific evidence or clinical experiences from other health facilities is less certain. A recent root-cause analysis of maternal mortality in Indonesia revealed that other factors such as health care worker behavior, training, and the quantity of supplies and equipment strongly influence implementation of maternal health practices and outcomes (82).

My study found one significant association between the evidence scale of the ORCA instrument and greater implementation of the six maternal clinical standards. This suggests that consideration be given to how the evidence scale influences ORC, and further how this translates into greater implementation. Two additional studies that test the ORCA or PARIHS framework also raise similar concerns. The findings from process evaluation suggest the need for further consideration of how the evidence component of PARIHS contributes to implementation of recommended practices. Rycroft-Malone et al. (2013) embedded the PARIHS framework in a U.K.-based process evaluation to understand the impact and reception of multiple interventions to improve peri-operative fasting times. Despite strong evidence supporting the practice recommendations, the intervention did not have a significant effect on fasting times; however,

through the evaluation the authors found that several factors are influencing the implementation of practices including behaviors and attitudes, communication structures, and the existing system and environment (83).

Hagedorn and Heideman (2010) examined the predictive validity of the ORCA evidence and context scales toward implementation of innovative clinical practices for hepatitis prevention in Veteran's Authority (VA) medical centers (20). The study compared mean ORCA scores from higher and lower implementation clinics based on the number of hepatitis prevention practices successfully implemented after a training experience. The authors measured differences in mean ORCA scale scores using effect sizes (Cohen's *d*) and reported significantly higher ORCA scores for part of the evidence scale that asks providers about evidence for the practice in terms of patient preferences. The lack of significant finding for the entire evidence scale (including research evidence and evidence from clinical experience) in this study relates to our own findings where greater implementation of clinical practices took place in hospitals, but the evidence scale of ORCA was not a significant factor.

The ORCA instrument was also tested in the field of speech-language pathology. This study looked at how speech language pathologists perceive evidence of nonelectronic external memory aids in relation to the reported use of these aids and found that an additional positive point on the overall ORCA evidence scale was associated with a 26% increase in the use of the aids (84). This study result indicates that some portion of successful implementation of a clinical practice is accounted for by health care workers perceptions of available evidence.

The context scale from the ORCA instrument was significantly associated with greater implementation of multiple maternal clinical standards promoted by the EMAS mentoring

activities. In the PARIHS framework, a strong organizational context consists of role clarity among staff, decentralized decision-making, transformational leaders, and performance evaluation from multiple sources (2). These organizational characteristics are proposed by the framework to facilitate successful implementation of evidence-based practices. Our results are consistent with other studies that found evidence of the relationship between organizational context factors like leadership culture and organizational climate and the successful implementation of practice changes. In their study looking at the implementation of hepatitis prevention practices, Hagedorn and Heideman (2010) found higher scores for leadership culture, a subscale from the ORCA context scale, for clinics with greater implementation of the prevention practices. The authors concluded that clinics with greater implementation of recommended practices had team leaders who provided strong endorsements for the leadership culture at the clinic. Based on the ORCA instrument, leadership culture includes effectively managing continuous improvement of patient care, clearly defining staff responsibilities, promoting team building to solve clinical problems and communication between clinical services and units (58).

Three ORC-related studies that took place in health care settings also emphasize the importance of leadership and management support for the successful implementing of practices in clinics (45,85,86). Wallen et al. (2010) report the importance of leadership support in relation to a mentorship program in the U.S. with the objective of increasing implementation of evidence-based practice by nurses. In the mixed-methods, pre-post study, all participants agreed that leadership support for a culture of evidence-based practice within the clinic was an essential factor to engage staff. The authors further reported that significant positive changes in perceptions of organizational change culture and readiness among the nurse participants to

implement evidence-based practice as well as increases in self-reported implementation of evidence-based practices occurred in clinics receiving the mentorship program compared to control clinics (85). Randall et al. (2019) reported that the perceived quality of management in a dental clinic setting was a significant predictor of organizational readiness to implement delivery system changes (45). An Australian-based study examined factors that predict ORC in aged-care facilities using responses from employees of 21 facilities. In their regression model that included organizational climate and leadership factors, transformation leadership was a significant predictor of ORC (86).

The ORCA facilitation scale failed to show a significant relationship with increasing implementation of clinical standards in the EMAS program in our study. According to Helfrich et al. (2009), the ORCA facilitation scale is intended to measure an organization's capacity for internal facilitation (58). The health care respondents in our study provided high scores for the facilitation scale; the overall mean aggregated hospital score for the facilitation scale was higher than for either the evidence or context scale. ORCA data in our study was collected from health care respondents at an appropriate time relative to program implementation, suggesting that each would already have knowledge of the EMAS program facilitation. The EMAS program, however, was designed with mentoring activities facilitated by mentors external to the hospital facilities. Therefore, the ORCA responses toward the facilitation scale in our study may refer to either internal facilitators (i.e. a clinical champion at the facility) or external facilitators (i.e. a clinical mentor from another facility). Previous studies examining the predictive validity of the ORCA instrument did not include the facilitation scale in their studies due to timing of the implementation effort (87).

Developers of the PARIHS framework describe the facilitation component as a continuum measuring appropriateness rather than "high/low" as in the other scales. The continuum varies from providing help and support to achieve a discreet task-oriented intervention on one end, to helping achieve a more holistic change where individuals reflect and adjust attitudes, behaviors, and the way that work is completed (2). The moderately high mean facilitation scale scores from our study translate to a transformational type of initiative on the PARIHS facilitation continuum, and this is consistent with several characteristics of the EMAS program. The objective of EMAS mentoring activities include enabling health care workers to establish standards of good care and practice in their hospitals through accountability, data-driven decision making, and clinical governance. There is also a sustainability aspect to create partner networks through mentorship that allow for on-going collaboration and clinical problem solving. These program objectives distinguish the change initiative from a more discreet task-driven purpose where facilitation involves "doing for others" that is found at the other end of the PARIHS continuum (lower scores on facilitation scale) (2,88). According to the PARIHS framework, the facilitator's role in a change initiative like the EMAS program is to mentor, guide, and empower staff to manage their own change in practice (88).

In the current study I relied on observational assessments conducted by EMAS technical personnel for program monitoring as a proxy for implementation success. While the EMAS technical personnel all employed the same rubric for assessing the clinical standards in each facility (See appendix), it is possible that some subjective variability was present in the clinical assessments because different personnel carried out assessments in the different provinces. EMAS monitoring and evaluation personnel conducted quality control by reviewing program

monitoring data and entering it into a central program database. In the current analysis, I adjusted for the province location in an effort to control for any bias that might have occurred regionally. Previous studies that examined ORC using the PARIHS framework also relied on self-reported data for the successful implementation variable (20,84,89). The operationalization of "successful implementation" in the PARIHS framework was recently revised to provide guidance for researchers and practitioners, and a recommended evaluation strategy for uptake of a clinical practice is to monitor the extent to which a practice has been maintained over time (90). To this effect, the clinical assessment data used in our study was collected over the course of consecutive quarters allowing for EMAS M&E personnel to review for consistency and abnormal observations.

In this study I assessed ORC among health care workers attempting to implement multiple evidence-based practices promoted by the EMAS program. I asked respondents to think about the effectiveness of the program as a whole by means of one evidence statement ("Clinical and governance standards implemented by the EMAS program will improve health outcomes for mothers and newborns in health facilities"). It is possible that the ORCA instrument elicited different responses from respondents depending on whether they considered the EMAS program as a whole or by reflecting on specific practice standards. Previous studies have encountered this issue and suggested that any measurement error would result in increased variance within scales, making them less distinct (58). Our results showed three distinct scales as evidenced by confirmatory factor analysis confirming that the evidence, context, and facilitation elements of the ORCA instrument measured distinct constructs (See chapter 3). Nonetheless, future studies with the ORCA instrument may benefit by asking respondents to focus on a specific evidence-

based practice while responding to the ORCA questionnaire as this would provide a consistent measure of ORC across all respondents.

This is the first study to examine the utility of the ORCA instrument in a middle-income country and to study the association between ORC and implementation of maternal evidence-based practices in this context. I demonstrated that ORC can be measured among Indonesian maternity care workers using the ORCA instrument, and that health care worker perceptions of practice evidence and organizational context factors are moderately associated with greater implementation of maternal clinical practices. The underlying PARIHS framework and ORCA instrument helped to explain health care worker perceptions of evidence for a practice change, the organizational structure and function, and an appropriate method of facilitation prior to implementation of an evidence-based practice in an effort to reduce the likelihood of implementation failure. The results of this study add support to the importance of strong evidence and organizational factors for implementing a practice change in hospitals in a middle-income country. While I found support for the appropriateness of facilitation methods used by the EMAS program, the use of the PARIHS framework in our study was independent of the program design. Future research that applies the PARIHS framework prospectively and incorporates the framework in the planning and design of an organizational practice change intervention will be able to make adjustments to the implementation based on findings of ORCA assessments. Research in this area will also benefit from interventions with the PARIHS framework and ORCA instrument embedded in the planning stage in order to provide comparisons of ORC between health care organizations that receive an intervention with those that do not.

Chapter 5: Analysis of Association between Organizational Readiness for Change Scores and Achievement of Neonatal Clinical Standards in Study Hospitals

5.1 Introduction

To further evaluate the association between the ORCA survey instrument and measures of successful implementation of the EMAS program, I examined the three ORCA scale scores (Evidence, Context, Facilitation) from study hospitals in association with achievement of neonatal clinical standards. In addition to the observational assessments of clinical standards similar to those conducted for maternal clinical standards in the previous chapter, I also examined the association between the ORCA scale scores and neonatal service data collected from standardized hospital registers. In EMAS hospitals, registers were used to track maternal and neonatal evidence-based practices through the collection of routine service data that could be reported to MOH at monthly intervals. From the service data recorded in the hospital registers, I selected newborn measures that describe the proportion of patients treated with services according to the appropriate clinical standard (i.e. proportion of women suspected of preterm delivery treated with antenatal corticosteroids). For this analysis, I use the neonatal clinical standard assessments and the hospital register data as two separate indicators of successful implementation.

5.2 Methods

5.2.1 *Design*

This study assesses whether a higher level of organizational readiness for change, indicated by a higher score on the ORCA scales, is associated with increases in the proportion of services provided for routine labor and childbirth practices and management of emergency

complications in compliance with clinical standards following completion of a peer-to-peer mentoring intervention during the EMAS program in Indonesia.

5.2.2 *Study Sites*

I approached all the hospitals that were implementing the peer-to-peer mentoring intervention. Hospitals were located in the three following Indonesian provinces: East Java, Central Java, and West Java. The EMAS program hospitals selected for this study were located in districts identified based on the greatest number of pregnant women and the highest maternal and newborn mortality. Within a district, EMAS selected a hospital to participate in the program if the facility was accredited, a positive working relationship existed between facility directors and local government officials, social insurance schemes were implemented, and the hospital had autonomy over its budget. Hospitals selected for EMAS program implementation were well equipped, had sufficient number of trained health care workers available, and employed midwives, general physicians, and obstetricians who were all trained in normal delivery, basic emergency obstetric and newborn care (BEmONC), and comprehensive emergency obstetric and newborn care (CEmONC) (37). All classes of hospital accreditation were included in the sample (A, B, C, and D). The hospital accreditation class is an indication of the number of specialty and sub-specialty services available, where class A hospitals offer specialty and a wide array of sub-specialties and also act as the top referral facilities.

5.2.3 *Questionnaire respondents*

Study respondents included health care workers and hospital staff participating directly in the EMAS peer-to-peer mentoring intervention. A field researcher explained the background and goals of the study to all participants prior to administering the ORCA questionnaire.

Participants were provided with an informed consent letter, and consent was assumed if the questionnaire was completed. At each hospital, the respondent sample included physicians (general practitioners and specialists), midwives, nurses, and support staff. Questionnaires were excluded from the final sample if respondents did not complete at least 50% of the items.

5.2.4 *Measures*

The ORCA questionnaire was adapted to the Indonesian health context through translation and cultural adaptation. Validation and psychometric analysis were examined prior to proceeding with analysis. All three primary scales of the ORCA were used (see Table 3.1, chapter 3); these included the Evidence scale, the Context scale, and the Facilitation scale. For a complete list of the ORCA scales and items, see table 3.1, Chapter 3. The Evidence scale includes five items that ask respondents to rate the evidence for the EMAS intervention. These items are divided into subscales that (i) compare the perceptions of hospital health care workers and leadership regarding the strength of research evidence for the intervention, (ii) measure perceptions of evidence supported by prior clinical experience, and (iii) ask for opinions about intervention evidence aligning with patient needs.

The items on the context scale are divided into six subscales that ask respondents about factors that contribute to organizational culture in their facility. These include (1) leadership culture such as whether leadership is open to staff innovation and opinions; (2) evaluation and accountability meaning clear performance goals and regular feedback between leadership and staff; (3) leadership practice such as clearly defining roles and promoting team building; (4) staff culture meaning sense of responsibility, presence of cooperation, and acceptance for change; (5)

opinion leader culture meaning the role of informal leadership in shaping service quality and change; (6) and the availability of institutional resources to support organizational change.

The items on the facilitation scale are divided into nine subscales that ask respondents about how the current intervention is being implemented at their health facility. These include (1) leadership characteristics in planning such as providing clarity in projects and goals; (2) the role of clinical champions to assume and exercise authority for the success of an intervention; (3) senior leadership roles in support through prioritizing the intervention and involvement in it; (4) implementation team member roles such as clear roles, responsibilities, and sufficient time resources; (5) the implementation plan meaning task division and support appropriate with education and skills; (6) methods of communication such as regular meetings and channels for feedback between staff and leadership; (7) intervention assessments meaning regular support for collection and analysis of feedback from patients and staff; (8) whether intervention resources are available such as equipment, protocols, and incentives; (9) and mechanisms of evaluation such as regular satisfaction surveys for patients and staff as well as review by senior leadership.

Study participants indicated their level of agreement to all 77 items on the ORCA instrument using a 5-point likert-type scale (1 = strongly disagree; 5 = strongly agree). Then I estimated an individual mean score for each scale (evidence, context, and facilitation) by taking the total score and dividing by the number of items. Individual mean scores were then aggregated per scale within each hospital to produce one facility score for each ORCA scale per hospital.

5.2.5 *Neonatal Clinical Standards and Hospital Register Data*

5.2.5.1 Neonatal Clinical Standards

Peer-to-peer mentoring activities were conducted to strengthen neonatal clinical practices and improve compliance with clinical guidelines. Mentoring activities for neonatal clinical standards followed similar procedures to those described for maternal clinical standards in the preceding chapter. Monitoring tools were used by EMAS program personnel to assess the compliance with neonatal clinical standards through observation similar to methods used for assessing compliance with maternal clinical standards. A summary of the components for the two neonatal clinical standards examined in this chapter are shown in table 5.1.

Table 5.1 Neonatal Monitoring Tools used by EMAS program to measure compliance with clinical standards.

Monitoring Tool: Antenatal Steroid Provision to Prevent Premature Complication in Hospital	**Monitoring Tool: Immediate Breastfeeding Initiation (IBI) and Exclusive Breastfeeding in Hospital**
Health Facility has a Standard Operational Procedure (SOP) on when and how to provide steroid during the antenatal period to prevent complications related to premature birth according to the national guideline	Health care workers perform immediate early breastfeeding initiation to each neonate born without complication
Adequate stock of dexamethazone in the pharmacy unit or maternity unit in this health facility	Health Facility has a Standard Operational Procedure (SOP) on the implementation of Early Breastfeeding Initiation and Exclusive Breastfeeding according to the national guideline and rules
Each pregnant woman with the following criteria has received the first dose of steroid before delivery: • Fetal age of 24 to 36 weeks • No severe infection • There is a threat for premature birth	Algorithm/job aid on Early Breastfeeding Initiation and Exclusive breastfeeding is clearly posted in the location of pregnant woman, postpartum, neonatal, and child services
	Health facility has an applicable system to assess the skills necessary to do steps in early breastfeeding initiation and exclusive breastfeeding
	Health care workers in this health facility provide education on exclusive breastfeeding for the first 6 months to the mother and her family.
	Health care workers in this health facility are able to demonstrate steps in Early Breastfeeding Initiation and correct breastfeeding

5.2.5.2 Hospital Register Data

A standardized Health Information System (HIS) for tracking maternal and newborn evidence-based practices was developed by the EMAS program and introduced to program hospitals and health centers. Four registers in the form of paper databases were introduced at the hospital level that cover delivery room services, neonatal services, maternal deaths, and neonatal deaths. Staff at hospitals entered data on services provided to patients into the register to complete routine recording for each patient. Next, aggregated summaries of the evidence-based practices were produced each month for reporting to MOH. EMAS program staff oriented and trained health care workers on data entry into the registers, then monitored their use and data quality.

A monitoring and evaluation (M&E) team from the EMAS program assessed data quality by using the MEASURE Routine Data Quality Assessment (RDQA) tool in 2013, 2015, and 2016 (91). The initial data quality assessment by the EMAS program revealed several inconsistencies and reliability issues with routine data collection among hospital facilities. This led to strengthening of the HIS through the introduction of tools (e.g. standardized registers described above), trainings, and workshops. A second and third RDQA conducted two and three years after the first assessment showed greater reliability and low discrepancy (less than 5%) between service data reported in the information system and the care observed at facilities.

Data collection for hospital services proceeded through the following steps. Every month, hospital staff summarized data from facility registers and completed EMAS specific data collection forms. These data collection forms were checked by a Quality Improvement Coordinator (QIC), a medical professional whose role was to check and review data for accuracy

and completeness. QICs then entered data into an EMAS online system with user-protected access as well as data and logic checks. Next, data were checked and reviewed by a provincial-level M&E officer to identify any abnormal values or changes in the reported data. Finally, M&E data managers at the national level conducted quality assurance checks with random samples of records.

This study uses two measures of newborn service delivery derived from aggregate hospital registry data (use of corticosteroids and exclusive breastfeeding within 1 hour of delivery) from Phase 3 of the EMAS program corresponding to April 2015 to December 2016. Data are limited to five quarters beginning with a baseline in quarter four of 2015 and continuing for one calendar year until quarter four of 2016. The two measures are derived from the hospital register data aggregated by month that reflect the neonatal services provided at each facility during the period. The derived measures indicate the proportion of women that receive a specific neonatal care service when that service is indicated in each hospital facility. The denominator is filled by the total number of women for whom an intervention to promote neonatal health is indicated; and the number of women receiving the intervention are in the numerator. For example, to measure breastfeeding within one hour of birth, the number of women whose infants are successfully breastfed within one hour is in the numerator while the total number of live births (women and their infants indicated for this intervention) are in the denominator. The newborn measures used for this analysis are shown in Table 5.2. Other maternal interventions such as the use of $MgSO_4$ for management of severe PE/E and the use of uterotonic in the third stage of labor were already very high in study hospitals when the EMAS program was initiated (38), therefore only the two newborn measures shown in Table 5.2 were used in this analysis.

Table 5.2 Derived Variables based on Neonatal services from Hospital Service Register data

Neonatal Service		Data Element
Proportion of women delivering preterm (24-34 weeks) who received at least one dose of antenatal corticosteroid	Numerator	Number of women delivering preterm (24-34 weeks) who received at least one dose of antenatal corticosteroid
	Denominator	Number of women delivering preterm (24-34 weeks)
Proportion of newborns breastfed within 1 hour of birth	Numerator	Number of newborns breastfed within 1 hour of birth
	Denominator	Number of live births

Assessment of Baseline Implementation and Implementation Outcomes

I assessed the two newborn intervention measures generated from hospital register data at baseline (corresponding to quarter four of 2015) to identify hospitals reporting greater than 80 percent of patients receiving either of the neonatal interventions. At these study hospitals, staff were successfully reporting greater than 80 percent of women receiving corticosteroids who had symptoms of preterm delivery, and more than 80 percent of newborn infants were successfully breastfed exclusively within one hour of birth. This threshold was chosen because it aligns with EMAS program objectives for hospital staff to achieve at least 80% compliance with clinical standards associated with neonatal interventions. I removed these high functioning hospitals with a baseline level above 80 percent from the analysis, and this resulted in 17 remaining hospitals below 80 percent for antenatal corticosteroid use, and 25 remaining hospitals below 80 percent for exclusive breastfeeding within one hour of birth.

The remaining study hospitals with reported baseline newborn indicators below 80 percent are further classified into two groups based on the final reported newborn indicator

level. Among these hospitals, high implementing facilities are those that report a fourth quarter newborn indicator equal to or greater than 80 percent. Meanwhile, low implementing facilities are those that report fourth quarter newborn indicators less than 80 percent. In order to describe the ORCA scale scores over the course of the study period, I compare the difference in mean ORCA scale scores between high and low implementing hospitals based on the threshold of 80 percent in the reported newborn intervention measures. I report the mean ORCA scale scores for each newborn indicator and estimate an effect size using Cohen's *d* for the difference in mean ORCA scale score after four quarters of mentoring activities with 95% confidence intervals. Cohen's *d* is a standardized effect size measure where 0.2 is considered a small effect, 0.5 is considered a medium effect, and 0.8 is considered a large effect (92,93).

Multiple Linear Regression

I generated multiple linear regression models to examine the association between each ORCA scale score (Evidence, Context, Facilitation) and each of the two newborn indicators at four time points (Q1, Q2, Q3, Q4) corresponding to the study period. Similar to the process of including only lower performing hospitals above, only hospitals with baseline newborn indicators below 80 percent are included in the analysis. At each time point, the newborn indicator is regressed as a dependent continuous variable on the independent ORCA scale scores. The newborn indicator at baseline is included in the regression model to control for initial differences in the reported hospital register data. Four facility-level covariates are assessed in the regression models including the mean education level of the health workers, the mean number of normal (vaginal) deliveries per month, the mean clinical experience of health workers in years, and the

mean leadership experience of health workers in years. I controlled for hospitals where mentoring activities began before the baseline ORCA score (quarter four 2015) in each model. As I estimated the multiple regression models, I removed covariates through backward selection if a p-value for a Wald statistic was greater than 0.05. Robust standard errors were used with all linear regression models to account for heteroscedasticity. Covariance between variables was assessed by ensuring that variance inflation factors remained less than 10.0 for covariates in the linear models (94). For each neonatal service examined, I report the coefficient (β) and 95% confidence interval, and R^2 value for the ORCA scale (evidence, context, and facilitation).

5.3 Results

I approached 37 hospital facilities that were all participating in the third phase of the EMAS program, a period from April 2015 to December 2016. Following data collection, one hospital was excluded due to not completing the EMAS program, and this left a final sample of 36 hospitals. The hospitals were located in three provinces, namely Central Java (44%), East Java (25%), and West Java (31%) (Table 4.3). The sample included hospitals of all four classes A, B, C, and D with the majority of hospitals accredited as class B and C (92%). According to administration type, the sample included slightly more private hospitals (53%) than public hospitals. The number of childbirth deliveries at each hospital was reported on a monthly basis during the program period. The total number of births per month at each study hospital are reported in Table 4.3 (pg. 64). The number of births per month during this period varied with the size of the facility, from 19 at the smallest facility to 354 at the largest facility.

5.3.1 *Baseline ORCA Score*

The results of the ORCA survey including a description of respondents, item responses, and measures of interrater agreement and reliability are found in section 4.3.1 on page 62. The survey was administered one time and the same survey results are applied to the analysis with neonatal clinical standards.

5.3.2 *EMAS Neonatal Clinical Standard Assessments*

The mean scores for neonatal clinical assessments conducted by the EMAS program during the period from the fourth quarter in 2015 (baseline) to the fourth quarter in 2016 are shown in table 5.3. Among study hospitals with baseline scores below 80 percent, the final scores for both of the neonatal clinical standards, the use of antenatal corticosteroids and the initiation

of exclusive breastfeeding within one hour of birth, showed overall increases during the study period. Twelve hospitals have baseline assessment scores below 80 percent for the neonatal clinical standard for using antenatal corticosteroids with a mean of 48.58%. By the fourth quarter of 2016, all twelve of these hospitals scored 100 percent on the assessment conducted by the EMAS program.

The baseline scores for the neonatal clinical standard on initiating exclusive breastfeeding within one hour of birth indicated that 24 hospitals scored below 80 percent. The mean score among these study hospitals at baseline was 36.88% and increased to 90.46% by the final assessment at the end of 2016.

Table 5.3 Mean Assessment Scores Measuring Proportion of Neonatal Clinical Standards Achieved at Hospitals using EMAS Monitoring Tools during Study Period.

Neonatal Clinical Standard measured with EMAS monitoring tools	**Mean Assessment Score at Hospitals Percent achieved (standard deviation)**				
	Baseline	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**
No. 4 Antenatal Corticosteroid N=12*	48.58 (16.94)	77.83 (32.84)	94.50 (12.85)	91.75 (14.92)	100 (0)
No. 5 Initiation of Exclusive Breastfeeding within 1 hour of birth N=24*	36.88 (22.50)	52.92 (34.13)	69.04 (30.43)	78.50 (21.46)	90.46 (14.47)
*Only study hospitals with baseline scores below 80 percent are included.					

5.3.3 *EMAS Program Hospital Service Statistics*

The service data reported by study hospitals from registers during the study period are presented by neonatal measure in Table 5.4. Hospitals that reported baseline service data that translated into greater than 80 percent for either of the neonatal interventions are excluded from the analysis. For the proportion of women delivering pre-term who received at least one dose of

corticosteroid when indicated, 17 hospitals reported less than 80 percent at baseline. Fewer hospitals reported a high proportion of infants breastfed within one hour of birth resulting in a remaining sample of n = 24 hospitals.

Over the four quarters of the study period, the mean values increased for both of the neonatal measures in the study hospitals with baseline levels below 80 percent (Table 5.4). The mean proportion of women delivering preterm who received at least one dose of antenatal corticosteroids increased from 51 percent at baseline to above 80 percent at quarter four of 2016. The reported mean across hospitals for the proportion of infants breastfed within one hour of birth 41%. This measure increased over the study period to 69 percent at quarter four of 2016 among hospitals that began with baseline levels below the 80 percent threshold.

Table 5.4 Hospital service statistics organized by Neonatal service provided showing increases in proportion of women who received recommended services in EMAS program hospitals.

Neonatal service reported by EMAS program hospitals*	**Proportion of women & infants who received services at Hospitals (standard deviation)**				
	Baseline**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**
Proportion of women delivering preterm (24-34 weeks) who received at least one dose of antenatal corticosteroid	N=17 51.48 (24.39)	N=17 63.10 (29.51)	N=17 69.28 (28.86)	N=16 84.85 (21.02)	N=16 81.00 (26.66)
Proportion of newborns breastfed within 1 hour of birth	N=24 40.91 (23.13)	N=25 47.46 (28.39)	N=25 55.12 (28.20)	N=25 65.13 (24.12)	N=25 68.96 (26.38)

* Only hospitals baseline Neonatal services reported below 80 percent.
** Baseline measured at quarter 4, 2015. Quarter 1-4 indicate four quarters of 2016 calendar year.

Study hospitals were divided into low and high implementation groups based on the clinical assessment score at quarter four, and mean ORCA scale scores are compared (Table 5.5). By quarter four, a majority of the study hospitals had already reached 80 percent achievement

for implementing the clinical standard for initiating breastfeeding within one hour of birth. Mean ORCA scale scores were not significantly different between low and high implementing hospitals. The effect sizes for the difference in mean ORCA scale scores between low and high implementing hospitals were also small (Cohen's *d* < 0.50). After four quarters, all of the study hospitals were assessed at 100 percent achievement of the clinical standard for providing antenatal corticosteroids to women suspected of preterm delivery. For this reason, no comparison of mean ORCA scale scores was completed for the antenatal corticosteroid clinical standard.

Table 5.5 Descriptive data and effect sizes of Mean ORCA Scale Scores for high and low implementation after 4 quarters of mentoring activities for clinical assessment with monitoring tool for Breastfeeding within one hour of birth.

ORCA Scale	n	Mean (SD)	Effect Size (*d*), (95%CI)
Breastfeeding within 1 hour of birth			
Evidence (Q4)			
Low Implementation	2	3.77 (0.06)	0.08 (-1.37, 1.53)
High Implementation	22	3.78 (0.13)	
Context			
Low Implementation	2	3.89 (0.31)	-0.14 (-1.59, 1.31)
High Implementation	22	3.86 (0.27)	
Facilitation			
Low Implementation	2	3.99 (0.06)	-0.48 (-1.93, 0.97)
High Implementation	22	3.88 (0.23)	

* Low implementation defined as Neonatal services reported less than 80 percent. High implementation defined as Neonatal services reported equal to or greater than 80 percent.

After study hospitals were divided into low and high implementation groups based on the newborn indicators at quarter four, the mean scores for each ORCA scale are compared (Table 5.6). Mean ORCA scale scores are higher among the eleven study hospitals that reported higher implementation for the use of antenatal corticosteroids with women that are at risk of preterm delivery (reported above 80 percent for newborn indicator), but there is no significant difference. The effect size for the ORCA evidence scale is large (Cohen's *d* > 0.80) and in the direction hypothesized, but it is not significant (the 95% confidence interval includes zero).

The mean ORCA scale scores are slightly higher among thirteen study hospitals that reported higher implementation for the initiation of exclusive breastfeeding within one hour of birth (reported above 80 percent for newborn indicator), but there is no significant difference. While the effect sizes for the difference in the mean scores were all in the hypothesized direction for each of the ORCA scales, the effect sizes were small (Cohen's $d < 0.60$) and not significant.

Table 5.6 Descriptive data and effect sizes of Mean ORCA Scale Scores for high and low implementation after 4 quarters of mentoring activities for Neonatal service: Use of Antenatal Corticosteroids among women with expected preterm delivery, and breastfeeding within one hour of birth.

ORCA Scale	n	Mean (SD)	Effect Size (*d*), (95%CI)
Use of Antenatal Corticosteroids among women with expected preterm delivery			
Evidence (Q4)			
Low implementation	6	3.72 (0.07)	0.95 (-0.09, 1.99)
High implementation	11	3.79 (0.08)	
Context			
Low implementation	6	3.75 (0.18)	0.72 (-0.30, 1.74)
High implementation	11	3.92 (0.27)	
Facilitation			
Low implementation	6	3.87 (0.07)	0.46 (-0.54, 1.47)
High implementation	11	3.93 (0.18))	
Breastfeeding within 1 hour of birth			
Evidence (Q4)			
Low Implementation	12	3.77 (0.13)	0.51 (-0.29, 1.31)
High Implementation	13	3.82 (0.10)	
Context			
Low Implementation	12	3.81 (0.18)	0.50 (-0.30, 1.29)
High Implementation	13	3.92 (0.25)	
Facilitation			
Low Implementation	12	3.92 (0.14)	0.06 (-0.72, 0.85)
High Implementation	13	3.93 (0.18)	
* Low implementation defined as Neonatal service reported less than 80 percent. High implementation defined as Neonatal service reported equal to or greater than 80 percent.			

5.3.4 *Multiple Linear Regression*

The multiple linear regression outcomes indicate the association between the baseline ORCA scale scores and the change in newborn indicators derived from study hospital service statistics. The reported newborn indicators were entered into the regression models as

dependent continuous variables to calculate estimates for each of the four quarters during the study period. Separate regression models were estimated using each ORCA scale score independently at each quarter resulting in three models per quarter for each of the newborn indicators.

Linear regression coefficients are displayed in Tables 5.7-5.9 with 95% confidence intervals and R^2 for the estimated model. Regression coefficients are intended to describe the change in the proportion of each newborn indicator that is associated with a 1-point increase in the respective ORCA scale score. Neither the linear regression coefficients that describe the change in the use of antenatal corticosteroids among women delivering preterm, nor those that describe the change in the initiation of exclusive breastfeeding within one hour of birth were statistically significant in terms of the association with increases in ORCA scale scores. For models estimating the change in corticosteroid use, the evidence scale explains 27% of the variance in the dependent variable after one quarter of mentoring activities and controlling for baseline corticosteroid use. This increases to 39% after three quarters. The context scale explains 29% of the variance after one quarter and this increases to 34% after three quarters of mentoring activities. Finally, the facilitation scale explains 26% of the variance after one quarter and then decreases in the following quarters. For models estimating the change in the initiation of exclusive breastfeeding within one hour of birth, the evidence scale, context scale, and facilitation scale explain 73%, 77%, and 75% of the variance in the dependent variable after one quarter and controlling for baseline breastfeeding initiation levels.

Table 5.7 Predicting Implementation of clinical standard for initiation of Exclusive Breastfeeding within One Hour of Delivery in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	17	17	16	16
ORCA Instrument Scores at baseline[1]	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2
Evidence scale	-1.35 (-73.21, 70.52) 0.76	44.70 (-38.86, 128.27) 0.38	1.83 (-43.91, 47.56) 0.55	0.74 (-36.45, 37.93) 0.25
Context scale	3.34 (-29.13, 35.81) 0.76	16.73 (-4.90, 38.36) 0.37	5.32 (-14.03, 24.67) 0.54	-2.69 (-19.88, 14.49) 0.23
Facilitation scale	12.63 (-13.94, 39.20) 0.77	-0.95 (-26.23, 24.33) 0.35	-0.84 (-19.92, 18.25) 0.54	-14.31 (-29.07, 0.45) 0.28

[1] At each quarter during 2016, the outcome variable implementation of initiation of exclusive breastfeeding within one hour of birth in Hospitals is measured by % achievement of this clinical standard. Regression coefficients reported above indicate the change in the proportion of women who receive Corticosteroids for pre-term deliveries for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 5.8 Predicting Implementation of Antenatal Corticosteroid use for anticipated preterm delivery in Hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	17	17	16	16
ORCA Instrument Scores at baseline[1]	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2
Evidence scale	0.87 (-1.49 - 3.23) 0.27	0.70 (-1.42 - 2.83) 0.17	1.47* (-0.27 - 3.21) 0.39	1.03 (-0.24 - 2.29) 0.08
Context scale	0.31 (-0.19 - 0.82) 0.29	0.52* (-0.07 - 1.11) 0.33	0.38 (-0.10 - 0.86) 0.34	0.36 (-0.30 - 1.02) 0.12
Facilitation scale	0.39 (-0.21 - 1.00) 0.26	0.48 (-0.35 - 1.32) 0.20	0.42 (-0.34 - 1.18) 0.23	0.19 (-0.60 - 0.98) 0.01

[1] At each quarter during 2016, the outcome Corticosteroid use in Hospitals is measured by proportion of women receiving this clinical service according to clinical standard. Regression coefficients reported above indicate the change in the proportion of women who receive Corticosteroids for pre-term deliveries for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

Table 5.9 Predicting Implementation of Initiating exclusive breastfeeding within one hour in hospitals from baseline organizational readiness for change score.

	Quarter one (1)	Quarter Two (2)	Quarter Three (3)	Quarter Four (4)
Sample (N)	24	24	24	24
ORCA Instrument Scores at baseline[1]	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2	β (95% CI) R^2
Evidence scale	-0.07 (-0.64 - 0.50) 0.73	0.24 (-0.42 - 0.90) 0.68	0.12 (-0.63 - 0.87) 0.60	0.40 (-0.76 - 1.57) 0.31
Context scale	0.25 (-0.19 - 0.69) 0.77	0.14 (-0.28 - 0.57) 0.68	-0.07 (-0.42 - 0.28) 0.60	-0.01 (-0.49 - 0.47) 0.29
Facilitation scale	0.21 (-0.22 - 0.64) 0.75	-0.04 (-0.48 - 0.41) 0.67	-0.14 (-0.55 - 0.27) 0.61	-0.13 (-0.76 - 0.49) 0.30

[1] At each quarter during 2016, the outcome variable Implementation of Corticosteroid use in Hospitals is measured by % achievement of this clinical service. Regression coefficients reported above indicate the change in the use of Corticosteroids for pre-term deliveries for a 1-point positive change on the respective ORCA scale. Models were adjusted for the baseline clinical assessment score and whether mentoring activities took place before the ORCA measurement (yes/no).

[2] 95% Confidence Intervals derived from robust standard errors.

[3] R-squared values are for explained variance in implementation scores using EMAS maternal standard tool 5.

[4] *P* values for the ORCA scale regression coefficients in respective model. *** p<0.01, ** p<0.05, * p<0.1

5.4 Discussion

The objective of this study is to examine the association between the level of organizational readiness for change among health care workers prior to the EMAS peer-to-peer mentoring intervention and their successful implementation of neonatal clinical standards. During the EMAS peer-to-peer mentoring intervention, successful implementation of neonatal clinical standards was measured through quarterly observational assessments and corresponding newborn indicators. Both of these measures increased across all of the study hospitals suggesting that EMAS program objectives were achieved by health care workers. The baseline organizational readiness for change scores were moderately high for each of the three scales (evidence, context,

and facilitation) across the study hospitals. Despite improvement in the reported newborn indicators and moderately high ORC among the study hospitals, I did not detect significant evidence for the hypothesis that higher ORC is associated with greater implementation of neonatal clinical standards, nor with increases in the proportion of neonatal services provided at each hospital.

In the previous chapter, I examined the relationship between the ORCA scale scores (evidence, context, and facilitation) and successful implementation of maternal clinical standards in the study hospitals. In the current analysis, I focus on the relationship between ORCA scale scores and the successful implementation of neonatal clinical standards. Successful implementation is operationalized by two measures of uptake among health care providers in the study hospitals. Observational assessments of health care workers implementing clinical standards provide an indication of whether practices were performed as outlined and reinforced in the EMAS program mentoring activities. The second measure of implementation is described through newborn indicators derived from the hospital registry data that are collected from each hospital and describe the proportion of eligible women who received the indicated services associated with the clinical standards. In this way successful implementation is operationalized to align with a process measure that indicates the degree that health care workers implemented the recognized clinical standard. When viewed through the lens of Donabedian's "Classic Systems Model", quality of healthcare can be evaluated through structure, process, or outcome measures (95). According to the PARIHS framework, implementation success is a function of the three elements that include rigorous and sound evidence, a supportive organizational context, and a clear design for facilitation. A revised version of the framework recommends the

operationalization of successful implementation as the uptake of an evidence-based practice (90). The uptake in our study is measured through the achievement of newborn clinical standards by health care providers in maternity wards.

The first newborn measure, use of antenatal corticosteroids to promote lung development in infants in anticipation of premature births, increased over the study period such that all hospitals reported levels above 80 percent by the EMAS program end date. This indicates improved compliance with the corresponding newborn clinical standard among health care workers across study hospitals. Among study hospitals that were high implementers for this newborn indicator (above 80 percent after the final quarter), the ORCA scale scores were on average higher than low implementing hospitals, but not significantly different. The ORCA scores and the implementation results were not impacted by the size of the hospital as measured by the volume of normal deliveries per month. Among those hospitals in the high implementation group, some reported as many as 354 deliveries per month while others averaged as few as 34. On the other hand, the average deliveries per month among hospitals in the low implementing group ranged from only 19 to 191 per month.

Improvement for the implementation of the clinical standard for initiation of exclusive breastfeeding within one hour of birth and the corresponding newborn indicator was observed across all the study hospitals. The mean ORCA scale scores among high implementing hospitals measured through observational clinical assessments suggest no significant difference in the ORC components compared to lower implementing hospitals. When the study hospitals were compared by the newborn indicator for initiation of breastfeeding, the mean ORCA scale scores

still suggest no significant difference in the ORC components between high and low implementing hospitals.

The context scale of the ORCA instrument covers different aspects of organizational culture including leadership culture, staff culture, and opinion leader culture. Our study showed that health care workers scored these cultural aspects similarly in all of the study hospitals regardless of implementation success. Other studies focused on the context component of the PARIHS framework to understand the challenges of implementing evidence-based practices in LMICs. One recent study took a qualitative approach to assess organizational context factors in health care centers in Uganda where health care workers undertook changes to improve neonatal health outcomes. The authors reported that organizational culture, leadership, and evaluation were all perceived as important by health care workers in this LMIC setting; in addition, two more factors emerged that include the availability of resources and the engagement of community members (40). The Context Assessment for Community Health Tool (COACH) is another PARIHS-based instrument developed to better understand the influence of organizational context on EBP implementation in LMICs. Evidence from six LMICs where the COACH instrument was assessed suggest that contextual aspects of health care organizations similar to those in high-resource settings are important to health care providers for greater implementation of evidence-based practice (96,97). By focusing specifically on organizational context, the COACH instrument explored aspects such as resources, community engagement, and informal payment that were only covered implicitly or not covered in the ORCA instrument. Assessing organizational context in a more targeted approach may be needed to differentiate between health care centers and detect a relationship with implementation success.

The facilitation component of ORC taken from the PARIHS framework has also been explored in LMICs independent of the evidence and context components. Studies in Vietnam and Tanzania used the facilitation component of the PARIHS framework to inform the design and implementation of a newborn health and postpartum care interventions (41,98). Facilitation by groups of local stakeholders through a bottom-up, problem-solving approach was well-received by health care providers and succeeded in helping local health communes to reduce neonatal mortality over a three-year period (98).

5.4.1 *Limitations*

The measure of implementation success in our study was based on clinical assessments performed by EMAS personnel and the service data collected from registers at study hospitals. The EMAS program is a comprehensive maternal and neonatal intervention, and some clinical standards were already performed near the target level by health care workers in study hospitals, even as the program began. For example, the provision of antenatal steroids to women suspected of premature delivery reached 100 percent across study hospitals by the final quarter of the study period. While this was a positive outcome for program monitoring, this result reduced the potential for change and reduced any variation among study hospitals. Still other clinical standards and corresponding services such as the use of $MgSO_4$ for severe pre-eclampsia/eclampsia and the use of uterotonic in the third stage of labor were removed from the analysis all together because of already high levels at the initiation of the EMAS program (38).

Further, the degree of implementation success varied across study hospitals at the beginning of the period, and one may argue that those facilities with lower baseline clinical assessment scores or reported services had greater potential for change and improvement. If

implementation success were measured by the change in clinical assessment score or change in the reported neonatal services performed when indicated, this could also be misleading since already high performing hospitals would be categorized with a lower degree of change. To account for this variation in baseline clinical assessment score and reported neonatal services, I chose to adjust the regression models for baseline scores.

The objective of this study was to generate evidence for the relationships between ORC measured by the ORCA scales and the implementation success of health care workers implementing the EMAS program in Indonesian hospitals. Few studies to date have examined ORC in a LMIC setting and this study represents an initial attempt to detect an association between the level of ORC among health care workers and implementation success. Identifying organizational factors that facilitate health care workers implementation of new evidence-based practices may have a significant impact on the success of organizational change strategies.

Chapter 6: Conclusion

The strategy of assessing Organizational Readiness for Change (ORC) prior to implementation of an initiative is attracting more attention from health researchers in high-resource countries, but little research has been done in LMICs. This dissertation research adds evidence for this strategy by adapting an ORC measurement instrument and assessing ORC in the middle-income country of Indonesia prior to implementation of an initiative to improve maternal and neonatal clinical standards. Many basic evidence-based interventions for maternal, newborn, and child health (MNCH) are known to be efficacious for saving lives and improving health outcomes (99,100). A gap remains, however, between what interventions are known to work and what interventions are practiced by health care workers in these settings. Through the successful measurement of ORC in study hospitals in Indonesia, this research demonstrates that ORC elements were associated with successful implementation of clinical standards; therefore health organizations in LMICs could benefit from assessing ORC prior to beginning change initiatives.

In this final concluding chapter, I return to the objectives of my thesis and summarize the relevant findings. I discuss the strengths and limitations of the studies in the thesis as well as the implications of my findings for health service managers in LMICs and for future research.

6.1 Pyschometric properties of the Organizational Readiness for Change Assessment in an Indonesian Health Care Setting.

The objective of this initial study in the thesis was to translate, adapt, and test the ORCA instrument in the Indonesian health services context. Currently, multiple definitions of

organizational readiness for change and multiple measurement instruments exist, but nearly all of these were developed and tested in health systems located in high income countries (101). As quality improvement interventions grow in complexity – and those in LMICs are no exception – there is increased need for coordination and collective efforts from many health care workers, clinical departments, and management entities. Assessing ORC has the potential to provide information about organizational motivation and efficacy, each of which can influence adoption of practice change and subsequent health outcomes. Therefore, validating a tool to assess ORC in this context is a valuable step to identify organizational level factors that may facilitate successful implementation of institutional health initiatives.

The Indonesian version of the ORCA instrument showed acceptable reliability among maternity and neonatal health workers in hospitals. The factor structure of the survey tested among this population of health workers identified subscales related to the three primary ORC elements (Evidence, Context, Facilitation) that align with the previously studied English version (58). Four subscales were identified under the Evidence scale including 1) staff discord over evidence 2) research evidence 3) clinical experience and 4) patient needs. Six subscales were identified under the Context scale including 1) leadership culture, 2) staff culture, 3) leadership practice 4) measurement, 5) opinion leaders, and 6) general resources. Nine subscales were identified under the Facilitation scale including 1) leadership practices, 2) clinical champion, 3) leadership implementation roles, 4) implementation team roles, 5) implementation plan, 6) project communication, 7) project progress tracking, 8) project resources and context, and 9) project evaluation.

6.2 Analysis of Association between Organizational Readiness for Change Scores and Achievement of Maternal Clinical Standards in Study Hospitals

After adapting and validating the ORCA instrument in the Indonesian language, I evaluated the association between higher ORC scores from the ORCA instrument and greater implementation of maternal clinical standards by Indonesian health workers in hospital facilities.

Building on the ORCA survey instrument analysis of the previous chapter, I aggregated individual respondent scores from the three scales, Evidence, Context, and Facilitation, to produce mean hospital level scores. To justify and support aggregating the ORCA scale scores from individual respondents to the respective hospital level, the interrater agreement and interrater reliability measures for the survey were calculated. These metrics showed satisfactory results and supported aggregation to a group mean. This step is in line with the theory of ORC being a collective measure and consistent with similar studies that measured ORC among individuals in multiple facilities (16,58,69).

After aggregating the three mean ORCA scale scores at each study hospital, I detected significant associations between the Context scale and greater implementation of four maternal clinical standards. Implementation of clinical standards was measured through observational assessment by trained staff using standardized tools. Health care workers with higher Context scores implemented the following clinical standards with greater success than those with lower Context scores: 1) active management of the third stage of labor, 2) adherence to SOP and protocols for management of severe pre-eclampsia/eclampsia, 3) adherence to SOP and protocols for management of maternal sepsis and severe infection, and 4) adherence to SOP and protocols for management of obstructed labor. The ORCA Evidence scale was associated with greater implementation of one maternal clinical standard, the implementation of obstetric

emergency response. The Facilitation scale was associated with greater implementation of one maternal clinical standard, active management of the third stage of labor.

The most significant associations were detected between the ORCA Context scale and greater implementation of maternal clinical standards suggesting that factors of organizational culture and context were more influential in determining whether health care workers implemented clinical standards relative to other ORCA scales that measure perspectives of evidence for change and facilitation of the change. Contextual factors include organizational culture among both senior leadership and staff members, leadership practices of those in senior positions as well as influential opinion leaders, evaluation practices, and the availability of resources. My findings lend support to the hypothesis that organizational context and culture factors in EMAS study hospitals are influential for preparing individuals for successful change implementation.

6.3 Analysis of Association between Organizational Readiness for Change Scores and Achievement of Neonatal Clinical Standards in Study Hospitals

After examining the association between ORC and achievement of maternal clinical standards, I evaluated the association between higher ORCA scores and the successful implementation of neonatal clinical standards by health care workers. For the analysis of neonatal clinical standards, I examined two measures of successful implementation. Initially, I compared ORCA scale scores with the achievement of neonatal clinical standards by Indonesian health workers in study hospitals, similar to that of maternal clinical standards. Clinical standard achievement was assessed through clinical observations by trained staff from the EMAS program using standardized tools. Secondly, I examined the association between scores from the ORCA

instrument and newborn indicators derived from hospital registry data. Standardized data registers were introduced in all of the EMAS program hospitals as part of an effort to improve the accuracy and reliability of data for tracking maternal and neonatal clinical practices at the hospital level. Staff at hospitals entered data into registers as routine recording. The hospital registers served as data sources for aggregate data categorized into indicators by the EMAS program. I used data from two newborn indicators for this analysis that track the two neonatal clinical standards described above (use of antenatal corticosteroids, and breastfeeding within one hour of birth). While registers were also used for the collection of maternal service data, the maternal indicators of interest were already very high for all study hospitals. In particular, these included routine use of uterotonic drugs during the third stage of labor for management of PPH, and the use of MgSO4 for pre-eclampsia / eclampsia (38).

I first examined differences in mean ORCA scale scores among study hospitals that I categorized into two groups based on high and low implementation of neonatal clinical standards using clinical assessment scores. I then attempted to detect differences in the mean ORCA scale scores between the high and low implementation groups based on hospital registry data. This was followed by a linear regression analysis where I regressed the two measures of successful implementation for neonatal clinical standards on each of the ORCA scale scores.

For high and low implementing hospitals of implementation of breastfeeding within one hour of birth, I detected only small differences between the mean ORCA scale scores. These differences were not significant when I compared mean ORCA scale scores by implementation of clinical standard assessment nor when hospitals were grouped by the newborn indicator for breastfeeding. When I compared hospitals according to the delivery of antenatal corticosteroid

among women with expected preterm delivery according to the newborn indicator, differences in the mean ORCA scale scores were greater, but not statistically significant. When I compared hospitals according to low and high implementation for the clinical standard of use of antenatal corticosteroids and adjusted for the baseline clinical standard assessment scores and the baseline newborn indicators, the association between ORCA scale scores and successful implementation remained small and not statistically significant.

A prior study was successful in detecting significant differences in mean scale scores of sub-elements of the evidence and context scales of the ORCA instrument between high and low implementing hospitals for hepatitis prevention services. This study reported that accounting for patient preferences and providing effective leadership culture were both associated with greater implementation (20). In order to draw conclusions about the predictive validity of ORC scores at the hospital level, my study examined the ORCA scale scores in their entirety rather than per sub-element. An analysis with sub-elements of the ORCA scales may provide valuable information for individual sub-elements of ORC that can be targeted by managers in health service institutions.

6.4 Strengths and Limitations of this Research

As one of the first studies to measure Organizational Readiness for Change (ORC) in an LMIC with the ORCA instrument, I designed my study with the unit of interest at the facility level and then included 36 different hospital facilities across three Indonesian provinces that were all implementing the EMAS program simultaneously. One of the challenges to studying ORC is the fact that the organization is the unit of interest and therefore sample sizes may be limited to a small number of intervention centers or organizations. By working with hospitals implementing the EMAS program, I was able to access a research sample with more than 30 intervention sites.

Several previous studies were limited to smaller samples, only analyzed respondents from a single organization, or did not evaluate at the facility level (20,44,45,89).

Some limitations to the research need to be acknowledged. The potential for social desirability bias occurs when respondents self-report on a questionnaire in a way that portrays a favorable image of themselves. Respondents may feel pressure from a social situation or respond in a way to avoid criticism. In this study, Indonesian health care workers were asked to describe the readiness of the facility where they work, their peers, and their supervisors while while in a group setting. This arrangement in addition to the hierarchy among health care workers may contribute to social desirability bias in the ORCA responses due to pressure to comply with the work environment. I attempted to control for this possibility by assuring respondents that questionnaire responses would be anonymous, kept confidential, and used strictly for research purposes. However, artificially inflated responses (suggesting high agreement) or a lack of extreme responses (suggesting neutrality) may indicate social desirability bias. The response patterns found in the ORCA questionnaire data presented here (e.g., lack of extreme responses) may be a result of social desirability bias. One recommendation for future work with the ORCA instrument in this context is to include a social desirability scale with the instrument. This scale is designed to detect social desirable responses so that adjustments can be made by the researcher in the analysis to account for potential bias (102).

Another limitation lies with a characteristic of the ORCA instrument and its use with the EMAS Program. The initial section of the ORCA instrument asks respondents to refer to the the organizational change that is being asked of them as they reflect on the first two survey items. For example, the evidence statement given at the beginning of the instrument stated, “Clinical

and governance standards implemented by the EMAS program will improve health outcomes for mothers and newborns in health facilities". The broad nature of the statement incorporates many clinical standards that were the focus of the EMAS mentoring activities for health care workers in the study hospitals. It is conceivable that responses to the survey items varied depending on whether respondents reflected on the program as a whole, or on individual program components that were more pertinent to the health care worker, or even on individual clinical standards that more directly impacted their daily tasks. The survey evaluation for the Indonesian version of the ORCA suggested this was not a significant issue because I did not find increased variance between the ORCA scales. Developers of the ORCA instrument hypothesized that increased variance between scales could be an indication of measurement error related to this issue. Nonetheless, future studies of ORC can further eliminate this possibility by focusing respondents on a single practice change when responding to the ORCA instrument.

The EMAS program was rolled out in multiple hospitals simultaneously across multiple provinces in Indonesia. The leadership at district hospitals and the district health office were supportive of the program in the majority of cases but in some instances leaders did not promote the program and objectives. I was not able to capture this information in the current analysis; the ORCA instrument was administered to health workers involved in EMAS program implementation but not to hospital leadership nor district health leaders. In Indonesia, health care services are decentralized to the district level and the head of this district office, along with district hospital directors, play an important role in planning, service delivery, and management of services. The support (or lack thereof) for a program like EMAS may also impact respondents

to the ORCA as they reflect on items that attempt to capture characteristics of the organizational culture within a hospital.

The ORCA instrument was administered to respondents at the study hospitals at one point in time at the beginning of EMAS program implementation. My objective was to investigate whether a baseline measure of ORC prior to implementation is associated with the successful implementation of maternal and neonatal clinical standards after one, two, three or four quarters of the EMAS program. Measuring ORC at baseline, prior to implementation of an organizational change, follows from the theoretical concept of ORC that describes it as a measure of collective preparedness before change implementation (15). As the EMAS program stretched over a year, another question is whether ORC among health care workers fluctuated during this period. The current study is unable to detect changes in the level of ORC over the course of program implementation since this would require multiple ORCA survey collection points. Recent studies that measure ORC more than once during the study period report changes from a baseline ORC measure, and additional measures may be useful in predicting outcomes of successful implementation (43,103).

In my studies examining associations between ORCA scores and successful implementation of clinical standards, I obtained program monitoring data from the EMAS program. This data was collected routinely by program staff, but there are some limitations that are inherent with this type of data. As an intervention, the EMAS program set objectives for hospitals to achieve 80-100% compliance with maternal and neonatal clinical standards. In some cases, these objectives were achieved uniformly by health workers suggesting factors other than ORC were responsible for the change. For example, the provision of antenatal steroids to women

suspected of premature labour reached 100 percent across study hospitals by the final quarter of the study period. Two of the maternal clinical standards, routine use of uterotonic drugs during the third stage of labor and the use of MgSO4 for pre-eclampsia/eclampsia were already very high in the study hospitals so that these were excluded from the analysis (38).

6.5 Implications for future research

This thesis is one of the first studies to attempt to measure an association between the level of ORC assessed in a health care organization and the successful implementation of organizational change in a LMIC. The associations detected were small, but this research can stimulate more work in this field to further specify ORC, develop measurement instruments, and evaluate associations with successful implementation. Below I discuss the value of using the PARIHS framework and the future research of ORC to improve implementation success in LMICs.

6.5.1 *Promoting Action on Research Implementation in Health Services*

The PARIHS framework describes a theory for implementing research into practice and consists of three primary, interacting elements (Evidence, Context, and Facilitation) that influence the outcome of successful implementation. Since the conceptual framework was first promoted, it has been widely cited, has undergone a revision (90), and benefitted from a critical synthesis of literature on its use (104).

At the time of this study, the PARIHS framework has been tested and used in research primarily in high-income settings. One of the objectives of my study is to investigate whether the ORCA tool, based on the PARIHS framework with all three primary components, Evidence, Context, and Facilitation, performs as well in a lower income setting such as Indonesia. Elements

of the PARIHS framework (e.g., Context) have been tested in a small number of low-income settings with the objective of improving implementation of evidence into practice.

Bergstrom and colleagues note the disparity of research using the PARIHS framework and then examined the perceived relevance of the context element of the PARIHS framework among health care providers in Uganda (40). Not only do contextual factors appear to be relevant in low- and middle-income settings, but the authors reported additional factors that may be important for implementing evidence-based practices, notably resources, community involvement, and commitment and informal payment. This led to the development of the Context Assessment for Community Health, a PARIHS-based instrument to fill the gap of assessing organizational context in low- and middle-income countries (96).

In a small number of studies in LMICs, the facilitation element of the PARIHS framework has also been used to guide the design of successful maternal and newborn interventions (41,98). In Tanzania, researchers designed an intervention to improve postpartum care that focused on facilitation strategies to change health worker behavior; while in Vietnam, a facilitation-based intervention reduced the neonatal mortality through a problem-solving approach with local stake-holder groups. These studies demonstrate the potential for evidence-based implementation when strategies based on the facilitation element are utilized.

Further research in LMICs is needed to determine whether instruments based on the PARIHS framework, either by element or in its entirety, will reliably predict successful implementation of evidence-based practices. The findings of my study to predict successful implementation from the PARIHS-based ORCA instrument demonstrated some associations with high evidence scores, high context scores, or high facilitation scores. However, the evidence

described in the previous LMIC studies described here suggests that components of the Context element are relevant for understanding organizational factors in these settings, and interventions designed with components of the Facilitation element hold promise for successful implementation.

6.5.2 *Organizational Readiness for Change in LMICs*

The findings of this thesis with respect to measuring ORC in Indonesian hospitals represent an initial benchmark for future studies to refine measures of ORC in health contexts outside of high resource settings. In an effort to test the ORCA instrument in its entirety, all three scales were translated and adapted to the Indonesian context and given to health worker respondents. Following closely with the PARIHS framework, my objective was to assess all the items of the ORCA in an effort to comprehensively examine the latent construct of ORC. While I chose to adapt several of the ORCA items to the EMAS intervention, the structure and number of items in each scale remained similar to the original assessment. However, some studies have also tailored the assessment to focus on specific aspects of ORC, repeated the measures multiple times during the study, or combined qualitative methods with the survey to further understand facilitator and barriers of ORC. These studies are further examples of efforts to understand factors of ORC, to assess whether ORC factors can be used to predict implementation outcomes, and to assess the value of ORC for diagnosing and tailoring an implementation approach to a specific context. A recent review of ORC assessments concluded that further research should aim to consolidate the existing measurement tools, relevant factors and the terminology in order to better understand what value is gained from measuring ORC and how this can impact the implementation of evidence-based practices (101).

There are examples of studies that abbreviate the ORCA instrument, using only one or two of the scales for reasons determined by the context of the intervention or organizational change or focus of the researchers (20,40,84). Bergstrom et al. (2012) examined the influence of organizational context on implementing evidence into practice in low-income settings through qualitative methods. The authors reported that not only were factors of organizational context from the PARIHS framework relevant for successful implementation, but additional factors were also identified including commitment and community involvement. Focusing on the utility of the ORCA scales independently may help to further understand the relevance of each scale for measuring factors of ORC in lower-resource settings.

Many of the studies assessing ORC have operationalized concepts and tailored instruments specific to the intervention (101). Conducting qualitative data analysis methods further allowed authors to assess organizational factors and identify those related to specific interventions in both high and low-resource settings (22,40). Combining qualitative methods with an ORC survey has helped to identify those factors that act as facilitators and barriers to implementation of evidence into practice that can be tested across facilities or organizations (22). Even when the organizational change or intervention is identical across health care organizations as was the case with the EMAS program, facility leadership and regional buy-in from district offices are unmeasured factors that could influence implementation outcomes. They may require methodologies other than survey administration for measurement.

Consistency in terminology and definitions is another issue that continues to impede ORC related research efforts. More than one review has identified the lack of consistent terminology and definitions across ORC assessments being used today (101). Studies that define successful

implementation using clear and consistent terminology will help to build an evidence base that can be compared across studies that examine ORC. The use of different definitions for successful implementation across studies creates challenges for comparing ORC measurement and implementation (18,25).

One implication for future analysis of ORC across multiple implementation sites is the opportunity to conduct a multilevel analysis. Where this study took steps to aggregate ORCA data from individuals to hospitals, it may be possible to estimate the effects associated with belonging to a facility and acknowledge in this way that individual health care workers are not independent but instead are related to other individuals from the same facility. Future research that uses longitudinal data may also help to answer questions around the fluctuation of ORC over the course of an implementation period.

6.6 Concluding Remarks

This research describes an adaptation of an ORC measurement instrument to the Indonesian context, a health setting in a middle-income country. Following translation, the ORCA instrument was used to measure ORC in association with the implementation of maternal and neonatal clinical care standards in Indonesian hospitals. While some associations between ORCA scales and the implementation of maternal and neonatal clinical standards were found in this thesis, the results were small and inconsistent. This suggests that further investigation across hospitals or health centers implementing a specific evidence-based change is needed to generate more clear evidence for ORC as a predictor of implementation success. Future investigations that focus on one type of health provider (midwife, nurse, physician) would also offer opportunities to identify organizational factors specific to a provider group. That said, measuring ORC in LMICs

has received little attention to date, and the Indonesian health care system is an appropriate setting for further ORC research given the need to improve health professional capacity in the country, especially in the maternal and newborn health field (31,105). Organizational readiness as a measure of both collective motivation and capability may help to identify and address deficiencies related to health worker training and education. Health care leadership in Indonesia may draw awareness from this research for assessing readiness among staff and identifying organizational factors in order to improve implementation of evidence-based practice changes. Research undertaken for this thesis should stimulate further exploration of ORC in Indonesia and other middle and low-income settings to improve our ability to understand factors associated with successful implementation of evidence-based practices in these health systems.

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