CHILD AND ADOLESCENT MENTAL HEALTH IN LMIC: APPLICATION OF TASK-SHARING APPROACHES AND AN EXAMINATION OF INTERGENERATIONAL TRANSMISSION OF RISK

CHILD AND ADOLESCENT MENTAL HEALTH IN LMIC: APPLICATION OF TASK-SHARING APPROACHES AND AN EXAMINATION OF INTERGENERATIONAL TRANSMISSION OF RISK

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Lay Abstract

Children who grow up in circumstances of chronic poverty and adversity suffer heightened risk for mental health problems as they grow up. This is especially true of children who live in low- and middle-income countries, where children are more likely to experience chronic and co-occurring forms of adversity. Access to mental health services in these contexts are limited or non-existent, conferring heightened vulnerability for mental health problems that may persist across the lifespan. The risk for mental health problems can be transmitted across generations. Although it is not fully understood how mental health problems can be transmitted from a mother to a child, one commonly studied mechanism is the role of maternal adversity and maternal mental health. Because the barriers to mental health care are abundant, the needs of children and mothers with mental health problems are frequently left unmet. The World Health Organization proposes a task-sharing solution, whereby less specialized community health care workers are trained to provide services to improve access to assessment and treatment in low income countries. Using data collected in rural Kenya, this dissertation seeks to explore: 1) the development of a partnership between the Africa Mental Health Research and Training Foundation and McMaster University with the aim of working together to create mental health assessment for children, using a task-sharing approach, 2) to compare the results of the novel mental health assessment to a gold-standard, and 3) to evaluate maternal adversity, maternal mental health, and the transmission of mental health problems between mothers and children in Kenya. Collectively, the results of this dissertation demonstrate that utilizing a task-sharing model for the development of a

mental health assessment for use by community health workers is a valid method for assessing and diagnosing mental health problems in children, and that the transmission of mental health problems across generations is associated complex factors (e.g. maternal exposure to adversity and maternal mental health) as a result of exposure to chronic and enduring adversity in LMIC.

Abstract

Children and adolescents in low- and middle-income countries (LMIC) suffer heightened vulnerability for the development of mental health conditions which is exacerbated due to enduring socioemotional, economic, and biological risk factors. The constellation of co-occurring adverse childhood experiences (ACEs; e.g. poverty, maltreatment, household dysfunction, exposure to violence) confer heightened vulnerability for the development of mental health disorders that may persist into adulthood. Although the mechanisms for transmission from one generation to the next has not yet been fully elucidated, contemporary evidence has converged primarily on maternal mental health as a key mediator between childhood exposure to ACEs, and the subsequent mental health of her children. Access to mental health assessment or treatment resources in Kenya are limited or non-existent. Due to the heightened risk for intergenerational transmission of mental health problems across generations, with support from the World Health Organization and key stakeholders in Kenya, the development of task-sharing approaches to address the unmet psychological needs of children and mothers has been advocated for. Task-sharing involves the rational redistribution of mental health care tasks from higher cadres of mental health professionals to non-specialized community health care workers in order to increase the capacity for, and access to, mental health services across Kenya.

This dissertation seeks to explore: 1) the development of a partnership between the Africa Mental Health Research and Training Foundation and McMaster University to explore the use of task-sharing in the development of a technology-supported assessment

for common mental disorders in children and adolescents; 2) the validity and reliability of the newly developed International Mobile Assessment for Children and Teens (IMPACT) administered by non-specialized community health workers when compared to a gold-standard assessment, the MINI-KID, when administered by trained psychology graduate students, and finally; 3) the association between maternal exposure ACEs and the subsequent mental health of her children, mediated by maternal mental health.

The first study outlines the process of the development of the IMPACT using a novel blending of emic-etic approaches, and the practical evaluation of the IMPACT by ten local community health workers. Results from this study demonstrated the demand for, and utility of, the IMPACT and outlined the practical considerations of conducting field work of this nature. The second study examined the diagnostic agreement (e.g. validity) of mental health conditions in Kenyan school children (n=189) between the IMPACT and the MINI-KID. The results of this study demonstrated relatively high agreement between the diagnosis of common mental disorders in children between the IMPACT and the MINI-KID. The third study explores the relationship between ACEs (Y-VACS) of mothers (n=149) and the socioemotional wellbeing of her children (e.g. internalizing and externalizing problems; CBCL), mediated by maternal mental health (CBCL). The results of this study demonstrate the association between maternal ACEs and child internalizing and externalizing behaviours, mediated by maternal mental health and moderated by maternal education. Collectively, the results of these dissertation studies support the use of task-sharing approaches for the assessment of common mental disorders in children and adolescents, by non-specialized community health workers and

that the transmission of mental health problems between generations is associated with a multitude of complex and inter-related factors (e.g. maternal ACEs and maternal mental health), exacerbated by chronic and co-occurring adversity. Additionally, the results of these studies demonstrated the need for further research that prioritizes the equitable accessibility interventions that target the mental health related-sequelae experienced by maternal-child dyads exposed to chronic and enduring adversity in LMIC.

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“If you want to go fast, go alone. If you want to go far, go together”
-African Proverb

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Amber D. Rieder,
McMaster University,
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Declaration of Academic Achievement

This dissertation is comprised of three studies, each of which were conceptualized by the student. The design and development of the International Mobile Psychiatric Assessment for Children and Teens (e.g. conceptualization, inclusion of disorders, programming, bug testing), in addition to the overall study design and data collection was generated by the student. The student analyzed the data in each of the studies and prepared the manuscripts for publication. The student made all revisions to manuscripts based on advice and feedback from co-authors and journal editors. This dissertation research was completed between September 2014 and July 2019. To meet the requirements of the sandwich thesis, the contributions of co-authors are described as follows.

The first dissertation study was co-authored by Dr. Geoffrey Hall, Dr. Andrea Gonzalez, Dr. Roberto Sassi, Dr. David Ndetei, Dr. Victoria Mutiso, and Dr. Abednego Musau who each critically reviewed the manuscript prior to publication. Dr. Geoffrey Hall provided advice and support for the development of the IMPACT. Dr. Christine Musyimi and Dr. Victoria Mutiso provided support for field-research. Ellis Freedman contributed to the programming of the IMPACT, debugging of the programming language, and collection of data in the field. Rita Abdel-Baki and Jennifer Mullen, (Undergraduate thesis students) and Ellis Freedman (Masters student) helped with Canadian pilot studies.

The second dissertation study was co-authored by Dr. Geoffrey Hall, Sophia Roth, Dr. Andrea Gonzalez, Dr. David Ndetei, Dr. Victoria Mutiso, and Dr. Abednego Musau, and Dr. Roberto Sassi who each critically reviewed the manuscript prior to publication. Dr. Geoffrey Hall provided advice on the psychometric development of the IMPACT. Dr. Roberto Sassi additionally contributed clinical advice and support. Writing support and statistical analysis was provided by Sophia Roth. Ellis Freedman contributed to the programming of the IMPACT, debugging of the programming language, and collection of data in the field. Laura Duncan and Eric Duku of the Offord Center provided statistical advice.

The third manuscript was co-authored by Sophia Roth, Dr. Christine Musyimi, Dr. David Ndetei, Dr. Roberto Sassi, Dr. Victoria Mutiso, Dr. Geoffrey Hall, and Dr. Andrea Gonzalez who each critically reviewed the manuscript prior to publication. Dr. Gonzalez provided substantial advice on the conceptualization of the measure selection, study design, statistical models, and the content of the manuscript. Sophia Roth contributed to the conceptualization of the models, analysis, and supported the writing of the overall manuscript.

Chapter 1 | General Introduction

1.1 Statement of Purpose

Mental health problems in children and adolescents account for a large proportion of the overall disease burden for this age group, especially in the context of poverty and scarcity of mental health resources (Patel, Flisher, Hetrick, & McGorry, 2007). Children and adolescents in Kenya suffer heightened vulnerability for the development of mental health disorders due to the extreme lack of financial and trained human resources dedicated to mental health assessment and treatment (Musyimi et al., 2016). Given the disparity between the unmet mental health needs of children and adolescents, especially in Kenya where poverty and exposure to adverse experiences is heightened, the purposes of this dissertation are threefold: (1) The first chapter is an introduction to the field of global mental health, the nature of childhood mental health problems in Kenya, and an exploration of the role of poverty and violence in this context. The purpose of the first study is to examine the development of a sustainable and equitable research partnership between McMaster University and a non-governmental research partner organization, the Africa Mental Health Research and Training Foundation (AMHRTF), located in Nairobi, Kenya. In the first study, an examination of the tools used to develop and sustain an equitable research relationship between partner organizations located across the global North and South is explored. The nature of this partnership was equitably established in the context of systemic, geopolitical, and financial imbalances through the utilization of a Partnership Assessment Tool (PAT). The first study outlines 'lessons from the field',

including the exploration of establishing a working relationship with the AMHRTF and with local community health workers who were integral to the success of the subsequent dissertation research. The first study also outlines the use of an emic-etic approach to evaluate the utility and feasibility of a technology-supported structured interview for the diagnosis of common childhood mental disorders, by non-specialized community health workers. (2) The second purpose of this dissertation seeks to evaluate the validity of a newly developed universal assessment for childhood mental illness, the International Mobile Psychiatric Assessment for Children and Teens (IMPACT). This study utilizes a task-sharing model, a solution-focused trend in the emerging global mental health literature, in response to the unmet psychological assessment needs of children in low-and middle-income countries (LMIC). Task-sharing is an approach supported by the World Health Organization, whereby mental health care is simplified, repackaged, and delivered by non-expert community health workers following training and supervision. The goal of task-sharing approaches, including the IMPACT, is to improve equitable access to mental health assessment for childhood psychological disorders. (3) The final purpose of this dissertation is to examine factors that contribute to the development of psychological disorders and explore the transmission of psychological risk for mental health problems across generations. This study utilizes a moderated-mediation analysis to examine the relationship between the unique experience of parental childhood adversity in LMIC and its later impact on maternal mental health, and the subsequent mental health of children in the next generation. Other relevant factors to the intergenerational transmission of risk between mothers and their children, including level of education and socio-economic

status, are explored. The final chapter encompasses a discussion of the findings from each of the three studies and explores their collective implications for future research and scaling of task-sharing approaches.

1.2 Global Mental Health

Global mental health has been broadly defined as "an area for study, research and practice that places a priority on improving mental health and achieving equity in health for all people worldwide" (Koplan et al., 2009, p.1; Patel & Prince, 2010). Although early research in cross-cultural and comparative psychiatry spans decades, the term 'global mental health' only became frequently used following a Lancet series on the topic in 2007 (Horton, 2007; Jacob et al., 2007; Patel, Araya, et al., 2007; Prince et al., 2007; Saraceno et al., 2007; Saxena, Thornicroft, Knapp, & Whiteford, 2007). The Lancet series helped establish mental health as a distinct discipline within the study and practice of global health. The goals of the emerging subdiscipline were more formally established in 2010 and set out to improve equitable access to evidence-based mental health treatments and to minimize human rights abuses for those suffering from mental illness (Patel & Prince, 2010). The Lancet series highlighted the needs of those living in low- and middle-income countries (LMIC) and set forth a call to action to scale up mental health services for those incurring human rights abuses with the least access to mental health services (Misra, Stevenson, Haroz, De Menil, & Koenen, 2019). The expansion of the field is evident by the emergence of mental health care in non-specialized settings (e.g. primary care, schools, communities), the evidence-based delivery of mental health care by non-expert community health workers (CHWs), and by the emergence of non-government organizations (e.g. Movement for Global Mental Health) (Patel, Minas, Cohen, & Prince, 2014). Support for the movement continued to grow through secured funding (e.g. Canada's Grand Challenges $42M investment), political prioritization, commitment from

the WHO (e.g. 2013 Action Plan) and inclusion of mental health priorities in the United Nations' (UN) Sustainable Development Goals (SDGs) which collectively have strengthened the rapid growth and inclusion of mental health as a distinct discipline within the global health landscape (Patel et al., 2014). Subsequently, there has been a ten-fold increase in global mental health publications between 2012 and 2016, with the majority conducted in LMIC, primarily concentrated in sub-Saharan Africa (Misra et al., 2019). The introduction of this dissertation seeks to outline the current literature on the global burden of disease within the framework of global mental health, especially as it pertains to LMIC. The examination of factors that contribute to maladaptive socioemotional development, particularly in child and adolescent populations, in rural Kenya are explored. Finally, the examination of mental health resources for the purposes of psychiatric diagnostic assessment, along with an outline of contemporary evidence for the use of task-sharing to meet the unmet psychiatric needs of children in Kenya, are explored.

1.2.a. Global Burden of Disease

The World Health Organization (WHO) measures the burden of disease around the world by examining the top 100 causes of all illness and injury and assessing their impact on quality of life. This burden is quantified by the disability-adjusted-life-year (DALY), where one DALY is equivalent to one year of life lost due to ill health, disability, or premature death. The global burden of disease (GBD) is a measure of the actual health of a population when compared to the ideal health of a population that can age free from

illness or disability. Following the establishment of the WHO International Consortium in Psychiatric Epidemiology, the WHO evaluated the burden of mental illness across 28 countries, the first large-scale epidemiological survey of its kind (Patel et al., 2014). This study was the first to measure the global burden of disease with the inclusion of mental health conditions. It was learned from this endeavour that approximately 14% of the world's total disease burden can be attributed to mental, neurological, and substance use (MNS) disorders (Prince et al., 2007). The MNS disorder category is the leading cause of non-fatal global DALYs and surpasses the burden for both cancer and cardiovascular disease combined (Whiteford et al., 2013). The largest contributor of burden by disorder is depression followed by substance use and anxiety disorders (Whiteford et al., 2013).

1.2.b. Mental Health in LMIC

Approximately 85% of the global population resides in a LMIC (Ndetei & Szabo, 2012). The majority of LMICs are contained within sub-Saharan Africa, a continent that spends relatively little of its total health budget on mental health conditions. Roughly, 80% of countries within Africa spend less that 1% of the total budget on mental healthcare (Ndetei & Szabo, 2012). High-income countries (HIC) spend on average 5% of their total budget on mental health, whilst all LMICs continue to fall short of the 2% goal set forth by the Sustainable Development Goals (Ndetei & Szabo, 2012). The gap between the number of people suffering from mental health conditions in LMIC and the resources allocated for research and treatment is astounding. Given that living in conditions of poverty nearly doubles the occurrence of mental health conditions, it is

particularly concerning that only 10% of the research conducted on mental health conditions are located in LMIC (Brundtland, 2001).

There is a complex bidirectional relationship between living in poverty and the experience of mental illness. Research in HIC has established a negative cycle of risk, where the risk for mental illness is heightened when living in conditions of poverty, and where the risk for poverty is heightened when living with a mental illness (Lund et al., 2011). Research on the mechanisms of risk for this negative cycle in LMIC is growing. A constellation of factors contribute to the understanding of causal mechanisms of risk for mental illness, and an overview of these factors will be discussed below. These mechanisms in LMIC have largely converged on social factors that include education, socio-economic status, and exposure of violence (Lund et al., 2011).

1.2.c. Mental Health in Kenya

Kenya, a country classified by the World Bank as LMIC, is one of the poorest nations in the world (World Bank, 2017). More than 50% of the almost 50 million residents of Kenya are considered to be living in poverty (Kenya National Bureau of Statistics, 2017). Kenya is primarily a subsistence agriculture-based economy, with approximately 24% of the population living in urban areas (Bitta, Kariuki, Chengo, & Newton, 2017). The average lifespan in Kenya is 62 and 65 years of age for males and females, respectively, and two thirds of the population is under the age of 24 (Ndetei et al., 2012). Most Kenyans speak both English and Kiswahili which are national languages, although, there is a rich diversity in indigenous cultural practices, language, and ethnic affiliation across

the country's 47 administrative counties (Ndetei & Szabo, 2012). Kenya's healthcare system is financially under-resourced and invests only .01% of its health care budget of $10 USD per capita per year on mental health (Tamburrino, Getanda, O'Reilly, & Vostanis, 2018). Interest in training and opportunities for capacity building in mental health is inadequate. The system is plagued by 'brain drain' due to emigration, where nearly one third of Kenyan psychiatrists' practice outside of the country (Ndetei et al., 2007). Less than 50% of 75 Kenyan psychiatrists hold clinical practice, and the remaining practitioners are concentrated in urban centers, primarily Nairobi, leaving the vast majority of the country under-serviced (Bitta et al., 2017; Ndetei et al., 2007). Rural or geographically isolated populations suffer the greatest dearth of mental health services, with only 9 practicing psychiatrists serving the entire rural regions of the country (Ndetei et al., 2007). Additionally, the overall health system is reported to be poorly coordinated and lack sufficient infrastructure or record keeping (Tamburrino et al., 2018). Existing public mental health services are primarily hospital-based and targeted toward severe adult mental illness (Tamburrino et al., 2018). Accessible mental health services for child and adolescent populations are limited or non-existent (Jenkins et al., 2010). The exploration of mental health services available in Kenya for assessment and treatment of childhood mental disorders is explored in the first and second dissertation studies.

1.2.d. Child and Adolescent Mental Health

Children in LMIC suffer heightened vulnerability for MNS disorders, due to the common experience of multiple chronic and inter-related risk factors (Patel, Flisher,

Hetrick, & McGorry, 2007; Tamburrino et al., 2018). Approximately one of every five young people worldwide suffers from MNS disorders, and estimates are greater where children are exposed to deprivation (Patel et al., 2007). Using the DALY as measurement in children and youth, over half of the top ten causes of disease are attributable to MNS disorders. This is exacerbated in LMIC, where poor living conditions including poverty confers further risk for social disadvantage, scarcity of food, inadequate education, exposure to violence, and lack of access to medical treatment (Patel et al., 2007). These risk factors, particularly poverty, in children are strongly associated with complex and bidirectional relationships with mental disorder. Additionally, there is a strong relationship between poor mental health and general health and development, including increased risk of substance use, poorer reproductive and sexual health, cardiovascular disease, diabetes, tuberculosis, malaria, and communicable diseases such as HIV (Prince et al., 2007).

Treating mental illness in young people is critical and of obvious public health significance. Mental disorders in adults often commence in childhood or adolescence (Patel et al., 2007). In the United States, 75% of individuals diagnosed with a mental disorder had an onset of illness after the age of 12 and prior to the age of 24 (Patel et al., 2007). A similar pattern of onset during adolescence is also recorded in LMICs, such as Kenya (Harder et al., 2014). This period of development, between the ages of 12 and 24, is of critical importance for early intervention due to its temporal relationship with environmental and social factors relevant to general development (Patel et al., 2007). Adolescence is a period of massive growth, development, and change and when important

life decisions regarding education, career, social, and romantic relationships are formed. If mental illness is left untreated, there is a high degree of likelihood that the illness will persist into adulthood, and consequently will impair important decisions made during this vulnerable period (Patel et al., 2007). An examination of common mental disorders in childhood and adolescents in Kenya is explored in the second dissertation study.

1.3 Adverse Childhood Experiences

A healthy developmental trajectory throughout childhood is influenced by several factors that include genetics, environment, and exposure to adverse childhood experiences (ACEs), along with supportive factors that mitigate the consequences of adversity (Shur-Fen Gau, Hodes, 2018). In LMIC, children are frequently exposed to multiple chronic adverse conditions, experiences, or traumas, that interrupt typical development (Feletti et al., 1998). ACEs encompass a constellation of intra- and extra-familial-based stressful or traumatic experiences, including exposure to poverty, childhood maltreatment and neglect, household dysfunction, or community violence (Dube et al., 2006). Research has demonstrated the dose-dependent nature of ACE-related sequelae, where increased exposure (e.g. multiple ACEs, severity, and chronicity) predicts poorer long-term physical and socio-emotional outcomes (Berens, Jensen, & Nelson, 2017). Children in LMIC experience heightened risk for ACEs. For example, 44% of children in HIC countries experience childhood maltreatment, compared to nearly 60% of children in LMIC (Hillis, Mercy, Amobi, & Kress, 2016).

1.3.a. Exposure to Violence and Household Dysfunction

Childhood maltreatment encompasses physical, sexual, and emotional abuse, in addition to physical and emotional neglect resulting in potential or actual harm to the child. Exposure to childhood maltreatment confers maladaptive developmental consequences to the child that contributes to a cascade of negative developmental consequences that persist across the life-span (Cicchetti, 2016). It is reported that children in LMIC suffer greater likelihood of experiencing harsh parenting and discipline (Blum, Li, & Naranjo-Rivera, 2019). Rates of childhood maltreatment in Kenya exceed those of HIC. In Kenya, 66% of girls report experiencing physical abuse, and 32% experience sexual violence (Kenya National Bureau of Statistics, 2017). Approximately 78% of children report exposure to intimate partner violence. In LMIC, adversity in the form of household dysfunction encompasses a myriad of exposures that range from parental loss (e.g. death, incarceration, divorce) to exposure to parental mental illness, substance use, or witnessing intimate partner violence. This is exacerbated for children living in LMIC through multiple and chronic exposures to adverse childhood experiences (Bhopal et al., 2019; Walker, Wachs, Grantham-Mcgregor, et al., 2011). In HIC, retrospective reports demonstrate that approximately 60% of adults experience at least one form of childhood adversity (Gilbert et al., 2014). Prevalence research of ACEs in LMIC is limited or non-existent, however, one comparison study reported 75% of children experiencing at least one form of ACEs (Berens et al., 2017). The negative cumulative impact of ACEs in LMIC is likely to be exacerbated based on higher incidence of chronic and co-occurring adversity that is frequently more severe and relatively prolonged in nature (Angold et al.,

2012; Walker et al., 2011). One such adversity that is often neglected in research in HIC is childhood exposure to community violence. In LMIC, exposure to extra-familial violence is highly prevalent, and the simultaneous exploration of both intra- and extra-familial adversity is a novel contribution to the literature that this dissertation seeks to explore. An examination of the role of both intra- and extra-familial ACEs (e.g. childhood maltreatment, and exposure to both intimate partner, and community violence) are explored in the third dissertation manuscript.

1.3.b. Exposure to Poverty

Children constitute a third of the global population, with 90% of 2.2 million children worldwide living in LMIC (Kieling et al., 2011). Living in poverty confers a constellation of complex and bidirectional consequences and inequities. Low socio-economic status (SES) is a well-established predictor of a cascade of negative physical health, socio-emotional, and educational outcomes in HIC (Shur-Fen Gau, Hodes, 2018). Although research on the relationship between poverty and its sequelae in LMIC is relatively sparse, a review of common mental disorders reported a 79% positive association with level of poverty (Lund et al., 2010). From this review, other factors associated with poverty and mental health emerged and include level of education, food insecurity, access to healthcare and unstable living conditions (Lund et al., 2010). Elucidating the negative consequences of adversity to the full extent is challenging due to the concurrent exposure of multiple ACEs, dose-dependent factors related to the severity and chronicity of ACEs, and the experience of protective factors that serve to buffer negative consequences. For

example, despite the challenges of growing up under conditions of deprivation, many children exposed to ACEs in the form of poverty are also provided with a safe psychosocial environment which serves to mitigate the cascade of poverty-related consequences (Lund et al., 2010). Another factor commonly cited in the literature that has been shown to mitigate the consequences of poverty is personal resilience (Kieling et al., 2011). Emotion regulation as a resilience factor, for example, is a personal quality that enables some children to overcome the consequences adversity (Kieling et al., 2011). Additionally, the quality of emotion regulation is associated with common mental disorders and academic achievement of children, both predictors of adult outcomes (Kieling et al., 2011). The role of poverty and an exploration of protective factors (e.g. education and socio-economic status) are explored in the third dissertation manuscript.

1.3.c. Intergenerational Transmission of Risk

Poor maternal mental health has been established as a well-known risk factor for the detriment of maternal-child interaction and maternal emotion regulation (Patel, Kieling, Maulik, & Divan, 2013; Stein et al., 2014). Optimal maternal mental health and emotion regulation serve to promote consistent sensitive and responsive caregiving behaviour, a key factor in the healthy socioemotional development of children (Flaherty et al., 2009). Evidence from HIC has established the relationship between a mother's pre- and postnatal exposure to ACEs and the enduring impact on her mental health across the lifespan ((Benjet, 2010; Feerick & Snow, 2005; Kessler, McLaughlin, Green, Gruber, Sampson, Zaslavsky, Aguilar-Gaxiola, Alhamzawi, Alonso, Angermeyer, Benjet,

Bromet, Chatterji, De Girolamo, et al., 2010; Madigan et al., 2018; Mbagaya, Oburu, & Bakermans-Kranenburg, 2013). Although there is limited literature on the mechanisms of transmission of mental health problems between mothers and their children, the exploration of factors that mediate this relationship is expanding. The relationship between a mother and her child is particularly vulnerable to exposure to maternal ACEs, and are known to interfere with positive and responsive parenting, attachment, and the mental health of her children (Lang, Gartstein, Rodgers, & Lebeck, 2010; Pereira, Ludmer, Gonzalez, & Atkinson, 2017; Plant, Barker, Waters, Pawlby, & Pariante, 2013; Rijlaarsdam et al., 2014). Although research from upper-middle and HIC are beginning to explore the association between both ACEs and the mental health of fathers and grandparents, and child outcomes, the majority of research has examined factors influencing the maternal-child relationship (R. M. Pearson et al., 2019; Wesseldijk et al., 2018). Contemporary evidence that explores the relationship between maternal ACEs and child socioemotional outcomes have converged on maternal mental health and parenting behaviours as key mediating factors in HIC (Min, Singer, Minnes, Kim, & Short, 2013; Pereira et al., 2017; Plant et al., 2013). Mothers experience heightened exposure to ACEs in LMIC due to chronic condition of poverty, increased exposure to violence, and limited access to mental health resources (Berens et al., 2017; Patel & Kleinman, 2003). The relationship between maternal ACEs, maternal mental health, and the subsequent socioemotional outcomes of her children has never been explored in a LMIC. The unique nature of ACEs in Kenya, and the role of maternal mental health on child mental health outcomes is explored in the third dissertation manuscript. Additional factors, including

the role of maternal education and socio-economic status, both known protective buffers, are also explored in the third dissertation study.

1.4 Grand Challenges in Mental Health

In order to address the severely under-met complex mental health needs of children in LMIC, innovative solutions that can be administered in the context of limited resources are required. The WHO has recognized a serious disparity between the level of need and the availability of mental health services worldwide. Due to the complex bidirectional relationship between health and mental health, the WHO developed an initiative, guided by the underlying proposition 'no health without mental health' (Collins et al., 2011). The initiative includes a series of 'Grand Challenges in Mental Health' that serve to improve access to assessment and treatment, with a specific focus on enhancing global initiatives that aim address common mental health disorders (Collins et al., 2011). The effort aims to build a wide-ranging community of global mental health researchers targeting priority issues such as: 1) providing effective and affordable community-based care, 2) improving access to evidence-based assessment and treatment, and 3) providing mental health packages that can be delivered by non-experts (Collins et al., 2011). Due to the dearth of trained psychiatrists and mental health professionals in Kenya, there is a need for treatment systems that can be used by non-experts, such as community health workers.

1.4.a. Definition of Task-Sharing

Task-sharing has been proposed as a solution to overcoming the shortage of psychiatric expertise and trained human resources to assess and treat common mental disorders in LMIC (Hoeft, Fortney, Patel, & Unützer, 2018; Mendenhall et al., 2014; Musyimi et al., 2017; Patel, 2009, 2012). Task-sharing is a process by which care for mental health conditions is redistributed to less specialized community health workers, following simplification of evidence-based assessments and treatments (Padmanathan & De Silva, 2013). Task-sharing works though scaling up access to mental health care where there is a shortage of psychiatrists and other specialized mental health professionals. As a result, overall coverage and capacity for mental health care is increased and human resources are used more efficiently (Padmanathan & De Silva, 2013). Rural regions face significant barriers to accessing mental health assessment and treatment. Task-sharing promotes the utilization of non-expert community health workers, who live and work within rural areas of LMIC, expanding the range of accessible mental health care (Hoeft et al., 2018). In the context of mental health, community health workers can be trained to prevent, screen and diagnose, and treat common mental health disorders (Kakuma, 2011). There are now many well-established studies and reviews on the effectiveness of task-sharing interventions, where community health workers with no background or expertise in mental health, have been trained to effectively assess for common mental health disorders, and administer psychological treatments (De Kock & Pillay, 2016; Fisher et al., 2014; Padmanathan & De Silva, 2013).

The role of task-sharing in the assessment of childhood mental health disorders in rural Kenya is the focus of both the first and second dissertation studies.

1.4.b. Examples of Task-Sharing

In response to the Grand Challenge initiatives, the WHO has utilized and promoted task-sharing approaches through the development of a low intensity intervention for common mental disorders. The WHO's Mental Health Gap Action Programme (mhGAP) provides guidelines that include explicit instructions for the brief screening and treatment of mental disorder that can be administered with minimal training (WHO, 2014). The mhGAP is freely accessible through the WHO website (https://www.who.int/mental_health/mhgap/en/). The guidelines are provided through a booklet that follows a branching logic (skip patterns) and details a wide range of treatment options including psychosocial support, addressing current stressors, activating social networks, and advice on medication for non-specialist health workers (WHO, 2014). A recent addition to the mhGAP is the Thinking Healthy Program, a low intensity intervention, for treatment of maternal depression. The Thinking Healthy Program is based in Cognitive Behavioural Therapy combined with techniques of active listening, family integration in treatment, and guided discovery; a style of questioning that allows the participants to generate alternative solutions to challenges and also probe the family to help understand their perceptions of healthy thoughts and behaviour (A. Rahman, Malik, Sikander, Roberts, & Creed, 2008). Although mental health experts and researchers in Kenya have advocated for the implementation of task-sharing approaches to address the

nation-wide dearth of mental health services, evidence of these approaches is non-existent. The role of task-sharing for the assessment of common mental health disorders in rural Kenya, including the use of the mhGAP as a potential follow up treatment, is explored in the first two dissertation studies.

1.5 Assessment and Assessment Methods

In LMICs, there is a wide range of recommended treatment options for common mental health conditions by non-expert health workers including providing psychosocial support, addressing current stressors, activating social networks, and providing advice and resources on psychopharmaceutical intervention (WHO, 2014). However, before treatment can be provided, adequate comprehensive assessment is required. Assessment is the first step towards treating MNS disorders in children, and thereby reducing the global burden of psychiatric pathology. There are currently no accessible comprehensive psychiatric assessments for child-specific disorders for use in Kenya. The socio-cultural milieu of a community influences the conceptualization, experience, and presentation of mental illness. Accordingly, culture-based norms around mental illness exerts influence on individual coping strategies, attitudes, stigma, and help-seeking behaviour on individuals within a given community (Patel et al., 2014). There is no doubt that mental illness is a universal burden and is experienced across all cultures and communities. However, variation in the presentation of symptoms, idioms of distress, and perception of impairment, presents a significant challenge for universally operationalizing the symptoms of mental illness across cultures. The wider purpose of diagnosis, or

identifying and classifying symptoms, is to share a common understanding of an illness which provides a means for communication within and between groups. From a shared understanding, determination and facilitation of treatment priorities can be made and resources can be allocated (Patel et al., 2014).

1.5.a. Emic and Etic Approaches

There is no single approach to the assessment of common mental disorders that address all cultural, ethnic, or regional groups. Etic approaches, or assessments 'from outside' are based on Western constructs of mental illness and commonly utilize the categories and definitions of the fifth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). The DSM-5 is a taxonomic and diagnostic handbook widely used by clinicians and researchers to diagnose and treat mental disorder. Although advances in the most recent version of the DSM-5 are enriched by the inclusion and acknowledgement of variation in illness presentation based on culture, the symptoms and categories remain primarily based in a Western understanding of mental illness. Many gold-standard assessments, including structured interviews for the assessment of common mental disorders such as the Mini International Neuropsychiatric Interview for Children (MINI-KID) (Sheehan et al., 1997), are based on the criteria and definitions of the DSM-5, but are rarely formally adapted and validated for use in LMIC. Emic approaches, or contextually-developed mental health assessments 'from within' incorporate local understanding and idioms of mental illness. Assessments in Kenya have typically utilized

etic approaches, using screening and diagnostic tools validated within the USA, but none have been fully validated for the diagnosis of mental disorder (Watson, Kaiser, Giusto, Ayuku, & Puffer, 2019). Researchers have advocated for a unique emic-etic approach that involves modifications to Western-based assessment instruments to improve cultural-salience while retaining the criteria and definitions of the DSM-5 (Watson et al., 2019). Context-specific adaptations may include translation and re-wording of assessment items and instructions (Harder et al., 2014; Musyimi et al., 2017). The first two dissertation studies explore the role of emic-etic approaches in the development methodology and adaptation of a novel structured interview for common childhood psychiatric disorders in Kenya.

1.5.b. Technology-Supported Assessment

The growing mainstream use of technology across the globe, primarily through use of mobile phones, has yielded an opportunity to promote the use of technology to improve access to mental health assessment and treatment. The application of technology to improve access to mental health services is especially warranted in LMIC where assessment and treatment resources are limited (Malhotra et al., 2014). Technology is being utilized more frequently in LMIC to provide both clinically- and cost-effective psychiatric treatment (Malhotra, Chakrabarti, & Shah, 2019). Emerging evidence on mobile mental health practices has demonstrated the effective facilitation of psychiatric treatment across geographic distances (Acharibasam & Wynn, 2018). The benefits of technology-supported assessment and treatment include improved access, enhanced

clinical supervision and training opportunities, and decreased financial burden (Acharibasam & Wynn, 2018). Assessments that include automatic diagnostic scoring yield fewer scoring errors and eliminate data entry errors. The role of technology in the assessment of common mental disorders, and its practical utility are discussed in the first dissertation study. The reliability and validity of the IMPACT, a technology-supported assessment for common childhood mental disorders, are examined in the second dissertation study.

1.6 The International Mobile Psychiatric Assessment for Children and Teens

The IMPACT is an open-source diagnostic assessment for common childhood mental health disorders that can be administered with minimal training. Using an electronic assessment model, the IMPACT has been designed using adaptive branching logic (Figure 1) to allow a non-expert interviewer to follow simple instructions to assess the interviewee, and input answers directly into a tablet or mobile phone. The device will trigger further questioning based on the answers or skip patterns to move to the next relevant assessment target. There are options to skip questions if the child is uncertain or does not want to answer any question. There is a prompt to complete a brief questionnaire at the completion of the interview to evaluate the quality of the interview based on opinion of the interviewer. The interviewer is asked to evaluate the child's overall understanding of the questions, the cooperativity of the child, and record any social or environmental factors that could have influenced the responses of the child. This non-expert, tablet-based model has been used extensively by one of the gold standard adult

diagnostic assessments, the Composite International Diagnostic Interview (CIDI), which has wide support for both clinical and research use, in addition to strong psychometric properties (Wittchen, 1994). Although the CIDI is has the benefit of being administered on a computer by a non-specialist interviewer, the training, computer and licence are expensive, and less portable than a standard personal mobile phone. The IMPACT is innovative because it employed an emic-etic approach the development of the first open-source mobile psychiatric assessment that can be used to diagnose common mental disorders in children, by non-expert interviewers. Thus, the IMPACT is the first comprehensive structured interview to use the most recent diagnostic definitions and criteria published in the DSM-5 in LMIC.

Fig. 1.

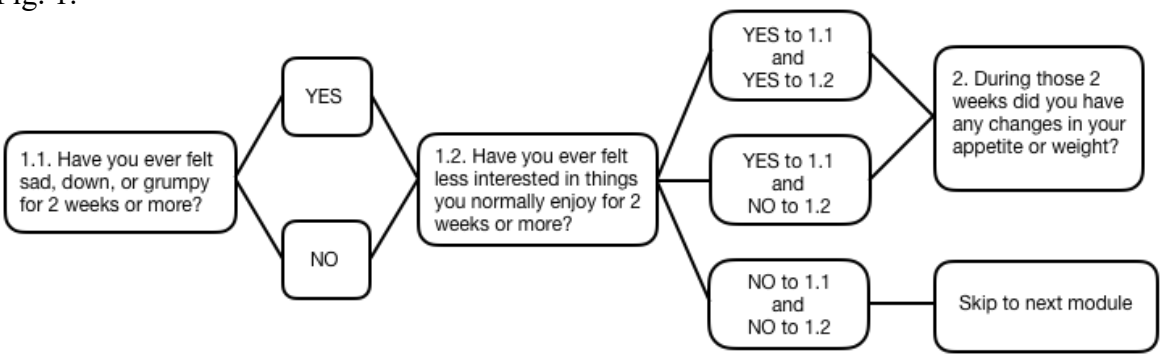


Figure 1. Adaptive branching questions from the MDD module of the IMPACT. Screening questions based on DSM-5 criteria are coded and based on response to target questions, the device will prompt further questioning or skip to the next module.

1.6.a. IMPACT Disorder Inclusion

The IMPACT is intended to be a comprehensive assessment, and the following is a list (Table 1) of diagnostic categories selected from the DSM-5 for inclusion in the development and programming of the IMPACT. The disorders in Table 1 were selected for inclusion in the IMPACT because they contribute to the greatest worldwide burden of disease, and are aligned with the existing, widely used childhood psychiatric assessments in HIC. Some additional categories were added to be more inclusive to challenges and burdens faced in LMIC, and examine the impact of harsh environmental conditions, including circumstances of poverty, abuse, inaccessibility of health care facilities and inadequate housing or homelessness. Due to timing and financial constraints of this dissertation project, only the following disorders were administered for the purposes of analysis: Major Depressive Disorder, Separation Anxiety, Social Anxiety, Post-Traumatic Stress Disorder, Generalized Anxiety Disorder, Conduct Disorder, Oppositional Defiant Disorder and Attention Deficit Hyperactivity Disorder. The examination of these disorders, and the utility of the IMPACT as a valid and reliable structured interview for the diagnosis of childhood psychiatric disorders, are discussed in the first two dissertation papers.

1.6.b. Technical Development of the IMPACT

The IMPACT utilizes a structured interview model of assessment and is based on the definitions and criteria of the DSM-5. The assessment was programmed using the open-source data collection and management software, Open Data Kit (ODK).

Programming of the IMPACT was designed to be modular; each diagnostic category can be administered independently for enhanced flexibility and utility for future research or clinical applications. The development of the questions, and logical branching (skip patterns) are programmed using ODK and converted to XML code before being uploaded to the tablet software for administration. The program includes algorithms that generate the following relevant diagnostic information in a summary at the completion of each diagnostic module:

- Relevant (context-specific) demographic information
- Symptom summary
- Sub-threshold diagnosis
- Full criteria diagnosis (corresponding DSM-5 codes)
- Onset and recency of symptoms
- Severity of symptoms (impairment rating scale)
- History of current (e.g. last 2-4 weeks) and lifetime symptoms and diagnoses

1.6.c. Establishing Emic-Etic Priorities for the Development of the IMPACT

Prior to the conceptualization and development of the IMPACT, three informal focus groups in Kenya were conducted to identify the demand for and characteristics of a child and adolescent psychiatric diagnostic assessment (emic). Informal consultations with key stakeholders were conducted with three populations: 1) mental health professionals at AMHRTF and local psychiatric hospital staff; 2) users of mental health services; and 3) caregivers of individuals who use mental health services. Three messages emerged that guided the development of the IMPACT. First, access to mental health services and expertise were limited in Kenya, and therefore, an assessment that could be administered by trained community health workers was a priority. Second, access to

mental health care in rural regions of Kenya remain limited or non-existent, necessitating the use of mobile technology to increase the reach and communication between service providers was required. Finally, although mental health services are scarce overall, services that target the mental health needs of children and adolescents are even more rare, which highlighted the need to concentrate efforts on the mental health of young people in Kenya. In response to these themes, the IMPACT was proposed for development as a collaboration between the AMHRTF and McMaster University and the proposed goal was to create a mobile technology-assisted assessment for the diagnosis of child and adolescent mental health disorders. The assessment would be structured to simplify symptom probing with adaptive branching logic and automatically generate diagnostic summaries (e.g. no scoring and minimal clinical judgement required) so that the length of the IMPACT would be reduced and suitable for administration by non-expert community health workers following training.

1.6.d. A Blended Emic-Etic Approach to Item Development

The initial content of the questions and available response options on each of the IMPACT modules were generated by the author (A.D.R) based on the definitions and criteria of the DSM-5 (etic). Questions were framed to be closely aligned with DSM-5 criteria and modified where necessary to include child-friendly language. During the development phase, 10 Canadian children and adolescents ranging in age from 6-18 years were consulted following the administration of each module on the language and understandability of items. As a result of this process, additional instructions to the

interviewer were added to improve clarity (e.g. Note to interviewer in the MDD module: "When probing children about loss of interest or pleasure, some children may describe this as boredom). Once the questions were finalized, two mental health experts from the AMHRTF (D.K and S.M), both trilingual speaking (English, Swahili, and Kikamba, the local language of the region where the validation study would be conducted), evaluated the questions for understandability and to identify any cultural discrepancies in language or content (emic). Modification and adaptations were made primarily in the demographic data collection battery to be more inclusive to the collection of demographic and sociodemographic characteristics of the diverse language and ethnic groupings of Kenya, as well as including Kenyan currency and academic grade standards. As an additional emic approach to the development of the IMPACT, the inclusion the Progress out of Poverty Index (Grameen Foundation, 2014) was programmed to be embedded within the demographic battery to assess the likelihood of living below the poverty-line, a Kenya-specific measure of absolute and relative poverty. Following this, the 10 community health workers that were hired research assistants for the purposes of the validation of the IMPACT were given the opportunity to review the language and content of the questions within each module. Feedback from community health workers was positive, and the questions were reported to be linguistically and culturally understandable in a Kenyan context and only minor modifications to the Interviewer Instructions were added for clarity in response to insightful feedback. Additional details on community health worker feedback is outlined in the first dissertation manuscript.

The psychometric properties (e.g. validity and reliability) of the IMPACT are presented in the second dissertation paper. A pre- and post-study survey was conducted amongst the ten community health workers who were familiar with the IMPACT after interviewing all study participants (n=189) for the purposes of validation, was administered to evaluate the demand, feasibility, practical utility and overall impression of the IMPACT. The IMPACT was widely accepted by both experts at the AMHRTF and the community health workers. Data on the development and perspectives of the community health workers on are detailed in the first dissertation paper. Following publication of the validation and reliability data and the development and testing of a standardized training program, the intention of the author is to release the IMPACT as a freely accessible and open-source tool for use by non-experts in Kenya and researchers in LMIC.

Table 1. List of DSM-5 disorders included in the IMPACT

DSM-5 Category	DSM-5 Disorder Title	DSM-5 Code
Neurodevelopmental Disorders	Autism Spectrum Disorder (Screen)	299.0
	Attention Deficit Hyperactivity Disorder	314.00, 01
Schizophrenia Spectrum Disorders	Schizophrenia	295.90
	Schizoaffective Disorder	295.70
	Schizophreniform Disorder	295.40
	Brief Psychotic Disorder	298.8
Bipolar Disorders	Bipolar I Disorder	296.40-296.70
	Bipolar II Disorder	296.89
	Cyclothymia	301.13
Depressive Disorders	Major Depressive Disorder	296.21-296.30
	Persistent Depressive Disorder	300.4
Anxiety Disorders	Separation Anxiety Disorder	309.21
	Selective Mutism	312.23
	Specific Phobia	300.29
	Social Anxiety Disorder	300.23
	Panic Disorder	300.23
	Agoraphobia	300.22
	Generalized Anxiety Disorder	300.02
Obsessive Compulsive Disorders	Obsessive Compulsive Disorder	300.3
Trauma- and Stressor-Related Disorders	Posttraumatic Stress Disorder	309.81
Feeding and Eating Disorders	Anorexia Nervosa	307.1
	Bulimia Nervosa	307.51
	Binge-Eating Disorder	307.51
Elimination Disorder	Enuresis	307.6
	Encopresis	307.7
Disruptive, Impulse-Control, and Conduct Disorders	Oppositional Defiant Disorder	313.81
	Conduct Disorder	312.81
Substance-Related and Addictive Disorder	Alcohol Use Disorder	305.00,303.90
	Cannabis-Related Disorders	305.20,304.30
	Phencyclidine Use Disorder	305.9, 304.6
	Inhalant Use Disorder	305.9, 304.6
	Opioid Use Disorder	305.5, 304.0
	Sedative, Hypnotic, or Anxiolytic Use Disorder	305.4,304.10
	Stimulant Use Disorder	305.7, 305.6, 305.2, 305.4
	Tobacco Use Disorder	305.1
	Other/Unknown Substance Use Disorder	292.9

1.7 Dissertation Objectives

The resources available for the prevention, assessment, and treatment of common mental disorder in LMIC is dismal. Globally, mental disorders are the leading source of overall health burden in children and adolescents. Children and adolescents in LMIC constitute one third of the global population, and the rates for mental illness in children exceed those of HIC due to enduring multiple, chronic, and severe ACEs. Mothers who are exposed to ACEs endure increased likelihood for mental disorder, and their children suffer heightened vulnerability for poor socioemotional outcomes. A proposed solution for the assessment and treatment of mental disorders in LMIC is through the utilization of a task-sharing approach. With this conceptual support, and the emerging empirical evidence in support of task-sharing solutions, this thesis will seek to explore the development of a sustainable and equitable research partnership in Kenya, in order to facilitate the development of a unique contextually-salient structured interview for common childhood mental disorders. The first study aims to outline the lessons learned from the field regarding the development of a sustainable and equitable partnership, and the development of a technology-supported childhood psychiatric diagnostic interview that can be administered by non-expert community health workers. I hypothesize that the use of technology-supported interviewing with automated diagnostic scoring will aid in the mobile assessment of mental health disorders by community health workers in rural regions of Kenya. For the second study, I hypothesize that the use of a novel emic-etic approach to the development of the IMPACT will improve the diagnostic validity and reliability when compared to a gold-standard paper-and-pencil-based interview. Finally,

the third study aims to examine the factors that that contribute to the transmission of mental health problems from mothers who were exposed to ACEs, to their children. It is hypothesized that there is a relationship between maternal ACEs and the socioemotional outcomes of her children, which will be mediated by maternal mental health.

Chapter 2 | Study #1

General Purpose

Access to mental health services for children and adolescents in LMIC is scarce or non-existent. As a result, children suffer heightened vulnerability for the development of mental health problems that may persist into adulthood. The development of an emic-etic based structured interview for the assessment of common childhood mental health conditions in rural Kenya is explored. This dissertation manuscripts seeks to explore the development and practical process of maintaining a North-South research partnership between the Africa Mental Health Research and Training Foundation and McMaster University. Sustainability and equity between partner institutions was a primary aim of the project, guided by the use of the Partnership Assessment Tool, generated by the Canadian Coalition for Global Health Research. The first objective of this dissertation is to explore the process and outcomes of this partnership: the development of the International Mobile Psychiatric Assessment for Children and Teens (IMPACT), and it's use by local community health workers.

Title and Authorship

Title: Partnerships, task-sharing, and the use of a mobile structured interview for the assessment of childhood psychiatric disorder in rural Kenya

Authors: Rieder, A.D., Freedman, E., Gonzalez, A., Musyimi, C., Ndetei, D., Mutiso, V., Musau, A., Sassi, R., Hall, G.B.

Conflicts of Interest: None

Submitted: *WHO Bulletin*

2.1 Abstract

Problem: Access to evidence-based mental health services in low- and middle-income countries is often non-existent. Children suffer heightened vulnerability to disorder, where risk, severity, and duration are exacerbated by poor living conditions. The dearth of expertise, training, and funding contribute to the lack of research and available services. The equitable development of global north-south research partnerships can be challenging due to imbalances in funding, allocation of resources, and deployment feasibility.

Approach: We utilized the Partnership Assessment Toolkit (PAT) to develop an equitable research partnership between the Africa Mental Health Foundation and McMaster University. The goal of the partnership was to implement a task-sharing model, where non-expert interviewers were trained to assess common childhood psychiatric illness in rural Kenya. Non-expert assessment was supported by the novel emic-etic approach to the development of a standardized mobile psychiatric interview for children.

Local Setting: The study was conducted in rural schools of Machakos, Kenya, where the incidence of mental illness is comparatively high and access to assessment and treatment is extremely limited.

Relevant Changes: A partnership focused on equity and sustainability was created using the PAT. The implementation of a task-sharing approach provided for the brief training

and deployment of the International Mobile Psychiatric Assessment for Children and Teens by non-expert community members.

Lessons Learned: Tablet-based interviews conducted by non-experts improved the portability of assessments into rural regions, reduced financial burden, eliminated the need for data entry, and improved rapid access to data. The partnership and the study were successfully guided by the PAT.

2.2 Background

Global mental health is an emerging field within the broader discipline of global health that pursues improved equity in access to evidence-based, culturally relevant, assessment and treatment. The field aims to reduce inequities and human-rights injustices through education and stigma-reduction, especially in low- and middle-income countries (LMICs).(Kieling et al., 2011; V. Patel & Prince, 2010) The demand for access to assessment and treatment around the globe is not being met, with 85% of people in LMICs not receiving necessary psychiatric services.(Demyttenaere K et al., 2004)

Children in LMICs suffer heightened vulnerability to psychiatric disorder which is exacerbated by poverty, poor living conditions, social disadvantage, and scarcity of locally generated or measured evidence-based assessment and treatment resources.(V. Patel, Flisher, et al., 2007; V. Patel & Kleinman, 2003) Mental, neurological and substance use disorders are the leading contributor to the global burden of all health-related disease in children and adolescents, ranging between 10-20% and even greater in LMICs (V. Patel & Prince, 2010). This burden is further increased by early onset of disorders that persist into adulthood, where earlier onset is attributed to a longer-lasting and more severe course of illness (V. Patel & Prince, 2010). The development of scalable, low-intensity approaches that emphasize local collaboration, aided through the use of technology and mobile services, is an effective strategy in reducing mental health burden and improving access through primary care (Musyimi et al., 2016).

2.3 Local Setting

Access to psychiatric assessment and treatment for children in rural Kenya is nearly non-existent, and is rarely addressed in primary care settings.(D. M. Ndetei, Khasakhala, Mutiso, & Mbwayo, 2009) The lack of training, funding, and adequate human resources contribute to the rate of unmet psychiatric need in Kenya.(D. M. Ndetei et al., 2007a) In Kenyan school children, the prevalence of mental disorder is 37.7%.(D. Ndetei et al., 2016) The current study was conducted in the Eastern African Province of Kenya in the rural and peri-urban district of Machakos, which has an estimated population of 44,930 children attending school.(D. Ndetei et al., 2016) Machakos was selected as a target region due to high levels of poverty conferring increased risk for mental illness. Moreover, the mental health needs of children in this district were further exacerbated following the 2003 legislation mandating all children attend primary school. Enrolment in free primary education increased by 22% in a system already overcrowded and overwhelmed by a lack of adequate financial and human resources which is attributed to poorer outcomes in children already at risk.(D. M. Ndetei et al., 2007a),(D. Ndetei et al., 2016)

To address the paucity of mental health assessment in LMICs, the development of a mobile structured interview for common psychiatric disorders, the International Mobile Psychiatric Assessment for Children and Teens (IMPACT), was proposed, and a partnership between the Africa Mental Health Foundation (AMHF) and McMaster University was established to inform and guide its development and testing. The nature of the partnership and the lessons learned in its implementation are central to this paper.

2.4 Sustainable and Equitable Partnership

Partnerships between the global north and south require extra care and equity monitoring given the disparity in resources. This tension persists in global health research partnerships as a result of enduring top-down colonial research program structure, issues of equitable funding and ownership, and the lack of inclusive capacity building and empowerment.(Afsana, Habte, Hatfield, Murphy, & Neufeld, 2009) The Partnership Assessment Toolkit (PAT) was developed by academics in LMICs and the Canadian Coalition for Global Health Research to inform research partnership ethics, guiding users to identify and evaluate research programs through discernable phases (inception, implementation, dissemination and wrap-up).(Afsana et al., 2009) This transdisciplinary tool is adaptable for small and large projects and focuses on establishing equitable negotiation and evaluation throughout the lifespan of the research program, improving relationships, project completion, and engendering effective research that can inform change.

The PAT was utilized to guide and inform the emerging partnership between researchers at McMaster University, Canada, and the AMHF in Kenya outlined in Fig. 1.

Fig. 1. **IMPACT study contributors**

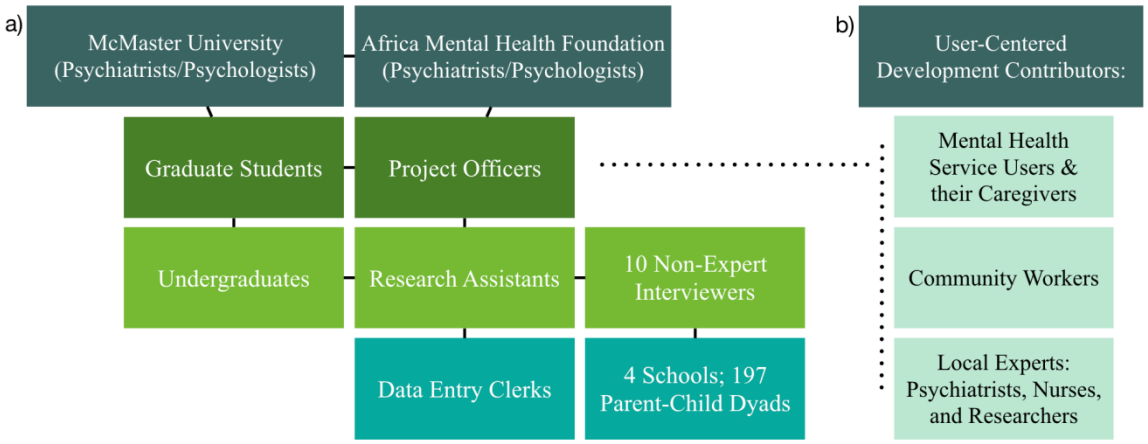


Figure 1. a) The Partnership Assessment Toolkit guided the emerging relationship between teams at the Africa Mental Health Foundation and McMaster University by providing structure for team members conducting field work. b) Local project officers and McMaster graduate students co-facilitated focus groups and administered pre- and post-study IMPACT user surveys with various local community and professional stakeholders to produce a user-centered design.

During the Inception Phase, partners facilitated focus groups for data gathering and forming a common understanding of the local context. Regular research meetings were conducted with the goal of establishing a mutually agreed upon vision of the partnership, in addition to defining roles and responsibilities, establishing shared project goals, and documenting site communication and dissemination plans. This phase included key research team members from both partnership sites as well as local mental health service users, caregivers, psychiatrists, nurses, and community workers (Fig.1). Broad inclusion helped inform the culturally relevant refinement in the development phase of the IMPACT, and guided on-going evaluation of the project through concrete action items which improved the equity and sustainability of the partnership and the project. Key features of the partnership included: seeking ethics approval in both countries; local

administration of funding; hiring of local research staff and employing non-expert community workers to administer interviews.

The Implementation Phase was a dynamic process which allowed for ongoing evaluation of research goals, as well as refining and nurturing the partnership through monitoring, evaluation and reflection. Integral to this phase was the development of positive working relationships with Kenyan school administration prior to the launch of the study. Preliminary meetings were fundamental to partnership development and research in Kenyan school settings to avoid interruption of the children's academic calendar (e.g. national exams/breaks), establishing a series of rapport building activities for use with the children, and identifying locally acceptable compensation for participation. Knowledge of local politics (e.g. nation-wide governmental strikes) was also integral to planning study implementation dates and understanding of the milieu. Shared benefits with schools included an offer to concurrently collect and share relevant demographic data beneficial to school administrators and providing psychoeducational sessions with parents and school staff.

Finally, the Dissemination Phase focused on developing clear roles, responsibilities, and vision for all knowledge translation activities. Communication regarding data dissemination priorities was outlined and scheduled to align with the ongoing development and implementation of the project. Data entry and storage responsibility remained with the AMHF, while paper writing activities, presentations, and authorship is shared between partners.

2.5 User-Centered Development

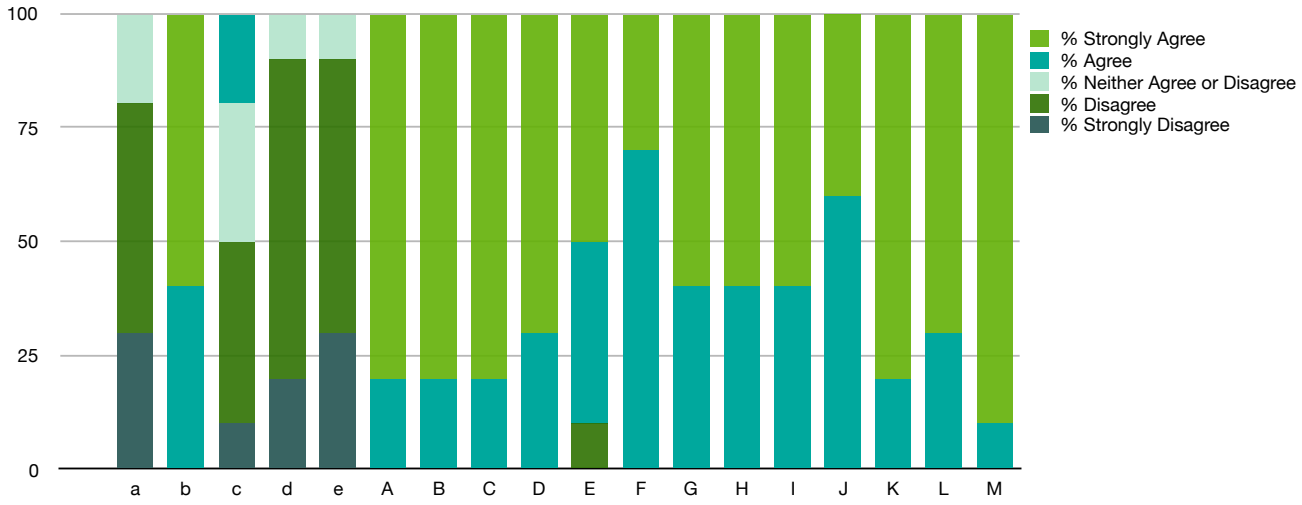
Demand for mental health assessment services was established prior to study deployment following surveys and focus group sessions with three main target populations: users of mental health services and their caregivers; community workers and mental health professionals in local hospitals (psychiatrists and nurses); and the expert research team at AMHF (Fig.1). The proposed solution involved the development of the IMPACT; a tablet-based mobile, accessible, and easily deliverable structured interview for assessing a wide range of common mental health disorders in hard to reach regions, globally. The assessment was programmed using Open Data Kit (Hartung et al., 2010) and intended for use by non-experts following brief training. The IMPACT was designed for assessment in children aged 6-18 and validated using a standard psychodiagnostic measure, the Mini International Neuropsychiatric Interview for children (MINI-KID).(Sheehan et al., 2010) The IMPACT was programmed to produce a diagnostic output using the most recent criteria of the fifth edition of the Diagnostic and Statistical Manual (DSM-5) (*American Psychiatric Association, 2013).* A novel etic-emic (Rasmussen et al., 2015) approach was undertaken, whereby a culturally neutral, Western perspective of the DSM-5 (the etic) was combined with the culturally relevant, Kenyan perspective (the emic), through review and evaluation of IMPACT questions by local research assistants and community members.

2.6 Task-Sharing Approach

Use of a task-sharing model, a collaborative approach where expertise and labour are reallocated to less specialized team members, has proven effective in other LMIC contexts, including the delivery of mental health services (Dua et al., 2011; Musyimi et al., 2017b). Non-experts, defined as individuals without training or expertise in psychiatry (e.g. community health workers), have been effective in implementing low-intensity psychological interventions in LMICs (Keynejad, Dua, Barbui, & Thornicroft, 2017; V. Patel et al., 2010). In the current study, ten non-expert community workers were recruited and received two days of training on deployment of the IMPACT using a tablet-based interface. Training was provided on use of tablet technology, including battery management, GPS use, and rules of structured interviewing (e.g., asking questions as they are posed on the screen and entering answers verbatim) and mock interviews were conducted to practice and evaluate performance. With supervision, the assessment administrators interviewed 189 children and their caregivers using the IMPACT. McMaster psychology graduate students were trained and administered the MINI-KID for the purposes of validation, and also collected a parent report measure, the Child Behaviour Checklist (CBCL)(T.M. Achenbach & Rescorla, 2001) for corroboration of symptoms. IMPACT administrators completed pre- and post-study surveys evaluating the feasibility of use and overall impression of the IMPACT as a tablet-based interview in the rural context. The lack of available psychiatric services for children was reported by local administrators in pre-study surveys (Table 1). The IMPACT was widely accepted and

determined to be valuable for the community (Table 1) by administrators at the completion of the study.

Table 1. **Pre- and Post-Study IMPACT-User Evaluation**



Pre-study survey: a. There are specialized psychiatric services available for rural children in Kenya; ***b.*** Families have to travel far distances to receive services for children with serious mental illness; ***c.*** Kenya is currently able to meet the needs of rural children with mental illness; ***d.*** Children who live in rural areas of Kenya can access a proper assessment for mental illness; ***e.*** Children are provided with adequate treatment for mental illness in rural locations.
Post-study survey: A. The IMPACT is easy to administer; ***B.*** The tablet is easy to use (opening the app, swiping between screens, entering responses); ***C.*** Technology (use of tablet or phone) is useful for the administration of mental health interviews; ***D.*** The IMPACT addresses the problems in mental health that children experience; ***E.*** The content of the IMPACT is relevant to children's mental health in Kenya; ***F***. The length of the interview was appropriate for the age of the children; ***G***. The IMPACT is culturally appropriate in Kenya; ***H.*** The diagnoses created by the IMPACT are especially useful for non-experts; ***I.*** The IMPACT is useful in rural or hard-to-reach populations; ***J.*** The IMPACT is useful in under-serviced populations; ***K***. The IMPACT could be a real benefit to my community because it is free to access; ***L.*** The IMPACT could be a real benefit to my community because it can be administered by non-experts; ***M.*** I would use the IMPACT again in the future.

2.7 Discussion

An authentic and sustainable research partnership afforded a unique emic-etic approach for improving access to mental health assessment for children in LMICs. The

key lessons learned (Box 1) include: training local non-experts to conduct structured interviews is an effective method for identifying common psychiatric illness in children and adolescents; tablet-based interviews enhanced implementation feasibility through increased portability, economic efficiency, and increased accuracy (e.g. no data entry or double-checking required), and allowed for rapid access to data output, which is especially vital during crisis or communication across vast geographical distances; and a successful equitable and sustainable north-south partnership was maintained through use of the PAT. Field work challenges faced included: travelling far distances on non-paved roads to access schools; working in hot conditions without access to electricity; and working within a population with diverse language abilities.

Box 1**. Summary of Lessons Learned**

- The Partnership Assessment Toolkit (PAT) was employed to ensure an authentic and equitable relationship throughout the lifespan of the project, from conceptualization and design to the implementation of the intervention.
- A task-sharing model using local, non-expert interviewers was effective in identifying common childhood psychiatric disorders in a rural setting.
- The use of an application-based, tablet-administered interview improved portability of interviews into rural settings, reduced financial-environmental burden (paperless, non-expert interviewers), provided rapid access to results across vast geographic distances or in cases where crisis intervention was required and eliminated the need for data entry and double checking.

These findings are relevant and generalizable to other field-work settings where task-sharing and/or mobile survey data collection is pertinent, and where partnerships are being established between north-south institutions. Leadership and management within the project, outlined in the PAT, were crucial to the success of the study. The involvement of the AMHF in establishing and maintaining relationships among stakeholders,

particularly in gaining trust and fostering a willingness to participate with schools and caregivers, was invaluable. Task-sharing is a feasible and promising solution for scaling up of mental health assessment and treatment services in Kenya and in similar LMICs where resources are limited. Future directions include: the integration of IMPACT assessment into primary care or low-intensity community interventions (e.g., Mental Health Gap Action Program);(Keynejad et al., 2017) scaling the use of the IMPACT through accessible standardized training programs; further translation and validation in other populations; and open-access to assessment and treatment training and tools.

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Chapter 3 | Study #2

General Purpose

Children and adolescents in rural Kenya have limited or non-existent access to mental health services, which leads to a heightened risk for mental health problems that may persist across the lifespan. Task-sharing, an approach supported by the World Health Organization, is a strategy utilized to improve access and distribution of mental health services in LMIC. Task-sharing is the rational redistribution of clinical tasks to enable lower levels of health care workers to provide care that is usually reserved for higher cadres of health care providers. Following simplification of mental health assessment and treatment approaches, community health workers are trained to provide mental health care improving overall access to care and reducing economic burden. The International Mobile Assessment for Children and Teens (IMPACT) was developed through a collaboration between the Africa Mental Health Research and Training Foundation and McMaster University. The novel technology supported assessment was developed utilizing a task-sharing model for the assessment of common mental health problems of children and adolescents in LMIC. The objective of this second dissertation study is to examine the validity and reliability of the IMPACT in comparison with a gold-standard assessment, the MINI-KID. The IMPACT will be evaluated for effective administration by local community health workers, in comparison to trained psychology graduate students.

Title and Authorship

Title: Identifying DSM-5 disorders in LMIC: Validity of the International Mobile Psychiatric Assessment for Children and Teens (IMPACT)

Authors: Rieder, A.D., Roth, S.L., Freedman, E., Ndetei, D., Mutiso, V., Musau, A., Sassi, R., Duncan, L., Gonzalez, A., Hall, G.B.

Conflicts of Interest: None

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3.1 Abstract

Background: Children in low- and middle-income countries (LMIC) have limited access to psychiatric assessment and treatment resulting in a more protracted and severe course of impairment and social disadvantage. Task-sharing, or the redistribution of roles and responsibilities to less specialized community health workers, has been proposed as a practical solution for the screening and treatment of common mental disorders in low-resource settings. The International Mobile Psychiatric Assessment for Children and Teens (IMPACT) is a novel, highly structured, tablet-based diagnostic interview for the assessment and diagnosis of common child and adolescent psychiatric disorders, The purpose of this study is to examine whether the IMPACT could provide valid psychiatric diagnoses in a LMIC setting, when administered by community health workers (CHWs).

Methods: 189 rural school children in Machakos, Kenya were interviewed by non-expert community health workers using the IMPACT for the assessment of common childhood psychiatric disorders. For the purposes of validation, the Mini International Neurological Interview (MINI-KID) was administered by trained psychology graduate students. Utilizing the STARD protocol for diagnostic accuracy, descriptive statistics, in addition to sensitivity, specificity, predictive values, Kappa, and correlations, were calculated and reported as measures of agreement between individual disorders and syndrome-level categories.

Findings: Satisfactory to excellent concordance between the non-expert administered IMPACT and the MINI-KID was found for most psychiatric disorders: kappa scores for individual disorders ranged from moderate (Social Anxiety Disorder: κ=.44; Conduct Disorder: κ=.49; MDD: κ=.52) to perfect (κ = 1: ADHD) with the remaining scores falling in the substantial range (ODD: κ=.66; PTSD: κ=.72; Separation Anxiety: κ=.79). The IMPACT identified a mean of 0.2 disorders per child, when compared with the MINI-KID (0.27).

Interpretation: The IMPACT was a reliable and valid assessment tool when administered by non-experts in rural Kenya. The potential for scaling up assessment utilization in both research and clinical settings, as well as other LMIC contexts holds promise.

3.2 Introduction

There is a striking gap in the availability of assessment and treatment resources for common mental health disorders in low- and middle-income countries (LMIC). Despite the significant life burden, less than 25% of those identified with a serious mental disorder receive treatment in LMIC (Demyttenaere et al., 2004). The determinants, prevalence, chronicity, and overall burden of mental disorder, however, have been relatively well-documented primarily in high-income countries (HIC) (WHO, 2000; Patel, Flisher, Hetrick, & McGorry, 2007). The cumulative and interrelated consequences of poverty and poor mental health contribute to a constellation of further psychological and developmental health risks that persist across the lifespan (Demyttenaere et al., 2004; Kieling et al., 2011). Prevalence estimates of mental disorder in LMIC are limited, however, emerging evidence suggest a more frequent, severe, and chronic illness trajectory due to the cascade of poverty-related sequelae (Patel & Prince, 2010). This burden is further exacerbated for children and youth. Although 90% of the global population of children live in LMIC, only 3-6% of all mental health research is conducted in these contexts (Risper, 2012). As a result, children and adolescents in LMIC experience grossly deficient or non-existent mental health care resulting in heightened vulnerability for chronic and inter-related lifelong risks and consequences (Kieling et al., 2011). The lack of accessible mental health resources has been attributed to enduring global systemic and geopolitical inequities that have resulted in insufficient prioritization and recognition of mental illness, stigma, and inadequate or non-existent formal psychiatric training (Risper, 2012; Tamburrino, Getanda, O'Reilly, & Vostanis, 2018).

This is largely due to inadequate national mental health policies and health-care funding in LMIC. There is on average, only 1 trained and qualified child and adolescent psychiatrist per 4-5 million children in LMIC, compared to 1 in 7000 in HIC (Malhotra et al., 2014; Susan Shur-Fen Gau, Matthew Hodes, 2018; Duffy, 2008). Even where mental health care is scarcely available, there is a paucity of evidence-based assessment and treatment programs that are locally responsive and ethnographically valid. The development of assessment and treatment resources capable of addressing the needs of those living in adverse conditions is sorely needed. Mental health services that are reflective of the unique nuances of the culture and the values with respect to mental health of the community are limited. Existing mental health treatment programs in LMIC are typically concentrated in larger urban areas, whilst rural populations that are geographically remote are most neglected (Tamburrino et al., 2018).

The long-term burden of mental illness for those without access to mental health services is severe. Early identification and treatment of symptoms, targeted prior to the emergence of clinically significant impairment, is a key priority for the prevention of additional morbidity that results in chronic disability (Merikangas 2009). Childhood impairment that persists into adulthood places a significant financial burden on the family, community, and health economy driving the need to prioritize equitable access to quality assessment and treatment programs (Merikangas, Nakamura, & Kessler, 2009; Susan Shur-Fen Gau, Matthew Hodes, 2018). In the context of poverty and limited access to treatment, the consequence of untreated childhood mental illness can lead to

heightened impairment setting the stage for a longer and more severe course of illness and psychosocial sequelae (Merikangas et al., 2009).

3.2.a. Mental Health of Children in Kenya

There is a paucity of high-quality epidemiological research on the prevalence and trajectory of mental disorders in sub-Saharan Africa, especially in regard to child and adolescent mental health. Existing research in Kenya, and throughout sub-Saharan Africa underestimate the rate of mental illness due to a lack of culturally relevant assessment tools that adequately capture the unique clinical symptom presentations (Ndetei et al., 2012). Studies are often conducted with inaccurate adaptations or translations of standard psychometric measures developed in HIC which do not reflect cultural variation in symptoms. Additionally, existing research is often non-representative of the overall population and rarely include scientifically rigorous assessment of child and adolescent mental health disorders (Ndetei et al., 2012). As a result, clinical assessment and treatment of childhood and adolescent psychopathology is nearly non-existent, especially in the rural context (Manders, Scholte, Janssens, & De Bruyn, 2006; Risper, 2012). Rural areas suffer heightened rates of poverty, lower levels of education, and reduced uptake of health services due to both financial and geographic limitations (Casale, Lane, Sello, Kuo, & Cluver, 2013; USAID, 2018).

Kenya is among the poorest nations in the world where mental health inequities are exacerbated by a lack of human and financial resources. The government of Kenya spends approximately 0.1% of its health care budget on mental health services from a

total health budget of $10 per capita (Jenkins et al., 2010). Furthermore, there are fewer than 100 psychiatrists for a population of approximately 45 million (Aillon et al., 2014; Musyimi, Mutiso, Ndetei, Unanue, et al., 2017b). Only half of these psychiatrists hold clinical practice, and nearly all practicing psychiatrists are based in major urban settings, leaving the rural population increasing with increased barriers to diagnosis and treatment (Aillon et al., 2014). Uptake of existing mental health care programs in urban areas are both financially and geographically inaccessible, are typically hospital-based where only the most serious conditions may receive treatment and are largely designed for adult populations (Jenkins et al., 2010; Tamburrino et al., 2018). Children and adolescents in rural Kenya are underserved and the consequences of untreated mental illness lead to increased personal, social, and economic burden for families, communities and health care systems (Aillon et al., 2014). Prevention and early intervention programs are necessary to address the complex intersectionality between poverty and mental illness. The resulting constellation of inequities are further reflected in the inability to access quality health care, lack of social programs for the prevention of adverse childhood experiences, increased likelihood for poor educational achievement, frequent exposure to violence and social instability (Marangu, Sands, Rolley, Ndetei, & Mansouri, 2014; Rieder et al., 2019).

In Kenya, it is estimated that as many as twenty percent of children and adolescents have a diagnosable mental disorder (Ndetei et al., 2016). Estimates of overall prevalence of mental disorders in sub Saharan Africa, and Kenya specifically, are predicted to be much higher than expected in HIC (e.g. 40% in South Africa) (Ndetei et

al., 2016). Methodological and practical constraints of conducting research in resource-scarce conditions has likely led to the underestimation of the prevalence of mental disorders (Ndetei et al., 2016). Existing research on prevalence is largely based on un-replicated, and un- generalizable measurements of mental illness that are often conducted without culturally-salient or validated measures (Kessler et al., 2010; Ndetei et al., 2016). Much of the current knowledge on prevalence is based on studies of major depression among youth and is estimated to have a high prevalence rate of 43.7% among children and adolescents attending public school, and 41.3% of respondents attending health care facilities (Khasakhala, Ndetei, Mathai, & Harder, 2013). In LMIC, greater levels of somatic symptoms are often present in children and adolescents who have been exposed to high levels of adversity and violence (Harder et al., 2014). Adults in Kenya also suffer even greater overall rates of common mental disorder with increased reports of somatic symptoms, which reflects the consequences of the enduring chronicity and severity of adversity and exposure to violence (Harder et al., 2014). Although the prevalence and course of common mental disorders in Kenya are not fully elucidated and likely underestimated, contextually- and evidence-based solutions that utilize a task-sharing approach should be prioritized for the prevention and treatment of common mental disorders.

3.2.b. Task-Sharing and Equitable Access to Assessment

The development, adaptation, translation and validation of diagnostic tools for use with children and adolescents are sorely needed in sub-Saharan Africa. Methods that

prioritize the use of mobile technology, and utilize a task-sharing approach provides the opportunity to overcome the lack of human resources and the challenges related to inadequate health record maintenance, training, supervision, as well as practical concerns like the lack of electricity in rural facilities (Ndetei & Jenkins, 2009). Task sharing models can be used to deliver mental health services by simplifying and re-distributing tasks usually undertaken by psychiatric experts to existing community health care workers (CHWs) or traditional healers following training. This delivery model has received support from the World Health Organization and has been advocated for by experts in Kenya (Hoeft, Fortney, Patel, & Unützer, 2018; Musyimi, Mutiso, Ndetei, Unanue, et al., 2017)

Mental health assessment and treatment programs administered by non-experts have been effective in treating common mental disorders in LMIC (Chowdhary et al., 2014; Fisher et al., 2014; Hoeft et al., 2018; Musyimi, Mutiso, Ndetei, Henderson, & Bunders, 2017). Programs like the WHO's Mental Health Gap Action Program (mhGAP), or Rahman's Thinking Healthy Program (THP) have proven effective for the treatment of common mental health disorders in various LMIC populations following training of CHWs. Such programs have been simplified for standardized training in existing CHWs for delivery across rural regions of LMIC (Fisher et al., 2014; Musyimi, Mutiso, Haji, Nandoya, & Ndetei, 2016). Task-sharing is the most promising pathway to addressing the challenges of accessibility in such challenging contexts. The effectiveness of task-sharing models capitalizes on the existing infrastructure of trusted CHWs who come from the communities they serve and that are already seen as trusted health care providers.

Existing CHWs therefore have a unique understanding of the local socio-political milieu, idioms of distress, the nature of stigma and barriers to treatment, and understand commonly held beliefs about mental disorder (Denckla et al., 2017). Effective assessment and treatment programs should be translated into local language and involve straightforward delivery, requiring little clinical interpretation. Additionally, task-sharing-based assessments should include simplified questions that can be read by a trained interviewer and where answers can be recorded for standardized evaluation. Translation and validation of existing assessments also serve to improve generalization to the overall population as well as cross-cultural comparison of mental health needs around the globe (Sousa & Rojjanasrirat, 2011). In Kenya and across sub Saharan Africa, there are currently no fully validated comprehensive diagnostic assessments for common childhood mental health disorders.

There has been a movement toward the emic-approaches for the development of ethnographically based assessment of common mental health disorders in Kenya (Denckla et al., 2017). Assessments using emic approaches are locally developed and reflect culturally salient beliefs and understanding of mental health within the cultural context. Etic approaches, on the other hand, are assessments developed from a typically Western perspective, and follow a system of categorization of symptoms based on the fifth edition of the Diagnostic and Statistical Manual (DSM-5) (American Psychiatric Association, 2013). There is evidence that combined etic-emic approaches are effective when thoughtfully adapted, translated, and validated within context (Watson, Kaiser, Giusto, Ayuku, & Puffer, 2019).

3.2.c. The Current Study

The current study will examine a unique emic-etic approach whereby the assessment of common childhood mental health disorders is conducted in reference to DSM-5 categorization which allows for sharing of a global language and understanding of mental health disorders (etic), in combination with local perspectives (emic). The local demand for validated mental health assessment was established following interviews and focus groups with hospital mental health care providers, community health workers, users of mental health services, and local mental health experts at the Africa Mental Health and Research Training Foundation (AMHRTF). The use of an evidence-based, technology-supported assessment was established as a priority to bridge the mental health care gap needs of rural, or geographically isolated health care workers.

The purpose of this study is to utilize a unique emic-etic user-centered approach to develop a scalable, comprehensive mental health assessment for children and adolescents in Kenya. The International Mobile Psychiatric Assessment for Children and Teens (IMPACT) is a mobile assessment that emphasizes sustainable and equitable partnerships through local collaboration with the goal of validating an effective strategy aimed at identifying and improving access through primary care.

3.3 Methods

3.3.a. Ethics

Following approval by the McMaster University Research Ethics Board in Canada and the Maseno University Ethics Review Committee in Kenya, informed consent was

obtained from all parents and children over 12, and informed assent was obtained from children under 12 participating in the study.

3.3.b. Population and Site Selection

English speaking children (n=189) (*M* = 15.16 years, *SD* = 1.98, range 10-18, 51:49 female: male) and their primary caregivers were recruited for participation from three rural schools in Machakos, Kenya. Machakos county is an agriculturally-based region that is primarily rural and located southeast of the capital of Nairobi. In Machakos, approximately 56% of children are living in poverty (Kenya National Bureau of Statistics, 2017). Schools were selected by the AMHRTF, a Nairobi-based NGO that leads mental health research and training in Machakos, Kenya. All children and adolescents that ranged from grade level primary standard seven to secondary standard four were invited to participate. Caregivers were contacted by telephone by the school administration and were invited to attend their child's school to obtain consent and complete demographic questionnaires. Kikamba is the primary language of Machakos although both English and Swahili are official languages of Kenya. Exclusion criteria for the children included inability to speak English, however, no children in the participating schools were excluded due to this criterion given English is the language of education in Kenya. The participants' socio-demographic data is presented in Table 1.

3.3.c. Measures

MINI-KID

The Mini Neuropsychiatric Interview for Children (MINI-KID) is a brief structured interview administered for assessing for the presence of DSM-IV-TR and ICD-10 disorders in children and adolescents ranging in age from 6 to 19 (Sheehan et al., 1998). Administrative time of the MINI-KID is approximately 30-45 minutes. The following disorders were included for analysis: Major Depressive Disorder (MDD), Separation Anxiety (SepAnx), Social Anxiety (SocAnx), Generalized Anxiety (GAD), Post-traumatic Stress Disorder (PTSD), Attention Deficit Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). The MINI-KID was developed for use in multi-center trials and large epidemiological studies. The MINI-KID has been demonstrated to have high validity and reliability for diagnosing DSM-IV-TR disorders in comparison with the Schedule for Affective Disorders and Schizophrenia for School-aged Children (Sheehan et al., 1998). The MINI-KID was selected for use in the current study as the gold-standard for comparison. To date, although not yet validated for the population, the MINI-KID is the only comprehensive interview-based assessment that has been used for the assessment of children in Kenya (Khasakhala, Ndetei, & Mathai, 2013).

International Mobile Psychiatric Assessment for Children and Teens

The International Mobile Psychiatric Assessment for Children and Teens (IMPACT) is a highly structured interview that is administered on mobile phones or

tablets to assess and diagnosis eight of the most common childhood and adolescent psychiatric disorders (Rieder et al., 2019). The following disorder modules were programmed in the IMPACT: Major Depressive Disorder (MDD); Separation Anxiety (SepAnx); Social Anxiety (SocAnx); Generalized Anxiety (GAD); Post-traumatic Stress Disorder (PTSD); Attention Deficit Hyperactivity Disorder (ADHD); Oppositional Defiance Disorder (ODD) and; Conduct Disorder (CD).

Demographics Battery

Following consent, primary caregivers completed a battery of demographic questionnaires (e.g. household income, education, etc.).

3.3.d. Procedure

Emic-Etic Approach to User-Centered Development of the IMPACT

Contemporary perspectives on culturally-adapted assessment tools for the measurement of mental health conditions advocate for a unique emic-etic approach that combines Western-based, from outside (etic) diagnostic models (e.g. criteria and definitions of the DSM-5), with locally valid approaches from within (emic) (Watson et al., 2019). The blending of both emic and etic approaches serves to minimize etic diagnostic bias and to improve cultural salience (Watson et al., 2019). In collaboration with local experts, context-specific modifications to pre-existing etic-based instruments may include: cultural adaptations to the questions, content, images or scales; forward and backward translations; re-wording for conceptual and semantic equivalency; and

providing alternative instructions (Harder et al., 2014; Musyimi et al., 2017; Sousa & Rojjanasrirat, 2011).

The demand for, and the characteristics of, the IMPACT were generated in consultation with local experts and service providers at the AMHRTF, rural community health workers, and users of mental health services in Kenya. Key concerns emerged from the consultations that guided the development of the IMPACT which include: 1) there is a dearth of child and adolescent mental health programs in Kenya, which garnered support for the development of an assessment to address common childhood mental disorders; 2) there is an extreme lack of mental health expertise in Kenya, which directed support for the use of a task-sharing approach whereby the IMPACT could be administered by non-specialized community health workers, and; 3) that of the very few mental health professionals that hold clinical practice in Kenya, the vast majority are private practices located within major urban areas, which provided support for the use of technology-supported assessment to increase range and capacity of care to particularly underserviced regions. Further details on these consultations and development of the IMPACT can be found in the Lessons from the Field manuscript, Rieder et. al, 2019.

Initial questions in each of the IMPACT modules were written to be closely aligned with the definitions and criteria of the DSM-5 (etic approach) by the author (A.D.R). Feedback on the local accessibility and potential cultural discrepancies of the IMPACT language and content was provided by local experts at the AMHRTF and rural CHWs. Overall perspectives from the AMHRTF and CHWs was positive (Rieder et. al,

2019), and the overall content was reported to be culturally-salient. Minor modifications to the Interviewer Instructions were recommended for detail and clarity.

Technical Development of the IMPACT

The IMPACT was programmed by authors (A.D.R and E.F) using Open Data Kit (ODK), an open source data collection suite that allows for survey development using a builder interface, excel formulas, or manually generated XML code. Both the builder interface and excel code are later compiled into XML and up-loaded to the tablets via an encrypted server and a data collection application ODK collect, available for android operating systems. Algorithms for diagnoses closely followed the criteria of the fifth edition of the Diagnostic and Statistical Manual (DSM-5) (American Psychiatric Association, 2013). Questions were generated using adaptive branching logic, which utilizes previous responses to generate confined predefined follow-on questions, eventually computing an electronic summary of diagnoses. Questions were written in child-friendly language (Figure 1) and examined the presence of current and lifetime history of psychiatric disorders, and included onset, duration, and severity, and number of episodes, where applicable (Figures 2-4).

Diagnosticians

Ten local and trilingual speaking (English, Kiswahili, and Kikamba) CHWs were recruited to conduct the IMPACT interviews following 2 days of training. Training of the CHWs included instruction on the use of tablet-supported technology (e.g. basic

operation and practical issues of battery saving strategies), rapport building, basic DSM-5 criteria, and managing sensitive matters. Additionally, CHWs conducted a minimum of eight supervised mock interviews, within partners and in groups, and additionally received supervision and feedback on interview style and administration accuracy through review of video-taped interviews. All CHWs independently entered mock responses into the tablets to compare diagnostic results, which were automated by the IMPACT resulting in perfect agreement between raters.

The MINI-KID was administered by 3 trained and supervised Canadian psychology graduate students with experience in the administration of structured interviews. Prior to the commencement of the study, the graduate students underwent observation of a minimum of 10 MINI-KID interviews, and then received training and supervision on the administration of structured interviews with emphasis on the establishment of inter-rater reliability, rapport building, crisis management, cultural sensitivity, and the criteria and definitions of common childhood mental disorders. All interviews were conducted in English and the order of administered measures was alternated to minimize order effects.

Statistical Analysis

The reliability and validity of the IMPACT was measured following the STARD (Bossuyt, 2015) protocol for reporting diagnostic accuracy studies, by comparing each IMPACT diagnosis with its corresponding diagnosis on the MINI-KID. Diagnostic concordance was assessed using unweighted kappa values, sensitivity, specificity,

positive predictive value (PPV) and negative predictive value (NPV). Agreement denoted by kappa values was categorized as poor (<0), slight (0.0-0.20), fair (0.21-0.40), moderate (0.41-0.60), substantial (0.61-0.80), or almost perfect (0.80-1.0) using interpretations set out by Landis and Koch (1977). Sensitivity is a measure of the *true positive (TP) rate,* and in the context of this study it refers to the probability of the target test (IMPACT) yielding a correct diagnosis (e.g. MDD) when in the presence of the disorder (Sensitivity= (TP/TP+FN), as measured by the gold standard test (MINI-KID). Specificity is a measure of the *true negative (TN) rate,* and in the context of this study refers to the probability of the target test (IMPACT) yielding no diagnosis (e.g. MDD) in the absence of a disorder (Specificity=(TN/TN+FP). Construct validity was assessed through the examination of convergent and discriminant validity amongst similar and dissimilar disorders on the MINI and IMPACT. Correlation coefficients were calculated to estimate the degree to which a positive diagnosis of X disorder on the MINI-KID was related to a positive diagnosis of the same disorder on the IMPACT. Related clusters of disorders (e.g. GAD, SAD) were expected to show higher agreement than unrelated disorders (e.g. GAD and ODD).

For the purpose of this analysis, both the IMPACT and MINI diagnoses of MDD-Current and MDD-lifetime were combined and renamed “MDD”. Analyses were conducted on diagnoses at the individual level as well as at the syndrome level in order to examine the IMPACT’s validity in correctly identifying disorders with related symptom clusters. To create syndrome categories, GAD, Separation Anxiety, Social Anxiety, and PTSD were combined and labeled “Any Anxiety” and ODD and CD were combined and

labeled “Any Conduct”; MDD and ADHD were the only disorders in their syndrome category, and so remained labeled accordingly. Internalizing and Externalizing syndrome categories were created by combining Mood and Anxiety Disorders (Internalizing) and Conduct and Neurodevelopmental Disorders (Externalizing).

3.4 Results

3.4.a. Clinical Descriptive Characteristics

Within our community sample, (n=189), 11% (n=21) met criteria for at least 1 current DSM diagnosis on the IMPACT and 16% (n=31) met criteria for at least 1 disorder on the MINI-KID (See Table 2). Five percent (n=9) met criteria for multiple current diagnoses on the IMPACT, and 5% (n=10) met criteria for multiple current diagnoses on the MINI-KID. Overall, the MINI-KID identified more current disorders (0.27 +- 0.76; range, 0-5) when compared to the IMPACT (0.20 +- 0.66; range, 0-5; paired t=-2.8, p=.006), almost exclusively driven by differences in MDD prevalence rates on the IMPACT (n=8, 4.4%) compared to the MINI-KID (n=14, 7.7%).

3.4.b. IMPACT Concordance with the MINI-KID

Table 3 provides kappa values, sensitivities, specificities, PPVs, and NPVs for individual diagnoses measured by the IMPACT and MINI-KID as well as syndrome level categories. At the individual diagnosis level, cross-instrument agreement indicated by kappa scores ranged from moderate (MDD, SocAnx, CD) to substantial (SepAnx, PTSD, ODD), and with ADHD demonstrating perfect agreement. Similar ranges were calculated

for the IMPACT operating characteristics: IMPACT specificity, PPV, and NPV were high across all diagnoses (0.75 or above) with the exception of the PPV of CD. Sensitivity scores were more variable; sensitivity ranged from acceptable (0.45-0.59) to very high (above 0.75) for all diagnoses with the exception of MDD and SocAnx.

Syndromal diagnostic categories were categorized by moderate (MDD, Any Conduct), substantial (Any Anxiety, Internalizing, Externalizing) and perfect agreement (ADHD) kappa values. Similar to results seen with individual disorders, sensitivity of the syndrome categories ranged from acceptable to very high with the exception of Any Mood. Specificity and NPV scores were very high for all syndrome categories (0.94 and above), while PPVs ranged from acceptable (Any Conduct and Externalizing disorders) to very high for all other syndrome categories.

To further demonstrate cross-instrument agreement between the IMPACT and the MINI, phi correlation coefficients were calculated to estimate the degree to which a positive diagnosis on the IMPACT was related to a positive diagnosis on the MINI-KID. As seen in Table 4 (individual disorders) and Table 5 (syndrome level categories), IMPACT diagnoses were related most closely with their corresponding diagnosis on the MINI-KID and related more closely to other like disorders or syndrome categories than dissimilar disorders or syndrome categories.

3.5 Discussion

The findings from this study demonstrate that the administration of the IMPACT by trained non-expert community health workers in rural Kenya achieved a relatively

high degree of agreement compared to existing diagnostic assessments. Existing assessments are typically developed and validated in HIC and require resources that are scarce in LMIC. These findings are consistent with other task-sharing approaches whereby community health workers are trained to administer mental health assessment and treatment programs in LMIC. The development of the IMPACT followed a user-centered focus employing a unique emic-etic approach. The demand for, and decisions regarding the preferred characteristics of, the IMPACT were considered in consultation with those for whom the instrument was intended (emic), while maintaining the diagnostic standards of the DSM-5 (etic) for cross-cultural validation and comparison (Rieder et al., 2019). Informal focus groups on the content of the IMPACT were conducted based on three relevant perspectives; lay participants (e.g. users of mental health services), CHWs (e.g. those intended to administer the assessment), and mental health experts (e.g. service providers) (Rasmussen et al., 2015; Van Ommeren et al., 1999). The mobile (tablet-based) nature of the assessment was a necessity for maximizing access to geographically isolated populations within Kenya. In addition, the simplified administration of the assessment by non-expert community health workers was a key feature of the IMPACT, and the task-sharing approach was in-line with WHO recommendations for improving access to mental health assessment and treatment in resource scarce regions of the world.

3.5.a. Validity of the IMPACT

Overall, the IMPACT demonstrated strong concordance with the MINI-KID, a gold-standard psychiatric assessment frequently used for research in LMIC. Low prevalence rates, as a result of a small sample size, likely contributed to lower sensitivity scores (e.g. SocAnx, CD) and concordance (MDD). In addition, differences in symptom profiles may have contributed to the differences between the MINI-KID and the IMPACT, especially with regard to MDD presentation. It has been observed that MDD symptoms in Kenya present differently than in Western cultures, with a heightened endorsement of somatic symptoms that are not specifically addressed by the MINI-KID (Ndetei et al., 2006).

When compared to the MINI-KID, the IMPACT was able to make accurate diagnoses at the level of individual diagnoses and even more so at syndrome level, suggesting that the IMPACT is a useful for assessing both symptom clusters and individual diagnoses. Given its intended use in community samples (where psychoeducation in children is limited) and where low prevalence rates are expected, it is important for a psychiatric assessment to be able to correctly identify non-disordered individuals: the IMPACT was able to correctly do so at least 95% of the time, leading to extremely high accuracy rates.

Phi coefficients showed further evidence of good construct validity of the IMPACT. Each disorder on the IMPACT was shown to correlate strongest with its matching disorder on the MINI-KID, and higher with MINI-KID disorders expected to be similar (e.g. CD and ODD), than disorders expected to be dissimilar, suggesting that the

IMPACT has strong convergent and discriminant validity and can be useful is assessing psychiatric disorders in Kenyan youth.

3.5.b. Practicalities

A mindfully developed partnership between the Canadian and Kenyan teams, with a focus on equity and sustainability, provided the opportunity to collaboratively develop the IMPACT using a unique emic-etic approach. The details of the partnership development and maintenance are separately discussed in detail in a Lessons from the Field manuscript (Rieder et al., 2019). With the goal of improving equitable access to mental health services in mind, two key priorities of the IMPACT were achieved: the successful use of non-expert community health workers to accurately assess childhood psychiatric disorders and the successful use of a technology-supported mobile assessment. After 2 days of training, non-expert community health workers were successfully able to administer and diagnose common childhood mental health conditions using the IMPACT at an equivalent level of expertise to trained psychology graduate students. This is a particularly important finding given the extreme lack of psychiatrists in Kenya and the severely limited access to professional mental health resources. Moreover, our results suggest clear benefits of a technology-supported platform. The use of tablet-based interviews improved the feasibility of administration by increasing portability, reducing economic burden (e.g. cost of purchasing and clinical training/supervision of gold-standard measures), and improving accuracy of data (e.g. no data or double checking is required, or paper-based record keeping challenges), all of which allow for vital

communication regarding the condition of a patient within the circle of care across geographic distances with relative ease.

3.5.c. Limitations

Although the results of this study are overall positive, they should be considered in the context of several limitations. First, all of the data gathered on childhood mental health problems were collected using self-report measures, where multi-informant reports are considered ideal, especially in the case of children. Future studies will include multi-method approaches that include expert clinical opinion, and other important informants from the lives of the children being interviewed (e.g. parents and teachers) which will improve the overall reliability of the IMPACT. Second, a larger sample size, in addition to the independent examination of both a clinical and community populations, would improve confidence and generalizability. A low base-rate, or the small number of children who met criteria for some disorder categories decreased the ability to fully estimate diagnostic concordance between measures. Low response rates for some disorders may also indicate bias due to stigma which may impact the reporting of symptoms of mental health disorders (Aillon et al., 2014). Third, the scale that was used to investigate validity has not yet been formally validated in a Kenyan population despite its frequent use in research practice. Additionally, Kenyan children were interviewed by trained Canadian graduate students which produced additional challenges regarding language, communication about the nuance of symptoms (especially in regard to depression) and potential bias due to perceived social desirability/authority. Depression was the first

diagnostic module to be administered during the children's first interview with a Canadian researcher, and as a result of this, MDD agreement was likely the most susceptible to inaccuracy. Although researchers visited the schools regularly in the two months prior to the study to play games and establish a rapport with the children, there were still some challenges with the apprehension of being interviewed by Canadian students. Validation against more ethnographically-based measures, such as the Ndetei–Othieno–Kathuku (NOK) Scale for common mental disorders, in addition to employing trained local CHWs, may yield higher concordance rates for depression diagnoses (Ndetei et al., 2006). Additionally, validation against contextually based measures such as the NOK Scale, would address commonly reported somatic complaints which are reported to mask depression symptoms and delay diagnosis and treatment (Ndetei & Muhangi, 1979). Finally, the MINI-KID is based on the criteria of the DSM-IV-TR, whereas the IMPACT was developed with criteria based on the DSM-5 which may have contributed to reduced agreement in some diagnostic categories.

3.5.d. Task-Sharing Approach

The strengths of a task-sharing approach promise future potential for scaling of the IMPACT. Given the strength of the existing community health worker infrastructure across Kenya, it is possible that following further refinement, the IMPACT could be successfully integrated into the primary care health system. Expansion into the community health worker network with a vision for nation-wide scaling could substantially improve screening for common mental disorders in childhood. Additionally,

the IMPACT could be utilized for large-scale epidemiological studies aimed at understanding the nature and prevalence of serious mental health conditions across Kenya. The use of a technology supported assessment can improve collaborative care across vast geographic distances where expertise in psychiatry is scarce.

3.6 Conclusions

Overall, the IMPACT was able to identify the presence of common mental disorders at the individual or syndrome level. Future directions will prioritize the refinement of diagnostic categories with the goal of integration of IMPACT into primary care settings, a key target outlined by the WHO and in the Sustainable Development goals. The IMPACT can also be targeted for used in low-intensity community interventions (e.g., Mental Health Gap Action Program). Additionally, scaling the use of the IMPACT for accessibility by creating a standardized training program is a priority while further translation and validation in other populations conducted. Evidence-based understanding of prevalence and severity of the Kenyan mental health landscape will help educate policy makers and support change at all stake-holder levels that aim to prioritize and allocate resources for the prevention and treatment of mental illness (Harder et al., 2014).

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Appendix

Table 1: Demographic Characteristics

		n (%)
Monthly Household Income	< 2000 KSH †	43 (23)
	2000-5999 KSH †‡	40 (21)
	6000-9999 KSH	20 (11)
	> 10000 KSH	47 (25)
Caregiver Marital Status	Married	131 (69)
	Widowed	8 (4)
	Divorced or Separated	5 (3)
	Never Married	3 (2)
Caregiver Education	None or Pre-School	4 (2)
	Primary Standard 1-6	10 (5)
	Primary Standard 7	22 (12)
	Primary Standard 8 or Secondary Forms 1-3	48 (25)
	Secondary Form 4 +	60 (32)
Child Gender	Female	96 (51)
	Male	91 (48)
Child Education	Primary Standard 7	51 (27)
	Primary Standard 8	37 (20)
	Secondary Form 1	31 (16)
	Secondary Form 2	22 (12)
	Secondary Form 3	23 (12)
	Secondary Form 4	21 (11)
Child Age	Range: 10-18 (*M* = 15.16, *SD* = 1.98)	

Note: International poverty line = $1.90 USD/day. 100 Kenyan Shilling (KSH) ≈1 USD.
† 2000 KSH/month ≈0.65 USD/day. †‡ 5999 KSH/month ≈1.94 USD/day.

Table 2: Clinical Descriptives

Disorder	Prevalence IMPACT n (%)	Prevalence MINI-KID n (%)
MDD	8 (4.4)	14 (7.7)
SepAnx	7 (3.7)	8 (4.23)
SocAnx	2 (1)	2 (1)
PTSD	9 (4.8)	10 (5.3)
GAD	0 (0)	0 (0)
ADHD	2 (1)	2 (1)
ODD	4 (2.1)	5 (2.7)
CD	4 (2.1)	4 (2.1)
MDD	8 (4.4)	14 (7.7)
Any Anxiety	14 (7.4)	20 (10.6)
Any Conduct	7 (3.7)	8 (4.2)
ADHD	2 (1.1)	2 (1.1)
INT	18 (9.5)	27 (14.3)
EXT	8 (4.2)	8 (4.2)

Note: ADHD=Attention-Deficit Hyperactivity Disorder, Anxiety=(GAD, SocAnx, SepAnx, PTSD), CD=Conduct Disorder, EXT= Externalizing Disorders (CD, ODD, ADHD), GAD=Generalized Anxiety Disorder, IMPACT= International Mobile Psychiatric Assessment for Children and Teens, INT= Internalizing Disorders (MDD, GAD, SocAnx, SepAnx, PTSD), MDD=Major Depressive Disorder, MINI-KID=Mini International Neuropsychiatric Interview for Children and Adolescents Interview, ODD=Oppositional Defiant Disorder, SepAnx=Separation Anxiety Disorder, SocAnx=Social Anxiety Disorder (Social Phobia).

Table 3: Agreement between IMPACT and MINI-KID Individual- and Syndrome-level Diagnosis

Disorder	Sensitivity	Specificity	Kappa	PPV	NPV	Accuracy
MDD	.43	.99	.52	.75	.95	.95
SepAnx	.75	.99	.79	.86	.99	.98
SocAnx	0.29	1	.44	1	.97	.97
PTSD	.70	.99	.72	.78	.98	.97
GAD	NA	1	NA	NA	1	1
ADHD	1	1	1	1	1	1
ODD	.60	.99	.66	.75	.99	.98
CD	.50	.99	.49	.50	.99	.98
MDD	.43	.99	.52	.75	.95	.95
Any Anxiety	.65	.99	.74	.93	.96	.96
Any Conduct	.50	.98	.51	.57	.98	.96
ADHD	1	1	1	1	1	1
Internalizing	.63	.99	0.72	.94	.94	.94
Externalizing	.63	.98	0.61	.63	.98	.97

Note [a]*:* PPV= Positive Predictive Value, NPV= Negative Predictive Value
Note [b]*:* ADHD=Attention-Deficit Hyperactivity Disorder, Anxiety=(GAD, SocAnx, SepAnx, PTSD), CD=Conduct Disorder, EXT= Externalizing Disorders (CD, ODD, ADHD), GAD=Generalized Anxiety Disorder, IMPACT= International Mobile Psychiatric Assessment for Children and Teens, INT= Internalizing Disorders (MDD, GAD, SocAnx, SepAnx, PTSD), MDD=Major Depressive Disorder, MINI-KID=Mini International Neuropsychiatric Interview for Children and Adolescents Interview, ODD=Oppositional Defiant Disorder, SepAnx=Separation Anxiety Disorder, SocAnx=Social Anxiety Disorder (Social Phobia).

Table 4. Multi-disorder, multi-method matrix showing Phi Coefficients between the IMPACT and MINI-KID disorder classifications by informant.

METHOD		IMPACT								MINI-KID							
	DISORDER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IMPACT	1. MDD	-															
	2. SepAnx	.10															
	3. SocAnx	-.02	-.02														
	4. PTSD	.48**	.35**	.22**													
	5. GAD	-	-	-	-												
	6. ADHD	.24**	.25**	-.01	.22**	-											
	7. ODD	.70**	.17*	-.02	.49**	-	.34**										
	8. CD	.15*	-.03	-.02	.14*	-	.34**	.23**									
MINI-KID	9. MDD	.54**	.37**	.17*	.34**	-	-.03	.38**	-.04								
	10. SepAnx	.09	.79**	-.02	.20**	-	.24**	.15*	-.03	.24**							
	11. SocAnx	.38**	.26**	.53**	.35**	-	.53**	.56**	.17*	.26**	.24**						
	12. PTSD	.45**	.33**	-.02	.72**	-	.21**	.46**	.13*	.22**	.19**	.20**					
	13. GAD	-	-	-	-	-	-	-	-	-	-	-	-				
	14. ADHD	.24**	.25**	-.01	.22**	-	1**	.34**	.34**	-.03	.24**	.53**	.21**	-			
	15. ODD	.46**	.32**	-.02	.27**	-	.63**	.66**	.21**	.20**	.29**	.67**	.26**	-	.63**		
	16. CD	.15*	-.03	-.02	.14*	-	.34**	.23**	.49**	-.04	-.03	.17*	.13*	-	.34**	.21**	-

Note [a]*:* ADHD=Attention-Deficit Hyperactivity Disorder, CD=Conduct Disorder, GAD=Generalized Anxiety Disorder, IMPACT= International Mobile Psychiatric Assessment for Children and Teens, MDD=Major Depressive Disorder, MINI-KID=Mini International Neuropsychiatric Interview for Children and Adolescents interview, ODD=Oppositional Defiant Disorder, PTSD= Post-traumatic Stress Disorder, SepAnx=Separation Anxiety Disorder, SocAnx=Social Anxiety Disorder (Social Phobia).

Note [b]*:* *=ρ<.05., **=ρ<.01.

Table 5. Multi-disorder, multi-method matrix showing Phi coefficients between the IMPACT and MINI-KID disorder classifications by informant (syndrome level groupings)

METHOD		IMPACT						MINI-KID					
	DISORDER	1	2	3	4	5	6	7	8	9	10	11	12
IMPACT	1. MDD												
	2. Any Anxiety	.36**											
	3. ADHD	.24**	.37**										
	4. Any Conduct	.52**	.27**	.25**									
	5. INT	.67**	.87**	.32**	.32**								
	6. EXT	.48**	.34**	.49**	.93**	.38**							
MINI-KID	7. MDD	.54**	.40**	-0.03	.26**	.62**	.24**						
	8. Any Anxiety	.37**	.76**	.30**	.30**	.71**	.36**	.37**					
	9. ADHD	.24**	.37**	1**	.25**	.32**	.49**	-0.03	.30**				
	10. Any Conduct	.35**	.24**	.49**	.52**	.29**	.61**	.14*	.30**	.49**			
	11. INT	.53**	.64**	.25**	.24**	.74**	.29**	.71**	.84**	.25**	.22**		
	12. EXT	.35**	.24**	.49**	.52**	.29**	.61**	.14*	.27**	.49**	1**	.22**	

Note [a]*:* ADHD=Attention-Deficit Hyperactivity Disorder, Anxiety=(GAD, SocAnx, SepAnx, PTSD), CD=Conduct Disorder, EXT= Externalizing Disorders (CD, ODD, ADHD), GAD=Generalized Anxiety Disorder, IMPACT= International Mobile Psychiatric Assessment for Children and Teens, INT= Internalizing Disorders (MDD, GAD, SocAnx, SepAnx, PTSD), MDD=Major Depressive Disorder, MINI-KID=Mini International Neuropsychiatric Interview for Children and Adolescents Interview, ODD=Oppositional Defiant Disorder, SepAnx=Separation Anxiety Disorder, SocAnx=Social Anxiety Disorder (Social Phobia).

Note [b]*:* *=ρ<.05., **=ρ<.01.

Figure 1. IMPACT Introduction

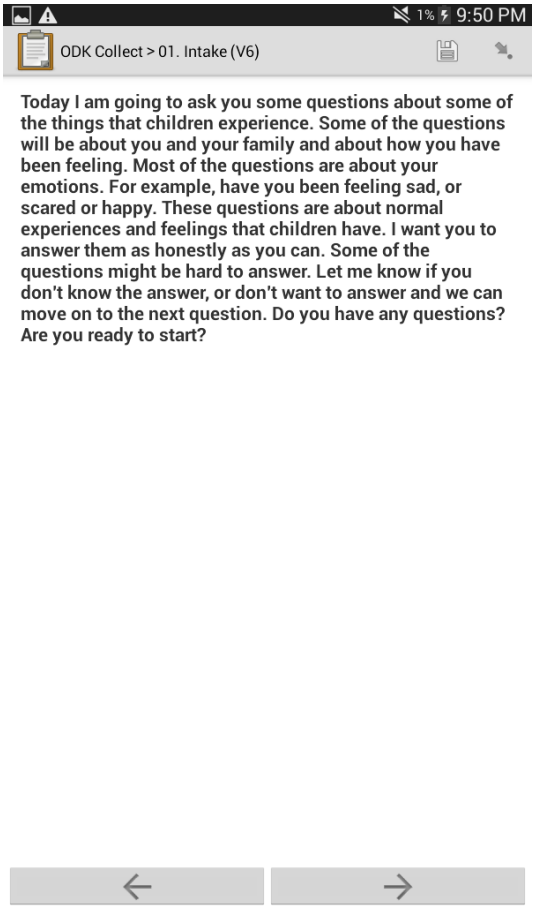
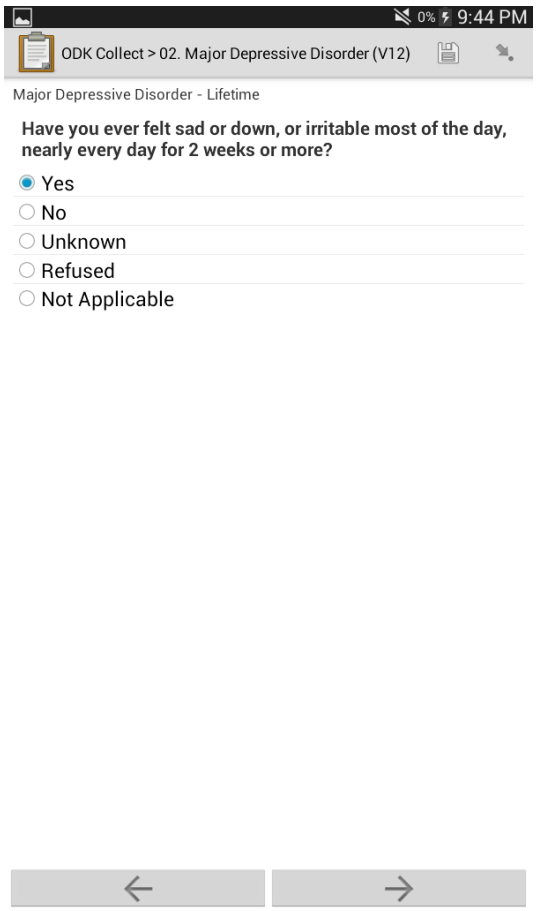


Figure 2. Depression Screening



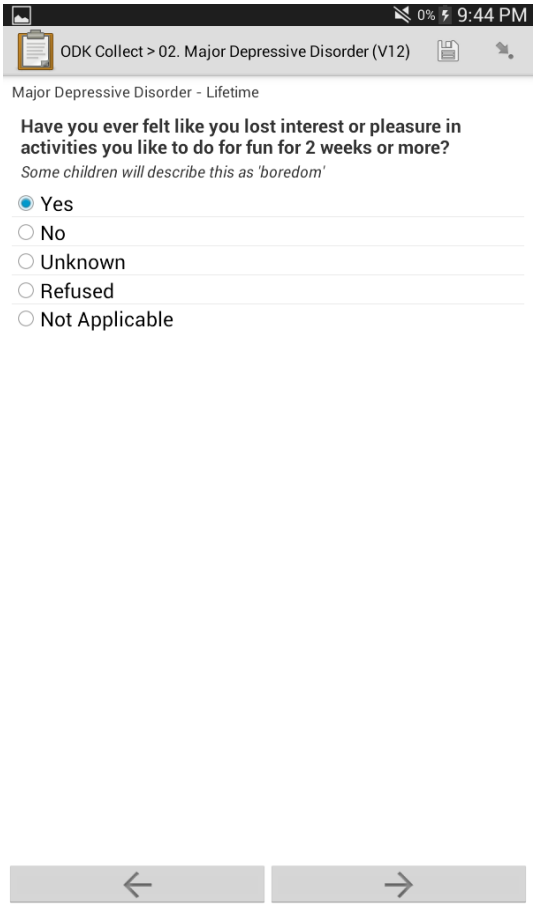


Figure 3. Demographic Questions

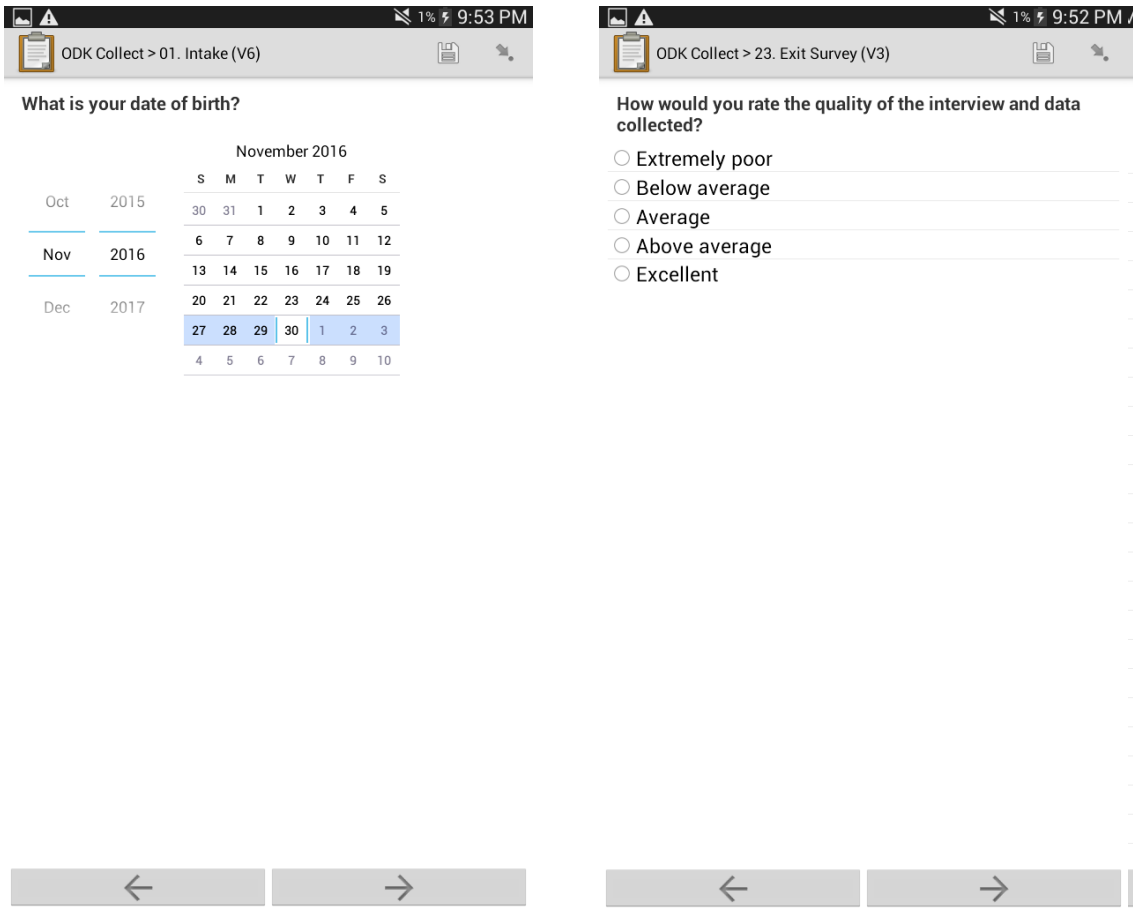
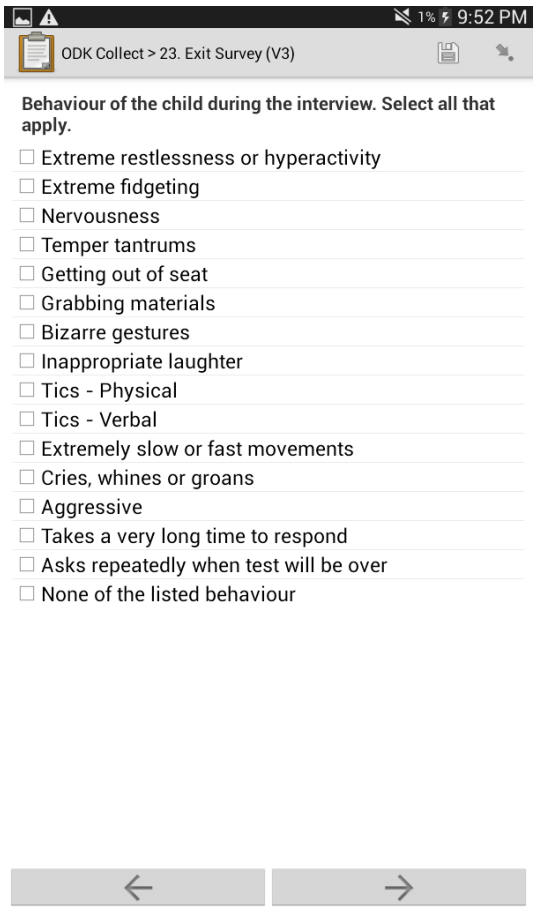


Figure 4. Quality of Interview and Behaviour



Chapter 4 | Study #3

General Purpose

Children in low- and middle-income countries are exposed to a wide variety of chronic and inter-related forms of adversity. As a result of these complex and co-occurring risk factors, children suffer heightened vulnerability for adverse development and maladaptive socio-emotional outcomes. Mothers who are exposed to adversity during childhood are at heightened risk for mental health problems and for transmitting vulnerability for the development of mental health problems to the next generation. The purpose of this third dissertation study is to examine the association between maternal exposure to childhood adversity in LMIC and the mental health of her children, mediated by maternal mental health. Additional factors such as poverty and the role of maternal education as a buffer for transmission of risk is explored.

Title, Authorship, and Copyright

Title: Impact of Maternal Adverse Childhood Experiences (ACEs) on Child Socioemotional Function in Rural Kenya: Mediating role of maternal mental health

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4.1 Abstract

Mothers in low- and middle-income countries (LMIC) suffer heightened vulnerability for adverse childhood experiences (ACEs), which is exacerbated by the multitude of risk factors associated with poverty and may lead to increased risk of psychiatric disorder. The constellation of complex, co-occurring biological, environmental, social, economic, and psychological risk factors are in turn transmitted to her child, conferring vulnerability for adverse development. The current study examines the association between maternal intra- and extra-familial ACEs, maternal education, and the mental health of her child, mediated by maternal mental health. Mother-child dyads (n=121) in Machakos, Kenya were examined cross-sectionally using self-report measures of ACEs, maternal mental health, and child internalizing and externalizing mental health problems. The four models proposed to examine the relationship between intra- and extra-familial maternal ACEs and child internalizing and externalizing problems demonstrated indirect pathways through maternal mental health. These effects were found to be conditional on levels of maternal education, which served as a protective factor at lower levels of maternal ACEs. These models demonstrate how the impact of ACEs persists across the lifespan resulting in a negative impact on maternal mental health and conferring further risk to subsequent generations. Elucidating the association between ACEs and subsequent intergenerational sequelae, especially in LMIC where risk is heightened, may improve targeted caregiver mental health programs for prevention and intervention.

Research Highlights

- The deleterious effects of intra- and extra-familial adverse childhood experiences (ACEs) have a negative impact on mental health that persists across the lifespan.
- Impaired mental health in mothers in low- and middle-income countries confers further vulnerability for the development of mental health problems in the next generation.
- Maternal mental health mediates the relationship between maternal ACEs, and child internalizing and externalizing problems.
- Maternal education moderates the relationship between ACEs and mental health, where higher levels of education provide a protective buffer against mental health problems.

4.2 Introduction

The transmission of mental health concerns in maternal-child dyads is multifactorial and determined through the complex interaction of environmental, social, economic, psychological, and biological mechanisms. Evidence from high-income countries (HIC) has demonstrated that maternal adverse childhood experiences (ACEs), such as childhood exposure to intra- and extra-familial violence, maltreatment, and a cascade of poverty-related consequences, impose far reaching implications across the lifespan and intergenerationally (Berens, Jensen, & Nelson, 2017; Jensen, Berens, & Nelson, 2017; Pereira et al, 2017; Rijlaarsdam et al., 2014). There is limited literature examining the mechanisms of transmission of risk for psychopathology from mothers who have experienced ACEs to her child, and this is especially true in low- and middle-income countries (LMIC); however, the exploration of factors mediating this pathway is broadening. ACEs have been shown to have a deleterious impact on later life outcomes that include mental and physical health, educational and financial attainment, and functioning within interpersonal relationships (Barcellos, Carvalho, & Turley, 2018; Benjet, 2010; Kessler, et al., 2010; Mbagaya, Oburu, & Bakermans-Kranenburg, 2013; Norman et al., 2012). The relationship between mother and child is particularly vulnerable to such adversity, with consequences that include disrupted parenting, impaired attachment, and poor educational and mental health outcomes in children (Lang, Gartstein, Rodgers, & Lebeck, 2010; Min, Singer, Minnes, Kim, & Short, 2013; Pereira et al., 2017; Plant, Barker, Waters, Pawlby, & Pariante, 2013; Rijlaarsdam et al., 2014; Schreier et al., 2016). Early exploration into the connection between maternal adversity

and childhood outcomes in HIC has converged on maternal mental health as an important mediating factor; mothers who have a history of ACEs are more likely to experience mental health problems, which in turn impairs healthy emotional and behavioural functioning of her child (Min et al., 2013; Pereira et al., 2017; Plant et al., 2013). ACEs in LMIC is heightened due to poverty, violence, and reduced access to essential health care, which substantially increases vulnerability for transmission of risk for mental disorder to the next generation (Jensen et al., 2017; V. Patel & Kleinman, 2003). The purpose of this study is to examine maternal childhood exposure to intra- and extra-familial ACEs, and factors such as education, that contribute to risk for psychopathology in the subsequent generation, in a sample of school-aged children and their mothers in Machakos, Kenya.

4.2.a. Adverse Childhood Experiences (ACEs)

The quality of a child's intra-familial (e.g. caregiving) and extra-familial (e.g. community experience) environment is crucial to healthy development and to the reduction of maladaptive psycho-social outcomes (Goodman, Hindman, et al., 2017; Muzik et al., 2013; Plant et al., 2013; Watts, Oburu, Lah, Rhodes, & Hunt, 2016). The majority of research in this area has focused on maladaptive family functioning, which has emerged as one of the most significant psychosocial determinants of healthy functioning due to its enduring impact on later life outcomes (Kessler, et al., 2010). The forms of maladaptive family functioning that have been examined most frequently in HIC include the loss of a parent or close relative, abuse or maltreatment, caregiver mental illness, and substance abuse, most of which are inter-related and exacerbated by

poverty (Kessler, et al., 2010). There is a paucity of literature that concurrently examines the consequences of extra-familial adversity (e.g. neighborhood violence, natural disaster, war), and this is especially true of studies from LMIC, where the risk for such experiences is compounded.

Although only 20% of the global population lives in HIC, only 10% of research examining the association between ACEs and mother-child mental health is conducted in LMIC, despite the heightened risk for ACEs (Goodman, 2017; Mbagaya et al., 2013; Prince et al., 2007). In HIC, 60-66% of individuals who endorse exposure to ACEs report histories of chronic, repeated, and/or multiple forms of adversity, which have a negative cumulative impact (Kessler, 2010). This is likely to be exacerbated in LMIC, where the consequences of chronic, co-occurring adversity may be more severe and relatively prolonged (Fisher et al., 2012; Walker, Wachs, Grantham-McGregor, et al., 2011). Though research in LMIC is limited, reported rates of various forms of ACEs in Kenya indicate relatively high rates of childhood adversity (Kenya National Bureau of Statistics, 2017; Mbagaya et al., 2013). Among caregiving women reporting retrospectively on adverse childhood experiences, 72.5% of females report experiencing physical abuse, 57.2% report experiencing emotional abuse, 57.7% report experiencing emotional neglect, 63.4% report experiencing physical neglect, 39.7% report experiencing sexual abuse, 78% report exposure to intimate partner violence. Moreover, 46% are reported to be living below the relative poverty line, complicating the cascade of poverty-related consequences (Kenya National Bureau of Statistics, 2017; UNICEF, 2010).

Few if any studies have concurrently examined the impact of maternal intra- and extra-familial ACEs. The detrimental impact of intra-familial ACEs on later-in-life outcomes has been well established in literature from HIC, and the same can be anticipated in LMIC, especially given the pervasive exposure to risk. Understanding the nature, chronicity, and severity of ACEs in LMIC underlines the consequence that the lack of prevention and adequate intervention can have on the physical and mental wellbeing of the mother-child dyad.

4.2.b. Transmission of Risk

Impact of Maternal Adversity on Child Outcomes

Existing research in HIC has explored the association between a mother's history of adverse childhood experiences and the health and well-being of her child. Though limited, evidence suggests that children whose mothers experienced high levels of ACEs are at elevated risk for several negative outcomes such as low birth weight, poor self-regulation, and increased vulnerability to other physical and mental health problems (Harville, Boynton-Jarrett, Power, & Hypponen, 2010; Jovanovic et al., 2011; Moog et al., 2018). Other evidence suggests that children of mothers with a history of ACEs are at high risk for a cascade of psychopathological sequelae including high rates of externalizing (aggression, impulsivity) and internalizing problems (mood, anxiety disorders, symptoms of trauma, and increased likelihood of suicide attempts)(Berlin, Appleyard, & Dodge, 2011; Bosquet Enlow, Englund, & Egeland, 2016; Cicchetti, Rogosch, Sturge-Apple, & Toth, 2010; Collishaw et al., 2007; Pereira et al., 2017;

Rijlaarsdam et al., 2014). The mechanisms by which this intergenerational risk is passed from mother to child are not fully understood; as such, research has begun to explore potential mediating factors. Attachment theory and mother-child interactions have been widely examined due to evidence demonstrating maternal ACEs can result in an impaired sense of self, inter-personal dysfunction, and heightened experience of stress.

In LMIC, similar evidence is emerging on the deleterious consequences of maternal ACEs on child outcomes. Recent studies have demonstrated that maternal maltreatment and exposure to violence are predictive of an increase in violent attitudes and tendencies toward children (Crombach & Bambonyé, 2015; Goodman, et al., 2017). In Kenya, maladaptive family functioning and stress are pervasive, which in turn increases exposure to physical punishment and other forms of childhood adversity (Goodman, Gutarra, et al., 2017; Oburu & Palmérus, 2003). The psychosocial mechanisms for the transmission of risk in the context of ACEs, and the investigation into potential mediators have primarily converged on maternal mental health, caregiving, social support, and exposure to stress in HIC. These pathways have not yet been explored in LMIC, especially in relation to childhood outcomes.

Maternal Mental Health

Maternal mental health is emerging as a particular concern in global research given the paucity of studies conducted in LMIC and the heightened vulnerability that women in resource-poor settings experience. Examination of the potential role of maternal mental health as a mediator between maternal ACEs and child outcomes is

complex in nature due to the reciprocity and inter-relatedness of the mother-child psychopathological sequelae (Lang et al., 2010; Min et al., 2013; Pereira et al., 2017; Rijlaarsdam et al., 2014).The determinants, onset, severity, and relative burden of mental health problems experienced by women and mothers consistently differ from the experiences of men. Moreover, mental disorders that compromise everyday functioning, such as depression and anxiety, are more prevalent among women than men, and are also likely to impact caregiving (Field, 2010; Moog et al., 2018; Pereira et al., 2017; Watts et al., 2016). Maternal mental health concerns are considered a serious global health epidemic as depression in women of childbearing age makes up the largest proportion of the global burden of mental disorders (Prince et al., 2007). Nearly 10% of pregnant women worldwide are likely to experience depression, as are 13% of women in the post-partum period (O'hara & Swain, 1996). This is further exacerbated in mothers raising children in LMIC, where rates of mood and anxiety disorders are already higher at 19.8%, when compared with 15.6% of mothers in HIC (Prince et al., 2007)

Research in HIC has already established the connection between maternal experience of ACEs and the persistence of mental health problems into adulthood (Feerick & Snow, 2005; Kessler, et al., 2010). Maternal exposure to intra-familial ACEs is associated with increased rates of internalizing and externalizing behaviour that span from adolescence into adulthood resulting in higher rates of mood and anxiety disorders (Goodman, Hindman, et al., 2017; Mbagaya et al., 2013; Norman et al., 2012). Additionally, adult women who are exposed to extra-familial adversity are more likely to experience depression or anxiety, even when controlling for the effects of other risk

factors such as intimate-partner-violence and poverty (Clark et al., 2008). Globally, ACEs account for approximately 30% of all adult-onset DSM-IV disorders and the risk for women of childbearing age is further exacerbated in LMIC where exposure to intra- and extra-familial adversity is frequent, chronic, and often severe (Fisher et al., 2012). Impoverished living conditions, social disadvantage, scarcity of food, inadequate education, exposure to violence, and lack of access to both physical and mental health treatment, confer further risk for the development of psychopathology (S.Patel et al., 2013).

With the negative consequences of maternal ACE's established, the mediating role of maternal mental health has emerged as a mechanism for the transmission of risk of psychological and developmental sequelae in the subsequent generation. Maternal depression, for example, has been linked to childhood disturbances in emotional, behavioural, and cognitive development, including self-reported mental health problems, increased risk for violence and substance use, and deficits in educational achievement (Barker, Jaffee, Uher, & Maughan, 2011; Rebecca M. Pearson et al., 2013; Prince et al., 2007). There is clear evidence demonstrating that poor maternal mental health is a potential mediator due to its association with reduced sensitivity in parenting, reduced attendance to and misunderstanding of the cues of her infant, and hostile or inconsistent responses to her infant (Muzik et al., 2013). Children raised in LMIC by mothers with mental health problems are more likely to endure a multitude of additional risk factors that increase vulnerability for developing mental health problems. These factors include reduced birth weight, increased growth stunting, increased risk for diarrheal

diseases, and reduced adherence to immunization schedules (V. Patel & Kleinman, 2003; Rahman, Bunn, Lovel, & Creed, 2007).

Despite the complexity and inter-relatedness of all the factors that contribute to the transmission of psychiatric risk, the role of maternal mental health as the mediating factor between maternal ACEs and child outcomes has been of particular interest (Koverola et al., 2005; Miranda, de la Osa, Granero, & Ezpeleta, 2013). Although most of the research to date has been conducted in HIC, similar findings would be expected in LMIC; though an individual's experience of adversity may be culturally unique, the associations between the variables that contribute to intergenerational risk endure (Mbagaya et al., 2013). Additionally, in LMIC the risk for ACEs is high and the opportunities for prevention and intervention for mental health concerns are limited, increasing the likelihood of transmission of psychiatric risk to subsequent generations.

The Role of Maternal Education in LMIC

Maternal education is a protective factor that may play a key role in mitigating the risks associated with intra- and extra-familial adversity in LMIC (Walker, Wachs, Grantham-McGregor, et al., 2011). Emerging evidence in LMIC is only beginning to replicate the research in HIC that examines the role of maternal education in association with ACEs, maternal mental health, and child outcomes. Low levels of maternal education in HIC are associated with increased risk for a number of deficits in childhood cognitive (e.g. executive function), behavioural, and emotional outcomes (Hughes & Ensor, 2009; Jeong, Mccoy, & Fink, 2017; Walker, Wachs, Grantham-McGregor, et al.,

2011). Education is known to serve as a protective buffer against various types of intra- and extra-familial ACEs which are pervasive and chronic in LMIC and are associated with a cascade of mental health concerns (Belle, 1990; Carlson, McNutt, Choi, & Rose, 2002).

Females in Kenya suffer heightened vulnerability for lower educational attainment, literacy rates (females 75%: males 81%), earning, and economic independence (Kenya National Bureau of Statistics, 2017). Following changes to Kenyan legislation in 2003 and 2008, primary and secondary education became compulsory and government funded, increasing overall enrolment by 22% (Ndetei et al., 2016; Ndetei et al., 2007). Despite legislation, a gender gap in education remains, especially in rural areas, where poverty disproportionately necessitates girls into child labour (Kenya National Bureau of Statistics, 2017). Few studies have examined the direct impact of maternal education on child outcomes in Kenya; however, given the known protective benefits of education, and the increased risk in its absence, it is necessary to better understand the role that maternal education has on the mother-child dyad, especially in settings where education is often compromised (Jeong et al., 2017; Landry, Smith, & Swank, 2006; Magnuson, 2007).

4.2.c. The Current Study

The purpose of the current study is to examine the complex factors that both contribute to and mitigate the transmission of mental health risk in mother-child dyads in Machakos, Kenya. This study is the first to independently examine the impact of both

intra- and extra-familial ACEs in an intergenerational context, with a focus on the mediating role of maternal mental health. Understanding the nature, frequency, and severity of maternal adversity in Kenya, in addition to the factors that buffer the consequences, enables targeted intervention with a focus on caregiver mental health and highlights the importance of policies that support education. The current study is timely in that it addresses the paucity of research that has historically been neglected in LMIC, while reinforcing the emergence of recognition of ACEs globally.

4.3 Methods

4.3.a. Ethics

Ethics approval was submitted and approved by both the McMaster University Research and Ethics Board in Hamilton, Canada, and the Kenyan Medical Research Institute in Nairobi, Kenya.

4.3.b. Population and Site Selection

Participants (n=121) consisted of mothers ranging in age from 26-60 (*M*=40.7, *SD*= 6.27), and their children, ranging in age from 10-18 (*M*=14.92, *SD*=2.03) who were recruited cross-sectionally from an existing McMaster University-Africa Mental Health Foundation (AMHF) research collaboration (International Mobile Psychiatric Assessment for Children and Teens (IMPACT) Study) in Machakos, Kenya. AMHF, a Kenya-based research NGO has established relationships with selected study schools and the broader community in Machakos. Machakos County is a predominantly

rural, agriculturally-based region located south-east of the capital district of Nairobi, where approximately 56% of children live in poverty (Kenya National Bureau of Statistics, 2017), closely matching the percentage of the current sample (57%) who have reported a household income falling below the International Poverty Line of 1.90 USD/day (Table 1). The dependency ratio is moderately high with 49% of the population under fifteen years of age. Machakos was selected for study due to its geographic accessibility, where the school recruitment sites are accessible year-round despite the change in weather (long rains and dry spells). Kikamba is the primary language of Machakos. English and Swahili are official languages of Kenya, with English being the language of education. Participant sociodemographic data are presented in Table 1.

4.3.c. Measures

Maternal Adverse Childhood Experiences

Mothers completed the self-report version of the Yale-Vermont Adversity in Childhood Scale (Y-VACS) to measure maternal exposure to ACEs (Holbrook 2014; 2016). The Y-VACS was adapted from English to Kikamba using the forward and backward translation procedure, following the World Health Organization's guidelines for translation and adaptation of instruments (Robine & Jagger, 2003). The purpose of the adaptation was to achieve a conceptually equivalent and culturally appropriate survey given the population. The Y-VACS is unique in its dimensional approach to measurement of adversity in that it consists of 20 items measuring exposure to both extra- and intra-familial adversity, including exposure to natural disasters, fires, war and terrorism, major

accidents, death of loved ones, health related traumas, community violence, bullying, sexual assault, loss or separation from a parent, domestic violence, caregiver criminal behavior, caregiver suicidality, caregiver substance abuse, neglect, psychological abuse, and physical abuse. For each adverse event, respondents endorse both frequency (0=never happened, 1=happened one time, 2=happened more than once) and severity (0=never happened, 1=mild, 2=moderate, 3=severe) of adversity for a maximum total score of 100. In the present study, intra- and extra-familial adversity subscale scores were derived for analysis, with a maximum score of 50. The Cronbach's alpha for extra-familial adversity was .73, and .76 for intra-familial adversity.

Maternal Mental Health Symptoms

Mothers completed the ASEBA Adult Self-Report (ASR/18-59; Achenbach & Rescorla, 2003) for ages eighteen to fifty-nine, consisting of 126 items querying a range of mental health symptoms across several domains. For each item, mothers circled either 0=not true, 1=sometimes or somewhat true, or 2=often or very true, which were summed to derive Total Problems scores. With permission from the authors, the ASR had previously been translated and adapted for use in Kenya, following the World Health Organization's guidelines for translation and adaptation of instruments (Robine & Jagger, 2003). The inventory has good reliability and validity (T. M/ Achenbach & Rescorla, 2003) and has been shown to be generalizable to the Kenyan context, having been previously utilized in Kenyan and African research settings (Rescorla et al., 2016). Raw

and T-scores were automatically generated using ASEBA Assessment Data Management (ADM) software. In the present sample, Cronbach's alpha is .96.

Child Mental Health Symptoms

Mothers completed the Child Behavior Checklist (CBCL/6-18; Achenbach & Rescorla, 2001)) for ages six to eighteen, consisting of 113 items querying mental health symptoms across several domains. Reflecting on the observed thoughts, emotions, and behaviour of her child, mothers circled either 0=not true, 1=sometimes or somewhat true, or 2=often or very true, and items were summed to derive scores for Internalizing, Externalizing, and Total Problems scores. With permission from the authors, the CBCL had previously been translated and adapted for use in Kenya, following the World Health Organization's guidelines for translation and adaptation of instruments (Robine & Jagger, 2003). The inventory has good reliability and validity (Achenbach & Rescorla, 2001) and has previously been used for research in Kenya (Harder et al., 2014; Kariuki, Abubakar, Murray, Stein, & Newton, 2016; Magai, Malik, & Koot, 2018). In the present study, the CBCL Broadband Scales for Internalizing Problems (Anxious Depressed, Somatic Complaints, and Withdrawn symptom domains) and for Externalizing Problems (Rule Breaking and Aggressive Behaviour symptom domains) were selected for analyses. Raw and T-scores were automatically generated using the ASEBA ADM software. Cronbach's alpha was .86 for Internalizing problems and .84 for Externalizing problems.

Covariates

Both gender of the child and household income have been included in the analysis as covariates in order to minimize the risk of confounding. There is evidence demonstrating that gender can influence caregiving style and differential gender-based developmental outcome (Radziszewska, Richardson, Dent, & Flay, 1996). Measures that account for age through standardized scores (e.g. ASEBA) were utilized. Household income has also been included given the abundance of evidence supporting the inter-related cascade of poverty-related consequences for healthy development (Jensen et al., 2017).

4.3.d. Procedure

All English-speaking children from primary standard seven to secondary standard four were eligible for recruitment from three study schools in Machakos, Kenya. Mothers were contacted by school administration via telephone and invited to attend school on the scheduled study dates in order to obtain consent and complete study surveys. Following informed consent and assent (by the child), mothers completed paper and pencil questionnaires (CBCL, ASR, and Y-VACS) administered in Kikamba and/or English by local research assistants. Additionally, a battery of demographic information (e.g. household income, education, etc.) was collected from both mothers and children.

4.3.e Analysis

To explore the association between maternal adversity and child mental health, conditional process modeling was used to test for moderated mediation as outlined by (Hayes, 2018). Moderated mediation occurs when an indirect effect of X (predictor) on Y (outcome) through M (mediator) is conditional on levels of a fourth variable, W (moderator), that moderates one of the model pathways. The current study proposes four models to examine the independent association of maternal intra- and extra-familial ACEs on both child internalizing and externalizing symptoms (See Figure 1 for models and pathway legend). In each model, the relation between maternal ACEs (intra- or extra-familial) and child symptomatology (internalizing or externalizing problems) was hypothesized to be mediated by maternal mental health. Additionally, given the protective benefits of education, the relationship between maternal ACEs and maternal mental health was hypothesized to be moderated by maternal education.

The conditional indirect effect of each model was assessed in SPSS (version 23) using Hayes' PROCESS macro (2018), model 7, for moderated mediation. The ordinary least squares regression-based method employed by PROCESS for estimating direct and indirect effects was utilized. For interpreting direct and indirect effects, bootstrapping with 5,000 bootstrap samples and 95% bias corrected (BC) confidence intervals (CIs) were used, as this method allows for direct testing of indirect effects while being robust to violations of traditional assumptions such as normality and linearity between variables (Hayes, 2018; Preacher, Rucker, & Hayes, 2007). To explore the moderation effect of maternal education, scores for intra- and extra-familial maternal adversity (Y-VACS) and

maternal mental health (ASR) were mean centered. A simple slopes analysis, the default technique within PROCESS, was utilized to probe the moderation using the 16th, 50th, and 84th percentiles as conditioning values (Aiken & West, 1994). Gender of the child and household income were also included as covariates.

Little's Missing Completely at Random (MCAR) test was run on the raw data (n=144) for all measures with missing data. Results were insignificant for all measures included (Y-VACS: p = 1.00; ASR: p = 1.00; CBCL: p = 0.70), indicating that data was missing completely at random. Cases without a total score for variables of interest were excluded from the model through the PROCESS macro list-wise deletion, resulting in a total sample size of 121 mother-child dyads, from the original sample of 144. The data were examined for outliers using Mahalanobis distance, with no outliers identified. Data were found to be heteroscedastic with non-normal residuals and so the PROCESS macro HC3 estimator was employed to allow for heteroscedasticity-consistent inferences (Davidson, Mackinnon, & Davidson, 1985).

4.4 Results

Each of the four models tested resulted in significant moderated mediation as hypothesized: the relationship between maternal ACEs and child mental health was mediated by maternal mental health conditional on level of maternal education. Descriptive statistics, maternal reports of adversity, and Spearman's *p* correlations are presented in Tables 2, 3, and 4 respectively.

4.4.a. Moderating Effect of Maternal Education

In all models presented, the relationship between maternal ACEs (X-variable; Y-VACS scores) and maternal mental health symptoms (M-variable; ASR scores) was moderated by level of maternal education (See Table 5). Across levels of education, higher Y-VACS scores were associated with higher ASR scores. Across levels of adversity, lower levels of education were associated with higher ASR scores; however, the strength of this effect varied across levels of adversity. At low levels of maternal adversity, ASR scores increased significantly as maternal education decreased (lower levels of education were associated with higher ASR scores). The same held true at average levels of maternal adversity. At high levels of maternal adversity, education did not significantly impact ASR scores (See Figures 2 and 3).

4.4.b. Mediating Effect of Maternal Mental Health

In all four models, significant relationships were found between maternal ACEs, maternal mental health, and child mental health. The regression path coefficients of the Total Effect models and mediation models are presented in Table 6. In each model, including maternal mental health as a mediator resulted in better model fit and significant mediation (see Table 7 for conditional indirect effects). Each model resulted in a similar significant conditional indirect effect of maternal ACEs on child mental health at both average and high levels of maternal education and accounted for 23-26% of the variance in child mental health. Statistical models are presented in Figure 4. These results suggest that maternal ACEs are associated with higher levels of maternal mental health symptoms

conditional on her level of education, which are in turn associated with higher levels of child mental health problems.

4.5 Discussion

The current study examined the relationship between maternal ACEs and child mental health problems in LMIC with a particular interest on the mediating role of maternal mental health on this intergenerational relationship. Exposure to both intra- and extra-familial types of adversity were of interest due to their relationship to child internalizing and externalizing problems through maternal mental health. As hypothesized, maternal mental health emerged as a significant mediating factor, and in all four models presented, this indirect effect was found to be moderated by levels of maternal education. The models presented in this study elucidate the conditionally mediated relationships between maternal ACEs and child mental health, capturing unique variance and predictive power not previously explored in the literature.

4.5.a. Maternal ACEs and Child Mental Health Problems

Maternal Mental Health as a Mediator

Research in HIC has established the connection between maternal ACEs and maternal mental health (Kessler, et al., 2010) and the association from maternal mental health to child internalizing and externalizing mental health problems (Bagner, Pettit, Lewinsohn, Seeley, & Jaccard, 2013; Trapolini, McMahon, & Ungerer, 2007). There is a paucity of literature in LMIC that examines all three constructs together in a single model

with maternal mental health functioning as the mediator between maternal ACEs and child mental health (Koverola et al., 2005; Miranda, De La Osa, Granero, & Ezpeleta, 2013.; Pereira et al., 2017; Rijlaarsdam et al., 2014). Our study is novel in its exploration of the relationships between both intra- and extra-familial adversity and child internalizing and externalizing problems, and, moreover, that it has replicated this association in an LMIC context where exposure to ACEs is prolific and protective opportunities are scarce. The effect of maternal ACEs on child mental health is likely multifaceted. However, our finding that the direct effects were reduced or no longer significant after accounting for the mediating effect of maternal mental health suggests that an indirect pathway of intergenerational transmission of psychiatric risk is much more likely. Regardless of the type of adversity experienced, a mother's mental health remains a significant mechanism through which the impact of her adverse early life experiences persists across her lifespan and influences the well-being of her child. Several additional factors could be responsible for explaining the association between maternal and child mental health, including human biology (e.g. genetics, epigenetics, neurobiology etc.), parenting (e.g. sensitivity, attachment etc.), or socio-cognitive pathways (e.g. transmission of helpless attribution styles); a complex combination of factors is the most probable (Berens et al., 2017; Fuchs, Moehler, Resch, & Kaess, 2017; Gavin, Hill, Hawkins, & Maas, 2011; Yehuda et al., 2016). A deeper exploration into the context-specific mechanisms of transmission in LMIC is grounds for future research.

Maternal Education as a Moderator

In all models presented, the indirect effect of maternal ACEs on child internalizing and externalizing problems through maternal mental health was found to be conditional depending on the level of maternal education. Specifically, maternal education moderated the pathway between both intra- and extra-familial maternal ACEs and maternal mental health; the association between ACES on later mental varied depending on the level of education obtained by mothers. Mothers who experienced low to average levels of adversity in childhood reported fewer mental health problems as their level of education increased. These findings suggest that maternal education exerts the greatest protection against the development of mental health problems later in life when adversity is not extreme.

This finding is consistent with literature conducted in HIC demonstrating that access to education increases resiliency against adversity in early life (Bornstein, Putnick, Bradley, Lansford, & Deater-Deckard, 2015; Gilligan, 1998; Jackson & Martin, 1998; Jeong et al., 2017; Sylva, 1994). Other research has explored the influence of education on a mother's ability to parent her child. Mothers who receive higher education in resource-poor settings are more likely to engage in higher quality interactions with their child, have greater knowledge of child development, provide an increased quality of home stimulation and scaffolding for her child, and are likely to have a greater number of books in the home (Ertem et al., 2007; McCoy, Zuilkowski, & Fink, 2015; Obradovíc, Yousafzai, Finch, & Rasheed, 2016). Such advantages produce opportunities for building strong maternal-child relationships and developing secure attachment, all of which are

crucial to the development of healthy emotional wellbeing (Jeong et al., 2017; Landry et al., 2006; Magnuson, 2007). Moreover, mothers with higher education are more likely to seek opportunities that act as protective buffers for her children against the deleterious effects of poverty, and other forms of adversity (Jensen et al., 2017). It is clear that maternal education is a crucial element in the transmission of psychiatric risk; however, the exact mechanism through which maternal education exerts its influence on the relationship between ACEs and maternal mental health, are beyond the scope of the current study.

4.5.b. Limitations, Conclusion, and Future Direction

The current study should be considered within the context of several limitations. First, although the a priori selection of variables in this study are theoretically-driven, the nature of the data remain cross-sectional. Thus, strictly speaking, the results of the path analysis cannot be readily interpreted to imply causality. We therefore cannot unequivocally conclude that the predictor variable, maternal adverse childhood experiences, causes increased mental health symptoms in the next generation. However, whilst the measures are collected concurrently, the experience of maternal childhood adversity must temporally precede the emergence of subsequent sequelae, which provides stability to the model. Similarly, subsequent evaluation of alternative models showed limited or no significance. Accordingly, the theoretically-driven selection of stable and reliable constructs serves to minimize this limitation to the extent possible.

Secondly, the utilization of maternal report for both measures of ACEs and child mental health should be considered. To better capture child mental health problems, multi-informant reports that include the children's own self-report, in addition to fathers and teachers, would serve to minimize rater bias and improve measurement validity. When considering the role of parental mental health, the influence of significant caregivers apart from the mother should be considered. This is particularly true in the Kenyan context in which caregiving responsibilities are often shared amongst immediate and extended family members, and sometimes other members of the community. Examining the relationship and relative impact of paternal mental health and ACEs, for example, may elucidate another significant path by which risk is intergenerationally transmitted. Additionally, it has been demonstrated that retrospective reports of ACEs may be subject to recall bias, resulting in under-reporting of adverse events by as much as half (Moffitt et al., 2010).

Prospective longitudinal studies that seek to examine ACEs and their impact across development could eliminate recall bias and contribute to the understanding of critical windows of vulnerability. Although this is the first study to measure both intra- and extra-familial adversity, we did not measure the full spectrum of childhood experiences. Moreover, our independent analyses of intra- and extra- familial adversity did not examine the shared versus unique variance accounted for by these predictors when measuring child mental health outcomes. The impact of ACEs chronicity, severity, and dose-dependent cumulative risk in the case of multiple adversities should be examined in this context (Danese et al., 2009; Felitti et al., 1998; Flaherty et al., 2009;

Jensen et al., 2017). Future research should utilize larger, broader samples that can be nationally representative, with the ability to parcellate the differential contribution of intra- and extra-familial adversity. This research is particularly critical in LMIC, where there is a severe dearth of evidence in which to base public policy that acts to improve on the lives of the most vulnerable.

The models presented in the present study emphasize the inter-relatedness and complexity of the constellation of factors leading to the transmission of psychiatric risk between mother and child. These models also highlight several opportunities for intervention at various steps along the risk trajectory, informing intervention practices that could change the course of transmission between a mother's experience of ACEs and the subsequent development of mental health problems in her children. Evidence from this study can be used to inform policies promoting early intervention through inclusion of public health initiatives that target families at risk for maltreatment, poverty, reduced educational attainment, and other adverse experiences. Evidence-based interventions, such as parent training programs, with a focus on mother-child relationships can significantly improve the mental health of mothers and the well-being of her child. Interventions that are delivered by trained non-experts (e.g. community health care workers) in resource-poor settings, such as low-intensity psychosocial interventions, may be particularly appropriate in the LMIC context, and have been shown to be effective in improving the mental health and well-being of both mothers and children in similar settings (Fisher et al., 2014; Rahman, Malik, Sikander, Roberts, & Creed, 2008). In addition to the existing evidence illustrating the cascade of benefits that education

provides for women, the models presented highlight the protective impact education has on maternal well-being, and that of her future children.

The consequences of ACEs on maternal mental health and the resulting impact on her child should continue to be examined, especially in LMIC, for the exact mechanisms through which these effects are taking place. Not only will this further our understanding of significant health determinants, but it will allow for targeted expansion of interventions in a context where it is vitally needed.

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Appendix

Table 1. Sample Characteristics of Mothers and Children

Sample Characteristics		n (%)
Monthly Household Income	< 2000 KSH †	35 (29)
	2000-5999 KSH †‡	34 (28)
	6000-9999 KSH	20 (17)
	> 10000 KSH	27 (21)
Marital Status	Married	103 (85)
	Widowed	10 (8)
	Divorced or Separated	1(1)
	Never Married	4 (3)
Maternal Education	None or Pre-School	7 (6)
	Primary Standard 1-6	9 (7)
	Primary Standard 7	16 (13)
	Primary Standard 8 or Secondary Forms 1-3	35 (29)
	Secondary Form 4 +	47 (39)
Child Gender	Female	69 (57)
	Male	52 (43)
Child Education	Primary Standard 7	32 (26)
	Primary Standard 8	30 (25)
	Secondary Form 1	15 (12)
	Secondary Form 2	17 (14)
	Secondary Form 3	12 (10)
	Secondary Form 4	12 (10)
Maternal Age	Range: 26-60 (M = 40.7, SD = 6.27)	
Child Age	Range: 10-18 (M = 14.92, SD = 2.03)	

International Poverty Line = $1.90 USD/day. 100 Kenyan Shilling (KSH) ≈ 1 USD.
†2000 KSH/month ≈ 0.65 USD/day. ‡ 5999 KSH/month ≈ 1.94 USD/day.

Table 2. Descriptive Statistics

		Min	*Max*	*M*	*SD*	*% Above Clinical Cutpoint*
Adverse Childhood Experiences (Y-VACS)	Intra-familial Adversity	0	35	7.4	7.8	-
	Extra-familial Adversity	0	33	6.5	7.1	-
Maternal Mental Health (ASR T-scores)	Total Problems	25	90	56.6	11.9	36
Child Mental Health (CBCL T-scores)	Internalizing Behaviour	50	77	53.6	5.6	15
	Externalizing Behaviour	33	83	56.5	10.2	40

Table 3. Distribution of Maternal Reports of Severity of Adverse Childhood Experiences Across Subtypes

		Frequency *n* (%)			Severity *n* (%)		
	Nature of Adversity	**Never**	**Once**	**>1**	**Mild**	**Mod.**	**Sev.**
Extrafamilial	Natural Disaster	85 (70)	24 (20)	12 (10)	11 (9)	13 (11)	14 (12)
	Fire	88 (73)	23 (19)	10 (8)	14 (12)	18 (15)	6 (5)
	War or Terrorism	112 (93)	7 (6)	2 (2)	11 (9)	3 (2)	2 (2)
	Accident or Serious Injury	115 (95)	4 (3)	2 (2)	8 (7)	1 (<1)	4 (3)
	Death of a Loved One	109 (90)	11 (9)	1 (<1)	12 (10)	7 (6)	1 (<1)
	Health Related Trauma	111 (92)	7 (6)	3 (2)	11 (9)	1 (<1)	5 (4)
	Community Violence	78 (64)	27 (22)	16 (13)	12 (1)	15 (12)	14 (12)
	Bullying	66 (55)	26 (21)	29 (24)	7 (6)	17 (14)	24 (20)
	Sexual Assault by Non-Family	103 (85)	15 (12)	3 (2)	10 (8)	7 (6)	8 (7)
	Other	113 (93)	5 (4)	3 (2)	6 (5)	3 (2)	2 (2)
Intrafamilial	Loss or Separation from Parents	95 (79)	12 (10)	14 (12)	13 (11)	6 (5)	11 (9)
	Domestic Violence	107 (88)	9 (7)	5 (4)	12 (10)	4 (3)	4 (3)
	Caregiver Criminal Behaviour	117 (97)	3 (2)	1 (1)	11 (9)	1 (<1)	1 (<1)
	Neglect	64 (53)	31 (26)	26 (21)	16 (13)	20 (17)	20 (17)
	Caregiver Substance Abuse	83 (69)	27 (22)	11 (9)	13 (11)	4 (3)	20 (17)
	Caregiver/Familial Suicidality	66 (55)	32 (26)	23 (19)	18 (15)	13 (11)	18 (15)
	Psychological Abuse	79 (65)	17 (14)	25 (21)	10 (8)	18 (15)	19 (16)
	Physical Abuse	101 (83)	12 (10)	8 (7)	9 (7)	3 (2)	9 (7)
	Sexual Abuse	95 (79)	23 (19)	3 (2)	10 (8)	9 (7)	7 (6)
	Other	118 (98)	2 (2)	1 (<1)	6 (5)	3 (2)	0 (0)

Table 4. Spearman's ρ Correlation Among Study Variables

Main Study Variables	1	2	3	4	5	6	7
1. Maternal Childhood Intra-Familial Adversity							
2. Maternal Childhood Extra-Familial Adversity	.62**						
3. Maternal Education	.04	.14					
4. Maternal Mental Health Problems	.32**	.23*	-.12				
5. Gender of Child	.07	.06	.04	.09			
6. Household Income	-.04	.07	.36**	-.01	-.10		
7. Child Internalizing Problems	.13	.15	.01	.37**	.23*	.03	
8. Child Externalizing Problems	.25**	.31**	-.03	.45**	.10	-.04	.54**

* ρ<.05. ** ρ<.01.

Table 5. Regression Coefficients of the Moderation of Maternal Education on the Relationship Between Maternal Adverse childhood experiences and Maternal Mental Health.

	b	*se (HC3)*	*t*	*p*
Intra-familial Adversity: Models 1 & 2				
Constant	58.83	3.38	15.92	<.001
Intra-familial Adversity (centered)	.52	.15	3.57	<.001
Maternal Education (centered)	-.41	.24	-1.66	.10
Intra-familial Adversity x Maternal Education	.07	.02	2.82	<.01
Extra-familial Adversity: Models 3 & 4				
Constant	53.71	3.43	15.65	<.001
Extra-familial Adversity (centered)	.47	.13	3.62	<.001
Maternal Education (centered)	-.53	.26	-2.03	.04
Extra-familial Adversity x Maternal Education	.05	.03	1.99	.04

Table 6. Regression Coefficients of the Total Effect Models (*c* Paths) and Moderated Mediation Models (Paths *a*, *b*, and *c'*).

	b	***se (HC3)***	***t***	***p***
Model 1				
a Path	.52	.15	3.57	<.001
Low Education	.32	.17	1.90	.06
Average Education	.52	.15	3.52	<.001
High Education	.79	.17	4.59	<.001
b Path	.16	.05	3.05	<.01
c' Path	.08	.07	1.30	.20
c Path	.16	.08	2.19	.03
Model 2				
a Path	.47	.13	3.62	<.001
Low Education	.31	.16	1.95	.05
Average Education	.47	.13	3.57	<.001
High Education	.68	.16	4.25	<.001
b Path	.15	.05	2.94	<.01
c' Path	.12	.08	1.47	.15
c Path	.19	.09	2.21	.03
Model 3				
a Path	.52	.15	3.57	<.001
Low Education	.32	.17	1.90	.06
Average Education	.52	.15	3.52	<.001
High Education	.79	.17	4.59	<.001
b Path	.34	.10	3.57	<.001
c' Path	.19	.12	1.52	.13
c Path	.37	.14	2.69	<.01
Model 4				
a Path	.47	.13	3.62	<.001
Low Education	.31	.16	1.95	.05
Average Education	.47	.13	3.57	<.001
High Education	.68	.16	4.25	<.001
b Path	.33	.09	3.60	<.001
c' Path	.33	.11	2.84	<.01
c Path	.48	.14	3.51	<.001

Table 7. Conditional Indirect Effects of X on Y.

Model	Moderator Level	*b*	BC CI	% Variance Accounted for
1	Low	ns	ns	23
	Average	0.08	0.02, 0.16	
	High	0.12	0.04, 0.22	
2	Low	ns	ns	24
	Average	0.07	0.02, 0.14	
	High	0.10	0.03, 0.19	
3	Low	ns	ns	23
	Average	0.18	0.06, 0.35	
	High	0.27	0.11, 0.44	
4	Low	ns	ns	26
	Average	0.15	0.05, 0.26	
	High	0.22	0.08, 0.37	

Figure 1. Model Variables (X, M, W, Y), measures, and paths (*a, b, c, c'*)

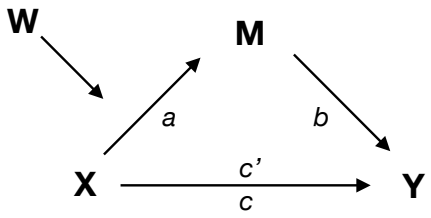
Variables	Measures	Models
X - Predictor	Intra-familial adversity (Y-VACS) Extra-familial adversity (Y-VACS)	
M - Mediator	Maternal mental health (ASR)	
W - Moderator	Maternal education	
Y - Outcome	Child internalizing symptoms (CBCL) Child externalizing symptoms (CBCL)	

Figure 1. Model variables (X, M, W, Y), measures, and paths (*a*, *b*, *c*, *c*'). The c path represents the Total Effect: the effect of X on Y without the inclusion of M in the model. The c' path represents the Direct Effect: the remaining effect of X on Y after controlling for M. The four independent models in the current study include: (1) intra-familial adversity to child internalizing symptoms; (2) extra-familial adversity to child internalizing symptoms; (3) intra-familial adversity to child externalizing symptoms; and (4) extra-familial adversity to child externalizing symptoms.

Figure 2. Moderation of maternal education on the relationship between maternal intra-familial adverse childhood experiences (ACEs) and maternal mental health.

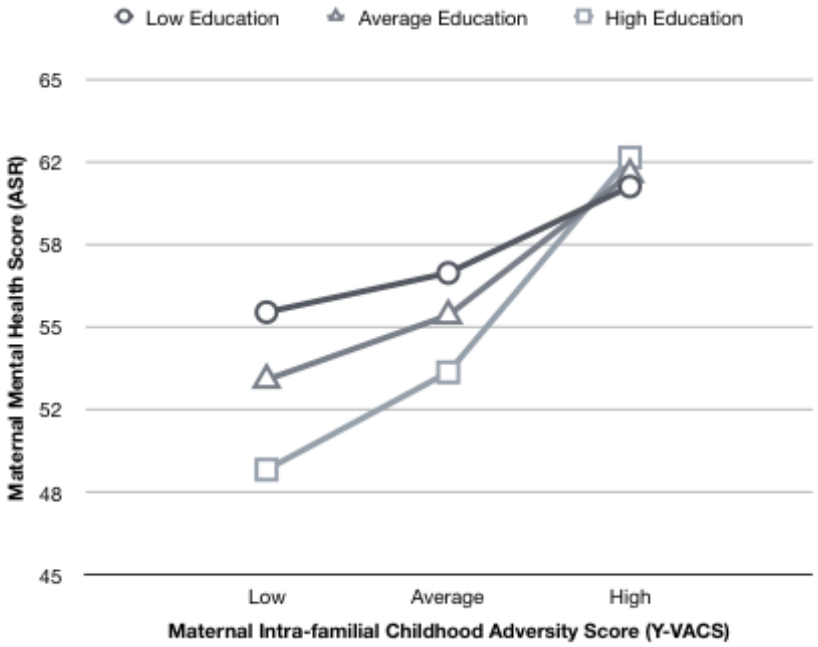


Figure 2. Moderation of maternal education on the relationship between maternal intra-familial adverse childhood experiences (ACEs) and maternal mental health. Mothers who report experiencing high levels of ACEs show no difference in their mental health scores conditional on their level of education. Mothers who report experiencing low and average levels of ACEs report lower mental health problems at average and high levels of education.

Figure 3. Moderation of maternal education on the relationship between maternal extra-familial adverse childhood experiences (ACEs) and maternal mental health.

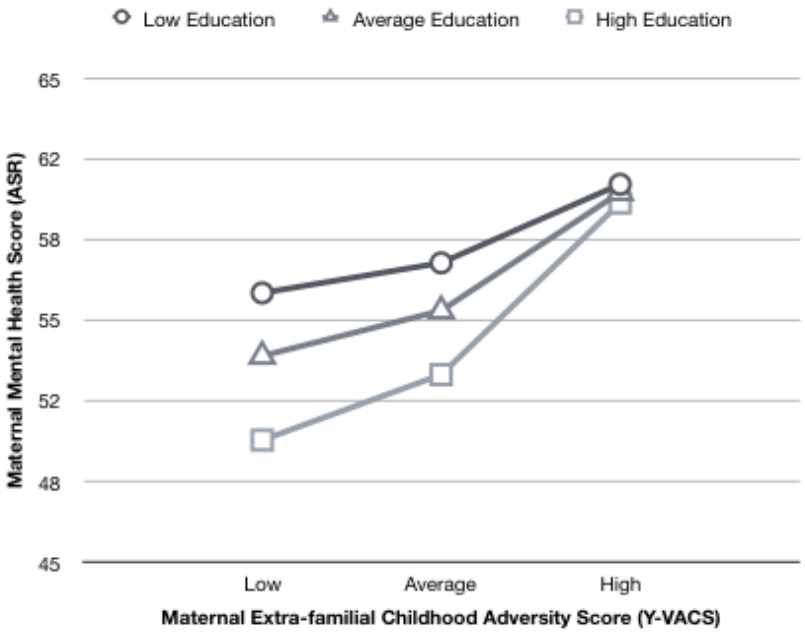


Figure 3. Moderation of maternal education on the relationship between maternal extra-familial adverse childhood experiences (ACEs) and maternal mental health. Mothers who report experiencing high levels of ACEs show no difference in their mental health scores conditional on their level of education. Mothers who report experiencing low and average levels of ACEs report lower mental health problems at average and high levels of education.

Figure 4. Moderated mediation models examining the relationship between maternal adverse childhood experiences (Y-VACS) and child mental health (CBCL), mediated by maternal mental health (ASR) and moderated by maternal education.

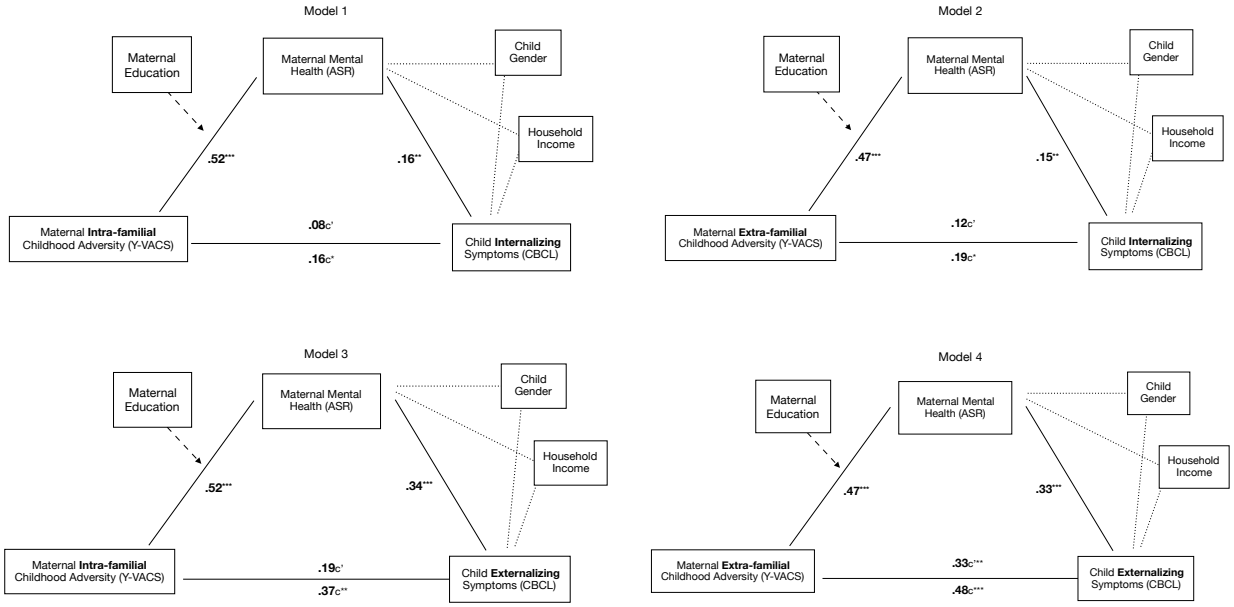


Figure 4. Moderated mediation models examining the relationship between maternal adverse childhood experiences (Y-VACS) and child mental health (CBCL), mediated by maternal mental health (ASR) and moderated by maternal education. Unstandardized mediation model path coefficients are presented. *p < .05. **p < .01. ***p < .001.

Chapter 5 | General Discussion

5.1 Summary of Dissertation Research

Collectively, these three studies were conducted in a low-resource context, and demonstrate: 1) the mindful development process of a sustainable and equitable partnership between research institutions in HIC and LMIC, and the practical utility of a unique, collaborative, and contextually-based approach to the development of a technology-supported assessment of childhood psychiatric disorders in rural Kenya; 2) the validity and reliability of the IMPACT administered by trained community health workers, using a task-sharing approach; and 3) the relationship between exposure to maternal adverse childhood experiences and the socioemotional outcomes of her children, which was mediated by maternal mental health.

5.1.a. Study #1

Support for task-sharing approaches to improve access to mental health assessment and treatment is growing in light of the extreme dearth of expertise and resources for common mental health disorders in LMIC. The development of an authentic and equitable research partnership between the Africa Mental Health and Research and Training Foundation and McMaster University provided the opportunity to develop a technology-supported structured interview for the assessment and diagnosis of childhood mental disorders in rural Kenya. A task-sharing approach was utilized to train local non-expert community health workers to effectively identify and diagnose common

psychiatric disorders. The use of technology enhanced the practical utility of assessment administration by providing automated diagnosis generation, increased portability and efficiency, and secure data transfer. These findings add to the body of literature in support of emic-etic approaches, that seek to combine both Western and culturally-salient methods of mental health evaluation and treatment (Rasmussen et al., 2015; Watson, Kaiser, Giusto, Ayuku, & Puffer, 2019). To the best of my knowledge, this is the first study to explore the guided development of a global North-South partnership between research institutions for the purposes of collaboration to develop a diagnostic assessment delivered by non-expert community health workers. The findings from this 'Lessons from the Field' study are likely generalizable to other partnerships and field-work settings where task-sharing and technology-supported assessment and treatment programs are being delivered. Task-sharing is a promising solution for overcoming the dearth of expertise and mental health resources in LMIC, through training and scaling up of care that can be delivered by local community health workers. Future research should concentrate on scaling the use of such task-sharing programs and evaluation within primary care settings to improve the capacity for and range of accessibility. Additionally, future research should include further adaptations and translation of task-sharing approaches in broader populations.

5.1.b. Study #2

Contemporary evidence on the development of psychological assessments in LMIC support the combination of both emic and etic perspectives to be inclusive of

variation in the presentation of mental illness across diverse settings to improve diagnostic accuracy. A collaboration with the AMHRTF afforded the opportunity to develop and evaluate the validity and reliability of diagnoses generated by the IMPACT when administered by local community health workers. The findings from this study demonstrate that assessment of childhood mental health disorders in rural Kenya, by non-expert community health workers, achieved a relatively high degree of agreement when compared to a gold-standard assessment. These findings are consistent with other task-sharing approaches whereby non-experts are trained and supervised to administer diagnostic assessments in LMIC (Musyimi et al., 2016; Rasmussen et al., 2015; Watson et al., 2019). The portable nature of tablets, and the adaptive technology-supported automated diagnostic features of the IMPACT maximizes access to rural or geographically isolated regions of Kenya. Additionally, the IMPACT demonstrated strong concordance with the diagnoses produced by MINI-KID, the gold-standard comparison. These findings demonstrate the capacity of non-expert community health workers to achieve a valid diagnosis of both individual disorders and symptom clusters, in comparison with diagnoses generated by Canadian-trained psychology graduate students. Given its intended use in low-resources settings, it is crucial that the IMPACT correctly identify non-disorder individuals, and the IMPACT achieved this with very high accuracy. The results of this study should be considered within the context of several limitations which include low prevalence rates which impacts agreement between the IMPACT and the MINI-KID, and the lack of multi-informant perspectives to provide additional confirmation of diagnoses. To the best of my knowledge, this is the first emic-

etic development approach to the comprehensive assessment of childhood mental disorders by non-experts. The findings from this study demonstrate that the IMPACT was able to identify the presence of disorders in Kenyan children at both the individual and syndrome level. Future directions for research should focus on evaluation of the IMPACT within the context of a larger sample size and across broader clinical and community populations. Future research priorities include scaling-up and evaluation of the IMPACT for expansion within community mental health programs, educational systems, and primary care practice, where appropriate. Future directions should prioritize the development of accessible standardized training programs, language adaptations, and validation for the purposes of generalizability to a nationally representative population.

5.1.c. Study #3

The mechanisms for transmission of mental health problems across generations has not yet been fully elucidated, however, current research has converged on the role of adverse childhood experiences, caregiver mental health, and parenting practices. In the current study, the examination of maternal exposure to ACEs afforded the opportunity examine the role of both intra- and extra-familial adversity on maternal mental health, and in turn, the subsequent socioemotional outcomes of children. Maternal mental health emerged as a significant mediator in all four models explored, which included the examination of both intra- and extra-familial ACEs and the resulting consequences for internalizing and externalizing behaviour in Kenyan children. This research extends the body of literature on the role of maternal mental health and ACEs on socioemotional

outcomes in children, in LMIC. Although the association between maternal mental health as a mediator , maternal ACEs, and child outcomes has been studied in HIC (Pereira et al., 2017; Rijlaarsdam et al., 2014), this is the first study to examine the mediating role of maternal mental health in a LMIC. The current study should be contextualized by a number of limitations. Causal models of the mediating role of maternal mental health and its association between ACEs and childhood outcomes should be outside of a cross-sectional design. Future research could benefit from a prospective longitudinal design that utilizes multi-informant data would strengthen causal associations and eliminate recall bias from retrospective measurement of ACEs.

The current findings highlight the inter-related of a complex constellation of factors that influence the transmission of psychiatric risk between a mother and child in LMIC. Given the moderating role of maternal education on the association between ACEs and maternal mental health, future research should examine intervention models that address simultaneous academic, socio-economic, and mental health inequities in low-resource settings. The current findings highlight several areas of focus for prevention and intervention, in order to minimize the risk of transmission of psychopathology across generations. Additionally, evidence from this research can be used to inform policy makers and mental health stake-holders in Kenya to include prevention and public health initiatives that prioritize the reduction of ACEs and address the risks of poverty and reduced academic achievement. Low intensity evidence-based parenting interventions that focus on positive and responsive caregiving and caregiver mental health, can

significantly improve the maternal-child relationship and improve socioemotional outcomes for children in Kenya.

5.2 Future Considerations and Conclusions

With an overarching goal of improving access to evidence-based mental health services in LMIC, this dissertation provides preliminary evidence for the use of collaborative task-sharing approaches to evaluate and diagnose common childhood mental health problems. Children in LMIC suffer multiple chronic exposures to adversity which increase the risk for mental health disorders, in a context where treatment is scarcely available (Kieling et al., 2011; V. Patel, Flisher, et al., 2007). Mixed-method approaches that prioritize authentic research partnerships between HIC and LMIC affords the opportunity to combine both emic and etic perspectives in the development of mental health assessments and treatment programs (Sawaya et al., 2018; Watson et al., 2019). This dissertation provides evidence in support of the practical utility of technology-supported assessment and the validity of diagnoses generated by trained community health workers. Children in LMIC face heightened vulnerability for the development of mental health disorders due to enduring exposure to ACEs. This dissertation expands on evidence from research in HIC that examines the association between maternal ACEs, maternal mental health, and child socioemotional outcomes. A notable limitation of the overall findings is the exclusion of fathers and factors related to fathers in association with child outcomes. Additionally, prospective longitudinal studies provide the opportunity to examine the complex and bidirectional relationship between known risk factors for the development of mental health problems across the lifespan. Research that

includes the examination of resiliency and protective factors, as well as focused exploration of other critical windows of transitional development across the lifespan (e.g. puberty) is needed.

The collective findings of this dissertation, in addition to the empirical evidence presented in each of the three studies have wide-reaching implications for future development of ACE and mental health prevention and intervention programs. A first priority is to minimize the gap between research on factors related to mental health, parenting, and poverty between HIC and LMIC. This can be achieved through policy and funding prioritization across all stakeholders. Ethically developed partnerships with a focus on sustainability and equity will afford research capacity building and shared opportunities for research expansion across north-south research programs. Research that prioritizes task-sharing interventions and the use of community health workers, with the vision of scaling up and integration into primary care, is encouraged. Additionally, the use of technology will provide opportunities to increase the range of mental health care to rural or isolated populations which remain severely underserviced. Research and capacity building in LMIC, financial prioritization, and policy development that addresses prevention, assessment, and treatment of mental disorders in LMIC will aid in the reduction of stigma, improve mental health outcomes, and reduce human rights abuses, globally.

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