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Leadership, Quality Improvement, Team Functionality, and HIV Viral Load Suppression in Uganda

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This is to certify that the doctoral dissertation by

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2020

Abstract

Leadership, Quality Improvement, Team Functionality, and HIV Viral Load Suppression in Uganda

by

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MSc Infectious Diseases, London School of Hygiene and Tropical Medicine, 2009

MBChB, Mbarara University of Science and Technology, 2002

Dissertation Submitted in Partial Fulfillment

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Abstract

Low viral load suppression rate is a significant public health issue in Uganda and similar countries. A nationwide quality improvement (QI) initiative was implemented from January 2019 to improve viral load suppression. Although QI team characteristics have been shown to influence the success of such QI initiatives, no studies have been found to understand how they influence the success of QI efforts to improve HIV viral load suppression in Uganda. The purpose of this cross-sectional, quantitative study was to determine whether there is a significant association between HIV clinic leader involvement in QI teams, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda, controlling for age, sex, and health facility type. The study was grounded in the model for success in quality improvement (MUSIQ) and the chronic care model (CCM). Secondary data for 2,758 patients attending 18 HIV clinics across three regions in Uganda were abstracted from the health management information system. Sampling was at the health facility level so that all patients in each sampled clinics were included. Data were analyzed using logistic regression, with one binary dependent variable of viral load suppression recorded as suppressed or unsuppressed. Leadership involvement, team functionality, patient age, patient sex, and health facility type were significantly associated with viral load suppression ($p<0.05$ for each). QI initiatives should invest in QI team characteristics because they affect patient outcomes. This study could potentially impact social change in low-income settings by improving service delivery for people with HIV in Uganda so that they achieve viral load suppression.

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Dedication

This work is dedicated to Mrs. Ann Mary Nakasoma Karamagi, Mr. Cyprian Rwakuliremu Karamagi, and Dr. Abel Nkolo. My parents, Mr. and Mrs. Karamagi, spent a significant part of their time and resources on mentoring and educating me. The resilience I have had to display to complete this work is a product of the character they built in me. My husband, Dr. Abel Nkolo, introduced me to Walden University, and selflessly and tirelessly enabled my progress. He has been a power source for me throughout this dissertation.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

In Uganda, unsuppressed HIV viral load is a significant public health issue. The World Health Organization (WHO) recommends three intensive adherence counselling (IAC) sessions over 90 days for all people with unsuppressed viral load (WHO, 2016). QI is an intervention that has been shown to close gaps in adhering to guidelines and protocols and is, therefore, an appropriate approach to improve the management of unsuppressed patients by ensuring all patients who are eligible for three IAC sessions receive all three sessions within the 90-day time frame. Contextual factors such as HIV clinic leaders' involvement in QI teams, QI team diversity, and team skill are important considerations for viral load suppression rates (Kiweewa et al., 2019).

The purpose of this cross-sectional, quantitative study was to determine whether there was a significant association between HIV clinic leader involvement in QI team, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda. This study is important because there are many unsuppressed patients on antiretroviral therapy (ART) in Uganda (Nasuuna et al., 2018; Yotebieng et al., 2019). This problem of viral load suppression persists even with good ART coverage (Flynn et al., 2017). This study could potentially impact social change in low-income settings by improving service delivery for people with HIV in Uganda so that they achieve viral load suppression amidst the challenges in such settings. This chapter includes information about the background of this study, problem statement, theoretical framework, purpose, research questions, nature of the study, assumptions, and limitations.

Background of the Study

Low viral load suppression rate is a current problem the AIDS Control Program is facing in Uganda and other countries in sub-Saharan Africa (Nasuuna et al., 2018; Yotebieng et al., 2019). The Joint United Nations Programme on HIV and AIDS (UNAIDS) 90-90-90 targets were set in 2014 to stimulate meaningful progress in the control of HIV (UNAIDS 2020). The third 90 refers to at least 90% of people on sustained ART have suppressed viral load. In Uganda, viral load suppression is poorly performing. IAC is successful for about 62% of unsuppressed children (Nasuuna et al., 2018). In addition, after 200 days, only 50% of the children eligible for three IAC sessions had received these (Nasuuna et al., 2018). This shows a need for improvement in processes and systems at the frontline to ensure all unsuppressed HIV patients receive the three IAC sessions within the 90 days recommended for IAC.

There is adequate evidence supporting the use of modern QI methods to improve health care in low-income settings (Broughton et al., 2016; Byabagambi et al., 2017; Karamagi et al., 2017; Livesley et al., 2019). QI is an appropriate approach to improve the management of unsuppressed patients by ensuring all patients who are eligible for three IAC receive all three sessions in time. QI involves frontline health workers identifying gaps and coming up with process and system changes to close them (Fulop & Ramsay, 2019).

Kiweewa et al. (2019) identified multiple patient-level predictors of virologic failure. The researchers also identified context as a predictor of virologic failure, specifically mentioning that accessing HIV care in a health facility outside Uganda

increased the risk of virologic failure in their study that covered health facilities in Uganda, Kenya, Tanzania, and Nigeria. One of the recommendations was further studies to understand contextual factors that predict virologic failure in people with HIV on ART.

Leadership is one of the contextual factors that has driven many successful healthcare interventions (Fulop & Ramsay, 2019). Morgan et al. (2019) conducted a qualitative study to understand the barriers and facilitators of the success of an intervention to improve dementia. Leadership engagement facilitated the success of this intervention. In addition, Vaughn et al. (2019) conducted a systematic review to understand the cross-cutting characteristics of health care organizations trying to improve quality, but without success. Vaughn et al. identified disconnection of leadership as one of the problems across all organizations struggling with improvement. One of the roles described for leaders in QI is ensuring the engagement of all staff in the improvement and managing resistance to improvements as they evolve (Fulop & Ramsay, 2019).

The MUSIQ summarizes the factors leading to the success of QI work (Kaplan et al., 2012). Kaplan et al (2012) recommend further research to unpack the relationship between the contextual, actionable factors that influence the success of QI work. QI team leadership involvement at the microsystem level and team diversity are two factors identified by Kaplan et al (2012) as influencers of the success of QI efforts in this model. I designed this study to evaluate the association between leadership involvement, QI team diversity, QI team skill, and the success of the QI team as measured by team functionality to improve viral load suppression.

Problem Statement

The HIV prevalence in adults in Uganda in 15–64 years old is 6.2%, and in children, 0–14 years is 0.5% (United States President's Emergency Plan for AIDS Relief [PEPFAR], 2019). IAC is successful for about 62% of unsuppressed children (Nasuuna et al., 2018). In addition, after 200 days, only 50% of the children eligible for three IAC sessions had received the sessions (Nasuuna et al., 2018). Economic strengthening has also been shown to improve viral load suppression 10-fold in adolescents living with HIV in Uganda (Bermudez et al., 2018). Economic strengthening in this study refers to an intervention to support saving at the family level to build capital to start an income-generating activity. Economically stronger families will be able to address the problem of paying for transportation to the HIV clinic or drug pick up point to receive ART monthly (Bermudez et al., 2018). Appointment keeping improves drug adherence, which improves viral load suppression (Bermudez et al., 2018). Implementation of economic strengthening in families with adolescents living with HIV could improve viral load suppression.

There is a need for QI in processes and systems used by health care providers to ensure all patients with unsuppressed viral load receive the three IAC sessions within the 90 days recommended for IAC. QI involves health care providers identifying gaps such as not accessing three IAC sessions within 90 days of an unsuppressed viral load result and not switching unsuppressed patients to a more potent regimen and coming up with creative ways to close the gaps (Fulop & Ramsay, 2019; MoH, 2018a). In this study, I examined QI teams for viral load suppression. Their functionality was a measure of the

number of documented changes tested to improve viral load suppression in the study period. Such functional QI teams effectively achieve their aims (Schentrup et al., 2018).

Contextual factors influence the success of interventions in health care and can influence the viral load suppression rates of patients attending ART clinics in different settings in African countries (Kiweewa et al., 2019). Kiweewa et al. (2019) recommend further research to understand these contextual factors. These factors have been studied in more detail in maternal health in the United States. Researchers have identified several differences in context as drivers for successful QI efforts to improve perinatal processes (birth registry and elective delivery before 38 weeks) in Ohio maternity hospitals in The United States of America (Reed et al., 2018). Systematic reviews and quantitative studies have shown that these contextual factors have been responsible for the success of a wide range of improvement projects in high-income settings, including improvements on early term delivery without indication, bacterial infections in infants, health outcomes of children at a children's hospital, and processes at different organizations of students at an improvement course (Kaplan et al., 2013). However, there are no extant studies regarding how contextual factors such as HIV clinic leaders' involvement in QI (QI) teams, QI team diversity, and team skill could influence the success of QI efforts to improve HIV viral load suppression in Uganda.

Purpose of the Study

The purpose of this cross-sectional, quantitative study was to determine whether there was a significant association between HIV clinic leader involvement in QI team, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates

in Uganda. The dependent variable was the HIV viral load suppression rates for patients on ART in the HIV clinic with 53 or more HIV patients with unsuppressed viral load in January 2019. The independent variables were HIV clinic leadership involvement in QI teams, QI team diversity, QI team functionality, and QI team skill. The control variables are patient age, patient sex, and health facility type.

Research Question(s) and Hypotheses

Research Question 1 (RQ1): Is there a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

Null Hypothesis ($H_0$1): There is no significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Alternative Hypothesis (H_a1): There is a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Research Question 2 (RQ2): Is there a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

Null Hypothesis ($H_0$2): There is no significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Alternative Hypothesis (H_a2): There is a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Research Question 3 (RQ3): Is there a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

Null Hypothesis ($H_0$3): There is no significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Alternative Hypothesis (H_a3): There is a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

Conceptual Framework

The framework for this study consisted of two models: CCM, and MUSIQ. The CCM was developed to describe what it takes to manage patients with chronic disease to achieve good outcomes (Wagner, 1998). The model has six components: self-management support, delivery system design, decision support, clinical information systems, organization of health care, and community support (Wagner, 1998). The result is productive interaction between health care providers and patients, leading to improved

clinical outcomes (Wagner, 1998). In a prospective controlled study on the effect of the chronic care model on HIV outcomes in Uganda, researchers found that the odds of increased CD4 cell count in the group that received the CCM was 3.2 times higher than in the group that did not receive the model (Broughton et al, 2016).

MUSIQ is a framework that outlines 25 actionable contextual factors that will influence the success of QI work (Kaplan et al., 2012). The model was developed following a systematic review to identify evidence-based contextual factors influencing QI success, followed by a consensus-building process among QI experts. Subsequently, Kaplan et al. (2013) conducted a quantitative study of 74 QI teams and found a significant association between these factors and improvement observed. A subsequent version of this model was developed to include more factors and expand or narrow the definitions of some of the factors within (Reed et al., 2018). The factors in this model are categorized as factors of the external environment, organization, QI capacity, QI team, microsystem, or miscellaneous (Reed et al., 2018). QI team factors are QI team skill, decision making, tenure, diversity, leadership, and prior QI experience (Reed et al., 2018). This model can be used to support the research questions as team HIV clinic leader's involvement in QI teams, QI team diversity, QI team functionality, and QI team skill are listed in this model as influencers of the success of the QI team. In combination, the CCM and MUSIQ grounded the study in theory.

Nature of the Study

I used secondary data for this quantitative cross-sectional study. The research questions to determine whether there was a significant association were best answered

using quantitative approaches. Uganda has 1,947 ART sites; 1,142 were targeted for a QI intervention to improve HIV viral load suppression. There is a total of 402 high volume health facilities in Uganda (MoH, 2018b). These are two national referral hospitals, 12 regional referral hospitals, two referral hospitals, 163 general hospitals, and 222 health center four level facilities (MoH, 2018b). A health center IV is a health facility that services a parliamentary constituency, also called a county. Two or more counties make up one district. Those without HIV clinics were excluded from this study. The dependent variable was the HIV viral load suppression rates for adults and children on ART in the clinic. This was a dichotomous variable. Patients with HIV are categorized as suppressed if their viral load is less than 1000 copies per milliliter, or unsuppressed if their viral load is equal to or more than 1000 copies per milliliter (MoH, 2018a; Kiweewa et al., 2018; WHO, 2016). In line with this, I categorized patients in this study as suppressed if their viral load is less than 1000 copies per milliliter, or unsuppressed if their viral load is equal to or more than 1000 copies per milliliter. The independent variables were the HIV clinic leader's involvement in the QI team, QI team diversity, QI functionality, and QI team skill. The control variables were patient age, patient sex, and health facility type. QI team diversity was a continuous variable measured by the number of different professionals or cadres represented on the QI team. The professionals or cadres were medical doctors, nurses, midwives, nursing assistants, laboratory technicians, data officers or clerks, counsellors, clinical officers, social workers, pharmacists, and community health workers (linkage facilitators and ART aides). QI team skill was a continuous variable that measured the correct use of a documentation journal. Each

health facility had a documentation journal for each QI project on viral load suppression, as recommended by MoH. Each journal contained an improvement aim reflecting the performance gap, an indicator for the improvement aim, the root cause of the performance gap, changes tested to address the root cause, and a time series chart. An updated time series chart to track progress included a title reflecting the indicator of the improvement aim, numerator, denominator, annotations, and analysis for trends and shifts. The data abstractor at each health facility used a checklist to indicate which of these components were filled in the team's documentation journal. I used binary logistic regression for data analysis.

Definitions

Leader's involvement: Leadership involvement is the connection of HIV clinic leaders to frontline health care providers so as to participate in solving problems presented by staff and use their positions to influence solutions to these problems (Sexton et al., 2018; Vaughn et al., 2019)

Team functionality: QI team functionality is a reflection of a team's ability to continuously test and implement changes (Costa et al., 2019; Harvey & Lynch, 2017; Parchman et al., 2019).

Team diversity: Team diversity refers to the extent to which people from different professions or people from different units comprise the improvement team (Engels et al., 2009; Rowland et al., 2018)

Team skill: In healthcare, this refers to the ability to apply QI science to identify and close performance gaps (Worsley et al., 2016)

Viral load suppression: In Uganda and similar countries, for public health purposes, a patient with HIV has an unsuppressed viral load if the viral load count is equal to or more than 1000 copies of the virus per milliliter of their blood (Kiweewa et al., 2018; MoH, 2018a; WHO, 2016)

Assumptions

I assumed that QI teams maintained a QI documentation journal. This is required by the MoH (MoH, 2016). This was important because the data source for team functionality, leadership involvement, team diversity, and team skill was the QI documentation journal. I also assumed that all patients with HIV had a viral load test done. The Ugandan national guidelines recommend a viral load test for each patient with HIV at least once every year (MoH, 2018a). Finally, I assumed HIV clinics had improvement projects to close performance gaps in viral load suppression. The AIDS Control Program (ACP) identified viral load suppression as a priority gap to be closed in 2019 using QI.

Scope and Delimitations

In this study, I focused on the context of a QI team working to improve viral load suppression in HIV clinics in Uganda. Leadership involvement in QI teams, team functionality, team diversity, and team skill were selected because they are actionable. HIV stakeholders in limited-resource settings like Uganda can take action to improve these contextual factors, and therefore improve the viral load suppression rates of patients attending HIV clinics. This is an important finding for healthcare in limited-resource settings.

The study included unsuppressed patients attending HIV clinics with QI projects to improve viral load suppression. I included all unsuppressed patients regardless of their age, sex, pregnancy or lactating status, and the ART regimen they were on. I excluded patients attending clinics that had no QI projects to close performance gaps in viral load suppression. At the analysis stage, SPSS excluded patients with missing data on viral load suppression rate. The results of the study are generalizable to HIV patients in Uganda.

The study was grounded in the MUSIQ and CCM conceptual frameworks. CCM has six components: self-management support, delivery system design, decision support, clinical information systems, organization of health care, and community support (Wagner, 1998). I focused on delivery system design and organization of health care. I did not use the other components of the model in this study. MUSIQ is a framework that categorizes actionable contextual factors into factors of the external environment, organization, QI capacity, QI team, microsystem, or miscellaneous (Reed et al., 2018). The factors included in the QI team category are: QI team skill, decision making, tenure, diversity, leadership, and prior QI experience (Reed et al., 2018). I focused on team diversity, team skill, and leadership involvement, all in relation to team functionality. I did not cover decision making, tenure, and prior QI experience in this study. I also did not investigate the categories of the external environment, organization, QI capacity, microsystem, or miscellaneous. I considered the Donabedian model for this study but did not use it. The Donabedian model implies that quality outcomes are determined by inputs and processes of care (Donabedian, 1988). Coyle and Battles (1999) highlighted that the

Donabedian model does not cover external and contextual factors that affect quality. Because I focused on the effect of contextual factors on the outcomes of unsuppressed HIV patients, the Donabedian model was not a good fit.

Limitations

The limitation of this study was the use of secondary data. Missing data is a common problem when secondary data is used. I expected that not all patients would have a record of their viral load suppression result. I countered this by using a larger sample size. Misinterpretation of variables during data collection was another potential problem. I provided detailed definitions of the variables of team functionality, team diversity, team skill, and leadership involvement to make sure the correct data is collected. Another challenge that I anticipated was the cost of collecting data from multiple facilities spread across Uganda. One research question required that different leaders be compared, therefore it was not possible to study data from one facility only.

Significance of the Study

The original contribution of this study may be to provide insight on whether contextual factors of team HIV clinic leader's involvement in QI teams, QI team diversity, and QI team skill influence the success of QI teams working on HIV viral load suppression in HIV clinics in high-volume health facilities in Uganda. Because these are actionable contextual factors, if there is a significant association, teams that do not have leader's involvement, team diversity, and team skill can take action to implement these factors before or during QI projects, and therefore improve the success of QI projects on HIV viral load suppression of patients attending their clinics. The leader who wants to

improve viral load suppression can join the QI team. Team diversity can be improved by inviting people from more professions involved in patient care like laboratory professionals and counsellors. HIV stakeholders can improve QI team skill improved by training staff on the topics of principles of QI, the use of QI tools and the use of time series charts. HIV stakeholders can also provide resource materials on time series charts and tools for QI.

Uganda has a high HIV prevalence of 6.2%. Only 63% of people with HIV have a suppressed viral load (UNAIDS, 2020). This is low considering the UNAIDS target of 74% by 2020 (UNAIDS, 2020). People with HIV in low-income settings such as Uganda access care from a system characterized by limitations in service delivery like inadequate skill (Figueroa et al., 2019). To manage, service delivery models have been designed and tested to improve the outcomes of patients. To manage HIV patients who have an unsuppressed viral load, the MoH in Uganda recommends three intensive adherence counselling sessions, followed by switch to second or third-line ART if the patient remains unsuppressed (MoH, 2018a). The positive social change implications could be to improve healthcare delivery for people in low-income settings.

Summary

Unsuppressed viral load suppression is a current significant problem in Uganda. I designed this cross-sectional quantitative study to link these QI success factors to viral load suppression rates in Uganda. QI is an appropriate approach to improve the management of unsuppressed patients by ensuring all patients who are eligible for three IAC receive all three sessions in time. Team diversity, team skill, team functionality, and

leadership involvement are known success factors for QI. Improvement of these factors may contribute to the improvement of delivery system design and organization of health care. The positive social change implications could be to improve healthcare delivery for people in low-income settings. Chapter 2 will include the literature search strategy, theoretical framework, and literature review for this study.

Chapter 2: Literature Review

In Uganda, HIV viral load suppression is a significant public health issue that needs urgent attention. The WHO recommends IAC for all people with unsuppressed viral load in low-income settings (WHO 2016). QI is an intervention that has been shown to close gaps in adhering to guidelines and protocols and is, therefore, an appropriate approach to improve the management of unsuppressed patients by ensuring all patients who are eligible for three IAC receive all three sessions in time. Contextual factors can influence the viral load suppression rates of patients attending ART clinics in different settings in African countries (Kiweewa et al., 2019). In addition, contextual factors have been responsible for the success of a wide range of QI projects in high-income settings, including improvements on early term delivery without indication, bacterial infections in infants, health outcomes of children at a children's hospital, and processes at different organizations of students at an improvement course (Kaplan et al., 2013). However, no studies have been found to understand how contextual factors such as HIV clinic leader's involvement in QI teams, QI team diversity, and team skill could influence the success of QI efforts to improve HIV viral load suppression in Uganda.

The purpose of this cross-sectional quantitative study was to determine whether there was a significant association between HIV clinic leader involvement in QI team, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda. This chapter includes the results of the literature review. The chapter starts with the literature search strategy and reviews MUSIQ as the conceptual framework for this study. This is followed by the literature review to elaborate on the history, successes,

and failures of HIV programming in Uganda, the involvement of leadership in healthcare and HIV, QI in healthcare, and what is known about QI team diversity, skill, and functionality.

Literature Search Strategy

To begin the literature search, I identified 11 topics relating to the research questions in the approved prospectus. These 11 topics were HIV in Uganda, ART, viral load suppression, intensive adherence counseling, leadership involvement in healthcare, HIV clinic leader, QI in healthcare, QI in HIV clinics in Uganda, QI team diversity, QI team skill, QI team functionality, and MUSIQ. For each topic, I started the literature search with searching the Walden University electronic library by the subjects of health sciences, counseling, business, and management. Any articles I identified using this broad strategy were used to identify keywords, databases, and websites to search further.

I searched the Thoreau, ProQuest health and medical collection, SAGE journals, CINAHL, MEDLINE, Uganda MoH website, WHO, PEPFAR, and CDC websites. Google search engine was another tool I used to find specific articles, especially on QI, known from my work experience. Keywords used I used were: *viral load suppression, leadership involvement, HIV, healthcare, healthcare leadership challenges, QI team, MUSIQ, leader participation, sustained virological response, virologic failure, intensive adherence counseling, Africa, Uganda,* and *chronic care model.*

This search strategy generated a total of 100 to 1000 papers each time the different combinations of keywords were entered in a search engine. These numbers were narrowed down to 20–60 papers for each of the 11 topics by including only scholarly

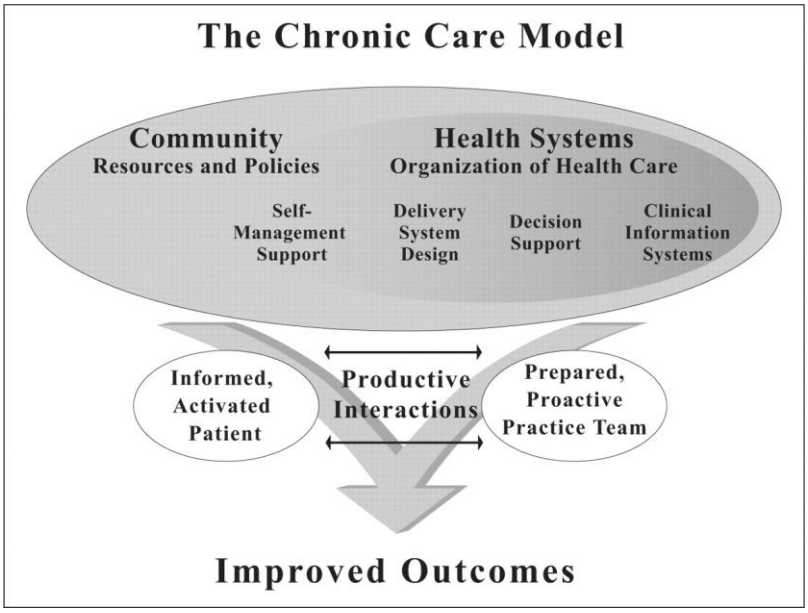
articles, and articles published from 2016 to 2019. I identified the final set of articles included in the literature review by reviewing the abstracts of the 20–60 papers for each of the 11 topics. The articles I used for the literature review were only those available as full text and peer-reviewed.

Conceptual Framework

The framework for this study consisted of two models: CCM, and MUSIQ. Wagner (1998) developed the CCM (Figure 1) to describe what it takes to manage patients with chronic disease to achieve good outcomes. The model has six components: self-management support, delivery system design, decision support, clinical information systems, organization of health care, and community support (Wagner, 1998). The model predicts productive interaction between health care providers and patients, leading to improved clinical outcomes (Wagner, 1998). MUSIQ is a framework that outlines 25 actionable contextual factors that will influence the success of QI work (Kaplan et al., 2012). The model was developed following a systematic review to identify evidence-based contextual factors influencing QI success, followed by a consensus-building process among QI experts. Subsequently, Kaplan et al. (2013) conducted a quantitative study of 74 QI teams and found a significant association between these factors and improvement observed. The second version of this model was developed to include more factors and expand or narrow the definitions of some of the factors within (Reed et al., 2018). In combination, the CCM and MUSIQ serve as the theoretical framework for this study.

Figure 1

The Chronic Care Model



Note. This figure illustrates the relationship between the six components of the chronic care model (Wagner, 1998)

The CCM has been applied widely in multiple settings. Several international studies have shown that application of the CCM improves the quality of care, patient experience, medication adherence, patient outcomes, and controls cost (Davy et al., 2015; Koh et al., 2013; Mackey et al., 2012; Stock et al., 2017). The CCM is practical, flexible, and generates sustainable results (Cramm & Nieboer, 2014; Jacelon et al., 2011). The success of the CCM is affected by factors like the organization's structural characteristics and support from the leaders (Kadu & Stolee, 2015). More recently, the CCM has been applied in low-income settings. In a prospective controlled study on the effect of the chronic care model on HIV outcomes in Uganda, researchers found that the odds of

increased CD4 cell count in the group that received the CCM was 3.2 times higher than in the group that did not receive the model (Broughton et al., 2016). A South African study demonstrated that it is possible to adhere to the components of the CCM amidst high disease prevalence and limited resources (Lebina et al., 2019). The model is now proposed for use at scale in HIV clinics in Uganda to improve HIV outcomes (Kiyaga et al., 2018; Kwarisiima et al., 2019). The CCM was appropriate for this study, specifically the model components of delivery system design and the organization of health care which cover the study variables of leadership involvement, team functionality, team diversity, and team skill.

Reed et al (2018) categorized the factors in the MUSIQ into the external environment, organization, QI capacity, QI team, microsystem, or miscellaneous. QI team factors are QI team skill, decision making, tenure, diversity, leadership, and prior QI experience (Reed et al., 2018). This model can be used to support the research questions as team HIV clinic leader's involvement in QI teams, QI team diversity, QI team functionality, and QI team skill are listed in this model as influencers of the success of the QI team. I focused this study on leadership and the QI team category.

One of the strengths of MUSIQ is that it provides specific definitions for each factor. MUSIQ defines the microsystem QI leadership factor as the extent of skill and involvement of microsystem leaders in the QI project (Kaplan et al., 2012). QI skill is a measure of the use of QI competencies to change the microsystem processes (Kaplan et al., 2012). QI diversity is a measure of how diverse the QI team members are in relation to professional backgrounds, personality, motivation, and perspective (Kaplan et al.,

2012). QI team functionality is part of the definition of QI success in the music model. QI success measured in this model is the implementation of changes in processes and systems, and an associated improvement in the outcome of interest (Reed et al., 2018). Inactive teams are excluded from MUSIQ (Kaplan et al., 2012). These definitions make it easier to compare different studies on similar factors.

MUSIQ provides a much-needed framework to understand the mechanics of QI. Earlier studies on contextual factors influencing QI did not have uniform definitions for the factors measured and were not embedded in a practical framework (Kaplan, et al., 2010; Kaplan et al., 2012; Kaplan et al., 2013; Reed et al., 2018). I address this gap using MUSIQ. After the development of MUSIQ in 2012, several studies have been conducted and analyzed using MUSIQ. A New Zealand study applying the MUSIQ model found factors at the microsystem level, reflecting highly functional teamwork, are responsible for success in improvement in healthcare (Wilson et al, 2018). MUSIQ was also applied to understand contextual factors that improve the success of independent verification visits performed by NHS to hospitals in England (Griffin et al., 2017). This qualitative study found that team diversity, knowledge exchange, and timely visits improved the effect of these independent verification visits (Griffin et al., 2017). In a qualitative analysis, Soghier and Short (2019) compared high and low performing neonatal intensive care units (NICUs) in the United States using MUSIQ and identified several factors including leadership involvement, team diversity, and QI skill of the team as factors responsible for high performance. Applying MUSIQ to independent validation visits introduced the importance of family and patient engagement while introducing it to low-

income settings introduced the value of political governance (Eboreime et al., 2017). MUSIQ has been used widely because of its multiple benefits.

MUSIQ is a robust framework. The same contextual factors broadly categorized as factors relating to the team, microsystem, macrosystem, and external environment have been found to support success in QI in multiple high, middle, and low-income settings (Adams et al., 2018; Barson et al., 2017; Eboreime et al., 2018; Zapata-Vanegas & Saturno-Hernández, 2018). Results are mostly self-reported and involve interviews with people involved in QI (Barson et al., 2017; Eboreime et al., 2017). The model identifies QI team factors as an independent set of factors affecting team success. Since this study used secondary data and not self-reported data, it presented an opportunity to test for associations between the success of a QI team, and the specific contextual factors of leadership involvement in QI, QI team skill, and QI team diversity, QI team functionality, and QI team success in Uganda.

Literature Review

HIV in Uganda

In the world, an estimated 37.9 million people are living with HIV, the virus responsible for the AIDS (WHO, 2018). Two-thirds of these people with HIV are found in Africa (WHO, 2018). The HIV prevalence in adults in Uganda in15–64 years old is 6.2%, and in children, 0–14 years is 0.5% (PEPFAR, 2019). Within adults, this prevalence is higher in women (7.6%) than in men (4.7%) (PEPFAR, 2019). Within females, this prevalence is higher in urban women (9.8%) than in rural women (6.7%) (PEPFAR, 2019). Uganda had 1,400,000 million people with HIV in 2018, translating

into 1,200,000 adults and 95,000 children (PEPFAR, 2019; UNAIDS 2020). In the same year, there were 53,000 new HIV infections (UNAIDS, 2020). The Uganda AIDS Control Program (ACP), Uganda AIDS Commission (UAC), United States President's Emergency Plan for AIDS Relief (PEPFAR) Uganda, and Uganda president's fast track initiative are some of the major efforts through which stakeholders have responded to this epidemic in Uganda through the years. As a result, the country has celebrated successes like reduction in mortality due to HIV by 58% between 2010 and 2018 from 56,000 deaths per year to 23,000 deaths per year, and in the same period, reduction in new infections from 92,000 to 53,000 per year (UNAIDS 2020). The country now has a nationwide HIV program through which all Ugandans can access free HIV testing, free care and treatment for those found positive, and free HIV prevention support for those found negative.

Anti-Retroviral Therapy

Although there is currently no cure for HIV, its effects have been minimized by antiretrovirals (ARVs), administered as ART to people with HIV. ART has prevented about 9.5 million deaths worldwide between 1995 and 2015 and accrued a total of 1.05 trillion U.S. dollars in economic benefits in the same period (Forsythe et al., 2019). At the patient level, the longer a person is on ART, the lower the chances of developing opportunistic infections due to HIV (Yen et al., 2019). However, ART introduces drug-specific side effects, the burden of taking daily pills, the cost and inconvenience of accessing healthcare regularly, and the possibility of developing drug resistance, necessitating switch to second-line drugs (Abbas et al., 2019; Moosa et al., 2019).

Uganda needs to invest more in viral load suppression because of an increase in opportunistic infections, despite increasing knowledge of HIV status and increased number of people on ART over the last 10 year period from 2006 to 2016 (Flynn et al., 2017). Over the years, the ART regimen recommended in Uganda by ACP has changed to improve outcomes, minimize side effects, and prevent resistance. For example, in September 2018, first-line ART was changed to a dolutegravir (DTG) based regimen for adults, from a regimen containing a group of drugs collectively called non-nucleoside reverse transcriptase inhibitors (NNRTIs) (MoH, 2018). This change was made because DTG based regimen were found to be more potent, less susceptible to drug resistance, better tolerated, and of lower cost than the other regimen (Phillips et al., 2019; WHO, 2019). To affect this and other changes, the MoH released new guidelines for the prevention and treatment of HIV in 2018 (MoH 2018a). This was followed by nationwide training and supply chain support to the health care providers. All people identified with HIV in Uganda are eligible for ART to effectively reduce their morbidity and mortality.

Viral Load Suppression

Poor viral load suppression is a current gap in HIV programming in sub-Saharan Africa (Nasuuna et al., 2018; Yotebieng et al., 2019). In Uganda and similar countries, for public health purposes, a patient with HIV has a suppressed viral load if the count is less than 1000 copies of the virus per milliliter of their blood (Kiweewa et al., 2018; MoH, 2018; WHO, 2016). The goal of ART is to achieve and maintain viral load suppression, which prevents progression and transmission of the disease. In Uganda, 64% of people with HIV have suppressed viral load (UNAIDS, 2020). This is below the

UNAIDS target to have 73% of people with HIV with suppressed viral load by 2020 (UNAIDS, 2020). The country needs to close this gap.

Despite the low social-economic status of the country, it is possible for patients on ART to achieve viral load suppression within Uganda's health system through streamlined service delivery models (Dolling et al., 2017; Kwarisiima et al., 2017). Several researchers have associated young age, poor adherence to ART, active tuberculosis (TB), high viral load at initial test, recent fever, female sex, and delays in switching patients with virological failure with poor viral load suppression in Uganda, amd effective ART, long duration on ART, male sex, community service delivery models, and early initiation on ART with good viral load suppression (Bulage et al., 2017; Barnabas et al, 2020; Diress et al., 2020; Kiweewa et al., 2019; Musinguzi et al., 2017; Natukunda et al.,2019; Namale et al., 2019; Ssempijja et al., 2017). Specific populations in Uganda like mobile fisher folks and men who have sex with men are vulnerable to poor viral load suppression (Hladik et al., 2017; Omooja et al., 2019). Although the literature has identified multiple patient factors associated with poor viral load suppression, not much has been done to identify contextual health system factors that contribute to poor viral load suppression in Uganda.

Bermudez et al (2018) demonstrated that economic strengthening improved viral load suppression ten-fold in adolescents living with HIV in Uganda. Economic strengthening in this study referred to an intervention to support saving at the family level to build capital to start an income-generating activity. Economically stronger families were able to address the problem of paying for transport to the HIV clinic or drug pick up

point to pick ART monthly (Bermudez et al., 2018). Appointment keeping improved drug adherence, which improved viral load suppression (Bermudez et al., 2018) A community-based test-and-treat intervention which facilitated linkage to care for positives, and subsequent follow-up support achieved 89.5% viral load suppression for people with HIV within 2 years, up from a baseline of 40% at diagnosis (Peterson et al., 2017). A randomized controlled trial in Uganda did not show any benefit of providing financial incentives to patients to improve viral load suppression (Thirumurthy et al., 2019). In these studies, in Uganda, it takes over two years for patients' viral load to reach undetectable levels (Peterson et al., 2017; Ssebunya et al., 2017)

Viral load monitoring guidelines in Uganda recommend a viral load test for all adults with HIV six months after they start treatment, 12 months after they start treatment, and annually subsequently if suppressed (MoH, 2018). Children, adolescents, pregnant, and lactating mothers get viral load tests every 6 months if suppressed (MoH, 2018). Patients with an unsuppressed viral load will get a viral load test after recommended interventions (MoH, 2018). Specifying when to do viral load tests is important at the public health level to minimize testing at points when the patient is expected to have a poor viral load. For example, newly identified HIV positive patients are not tested for viral load until they complete six months on ART. Instead, such patients are managed and tested after the intervention has been completed. Samples are sent to the government Central Public Health Laboratories (CPHL) and results returned to patients through an elaborate transport and hub system that crisscrosses the country (MoH, 2018).

Viral load tests are prescribed by the attending clinician and done at no cost to the patient.

Intensive Adherence Counseling

Problems with adherence to ART are the most common reason for poor viral load suppression (Fox et al., 2016; WHO, 2016). In a context where drug resistance testing is difficult, scalable interventions to improve adherence are a feasible approach to manage the problem of poor viral load suppression. A landmark systematic review of six retrospective and two prospective studies in eight high, middle, and low-income countries showed that 70 percent of unsuppressed patients on first-line ART re-suppressed after IAC (Bonner et al., 2013). Consequently, WHO's latest guidelines (2016) and Uganda's 2018 guidelines recommended IAC for unsuppressed patients (MoH, 2018a, WHO, 2016). According to the Ugandan national guidelines, adults and children with unsuppressed viral load should undergo intensive adherence counseling (MoH, 2018a). Intensive Adherence Counselling as an independent intervention has also effectively achieved viral load suppression for 64% percent of patients who were unsuppressed on second-line ART in South Africa (Fox et al., 2016). Patients who do not respond to IAC are switched to second or third-line ART to achieve viral load suppression (Fox et al., 2016; MoH, 2018a).

Children and adolescents face unique challenges and are less responsive to IAC than adults (Ford et al., 2019; Nasuuna et al., 2018). Thirty-seven Ugandan caregivers of unsuppressed children with HIV, through five focus group discussions, identified three areas of support needed to improve their children's adherence to ART and consequently

their lower their viral load: health system reforms like flexible clinic appointments outside school hours, better quality counseling, and no stock out of ART; psychosocial support like supported disclosure of child's HIV status; and economic strengthening to manage costs of food, school tuition, and travel to the clinic (Nasuuna et al., 2019). The Uganda national guidelines recommend an immediate switch to the second line ARVs for all unsuppressed children, with simultaneous IAC (MoH, 2019).

Clinics need to be re-organized to ensure all patients receive the appropriate response action following their viral load result. This level of re-organization is limited in low resource settings (Ford et al., 2019). This re-organization includes, for example, the creation of viremia clinics. These are special clinics for unsuppressed patients, where care is organized to ensure each patient receives the correct service at each visit, including IAC sessions. Researchers recommend the application of QI interventions to identify and close gaps in meticulous adherence to guidelines on the management of unsuppressed patients (Ford et al., 2019).

Leadership Involvement in Healthcare

Disconnection of leadership from the health care providers is one of the characteristics of healthcare organizations struggling in vain to improve performance (Vaughn et al., 2019). Leaders involved in healthcare present opportunities for staff to share problems and participate in solving these problems, while their leaders use their positions to contribute to the solutions (Sexton et al., 2018). There is evidence of the contribution of leadership involvement to improved health outcomes like reduction in the incidence of hospital-acquired infections, the success of indoor residual spraying and

mass drug administration for malaria prevention, and improvement in patients with dementia (Knobloch et al., 2018; McClung et al., 2017; Morgan et al., 2019; Wanzira et al., 2018). Leadership involvement has also resulted in improved clinic practices like the adoption of evidence-based practice in healthcare and changing from a physician-focused to a patient-focused service delivery model (Ariyo et al., 2019; Hijazi et al., 2018). However, leadership involvement in HIV work has mainly shown the added value of and opportunities presented by involving community leaders (De Neve et al., 2017; Gichuru et al., 2018; Lyatuu et al., 2018; Kalembo et al.,2018; Kamaara et al., 2019). Researchers have not extensively explored the value of involving clinic leaders in HIV prevention, care, and treatment. In this study, I will address the effect of involving healthcare leaders on the outcomes of HIV patients.

HIV Clinic Leaders

Leadership theories have evolved over the years from the idea of certain people being born leaders to theories that link different styles to success like transactional, transformational, and collaborative leadership (Ayeleke et al., 2018; Cummings et al., 2018). Situational leadership was also proposed as a theory that matches leadership styles, to specific contexts (Ayeleke et al., 2018). Such a situational leader would apply different leadership styles in different situations. Most recently, studies on healthcare leaders have extended beyond leadership style, to understand practices, competencies, and actionable factors influencing the success of a leader (Ayeleke et al., 2018; Cummings et al., 2018; Reed et al., 2018). This direction is helpful to guide training and

other actions to support healthcare leaders like HIV clinic leaders, who are usually from a clinical background, to achieve their goals.

Leaders in healthcare like HIV clinic leaders usually perform both management and leadership roles including setting a vision, providing direction, motivating staff, planning, organizing, controlling, implementing, evaluating, and efficient use of resources (Ayeleke et al., 2018). These leaders face many challenges including human resource shortages and demotivation, continuously changing policies, and the need for higher quality healthcare at a lower cost (Figueroa et al., 2019). The HIV clinic leader in Uganda works in an environment of new technological innovations, health financing reforms, focus on cost-saving, a disconnect of resource allocation from demand, increasing community-based population-level service delivery models in place of clinic-based models, need for new cadres not part of the existing staffing norms like counselors and quality specialists, persistent bureaucracy, heavy focus on targets and less on quality, increasing intensity of work, changing district leaders, ill-defined roles, frequent need to delegate leadership roles to untrained and busy health care providers, need to perform the hybrid role of clinician and manager, and a myriad of expectations and interests from stakeholders which do not always match the clinic priorities (Costa et al., 2017; Figueoa et al., 2019; Lees, 2019; Spehar et al., 2017). These challenges can potentially result in overwhelmed HIV clinic leaders and staff who lack an understanding of the contextually appropriate actions needed to improve the health outcomes of patients with HIV (Hunter, 2017; Lee et al., 2019). In such an environment, research to identify actionable factors to improve clinic performance is important for HIV clinic leaders.

HIV clinic leaders can manage the challenges they face by running their clinics using different service delivery models (Mukumbang et al., 2017; Pathmanathan et al., 2017). Differentiated service delivery (DSD) is one such approach, which involves categorizing patients according to their preferences, aiming to maintain good outcomes while improving efficiency (MoH, 2018a). Patients only need to see an HIV clinician if they are categorized as unstable because they have been on ART for less than 12 months, are not virally suppressed, currently have or have a history of WHO stage 3 or 4 opportunistic infections in the past 12 months, are on third-line ART, have poor adherence, are in the intensive phase of TB treatment, or they have multidrug-resistant TB (MoH, 2018a; MoH, 2017). The rest pick drugs through community or facility drug distribution mechanisms that do not involve clinicians. This helps reduce the workload in settings with limitations in human resource, improves efficiency, and operationalizes patient-focused care (MoH, 2017; MoH, 2018a; Mukumbang et al., 2017; Pathmanathan et al., 2017). In addition to DSD, MoH recommends working with community structures to optimize the delivery of health services and integrating continuous QI into HIV care (MoH, 2018a). Multiple task shifting models also already exist in the country, differing by roles and responsibilities of medical officers, nurses, and lay health providers (Tsui et al., 2017).

Quality Improvement in Healthcare

The International Organization of Migration (IOM) defines quality of healthcare as the extent to which health services are organized to achieve health targets while applying updated professional knowledge (NASEM, 2018). This definition translates into

several dimensions of quality of healthcare, including the effectiveness of health care, its efficiency, patient-centeredness, patient safety (medical errors), equity, and timeliness (NASEM, 2018). QI presents a systematic way to close gaps in the quality of healthcare by identifying the gap, understanding the root cause of the gap, testing solutions, and implementing what is learned at scale (Leis & Shojania, 2017). QI has been successfully applied in healthcare to improve all the dimensions of quality of health care including the effectiveness of health interventions like cancer screening interventions, patient experiences, the efficiency of support supervision, and patient safety (Bastemeijer et al., 2019; Coury et al., 2017; Knudsen et al., 2019; Manzanera et al., 2018; Renggli et al., 2017).

In Uganda, the application of QI started in the1990s with the creation of a quality assurance unit in MoH (Sweetser et al., 2019). This department, in conjunction with the respective technical units, has led the country to successes like the improvement in facility utilization and client satisfaction through the yellow star program, improvement in the quality of HIV outcomes through the HIV quality of care collaboratives, improvement in maternal and newborn health through the Saving Mothers Giving Lives (SMGL) program, and most recently the national QI initiative to improve HIV and tuberculosis outcomes (Karamagi et al., 2017; Karamagi et al., 2018; Sensalire et al., 2019; Sweetser et al., 2019). Consequently, there is precedence, skill, and buy-in for QI in Uganda. This is supported by the QI framework and strategic plan (QIF&S) that provides structure to QI in the country (MoH, 2016).

Quality Improvement in HIV Clinics in Uganda

Approximately ninety percent of the funds spent on the HIV response in Uganda is from external funders, and about 99.8% of this if from PEPFAR (PEPFAR, 2019). In 2018 alone, PEPFAR funding covered 94% (1,097,779 /1,165,562) of the people with HIV on ART in Uganda (PEPFAR, 2019). Other than the government of The Republic of Uganda, The Global Fund is the next major funder of the HIV response in Uganda (PEPFAR, 2019). PEPFAR prioritizes QI as a core approach in all the work they fund (PEPFAR, 2019). The HIV improvement priorities are directed by the ACP at the central MoH and may be from any performance gap along the spectrum of HIV prevention, care, and treatment in the country. Consequently, almost all HIV clinics in the country apply QI approaches to identify and close performance gaps in HIV care, including gaps in viral load suppression for people with HIV. Collaborative improvement approach is commonly applied in the country (MoH, 2016; Sensalire et al., 2019). This refers to a set of clinics working to close the same gap by applying QI approaches and knowledge management with the overall purpose of accelerating improvement in the prioritized area (Livesley et al., 2019; Rowland et al., 2018). Documented results of HIV clinic QI work in Uganda includes a reduction in mother to child transmission of HIV in Uganda from 17.2% to 1.5%, odds of increased CD4 cell count for HIV patients managed by CCM was 3.2 times higher than those not managed by the CCM; adherence to ART increased by 60% for patients managed using the CCM, dispensing practices for HIV drugs improved by 45%, and clinical wellness of HIV patients improved by 28% (Broughton et al., 2016; Byabagambi et al., 2017; Karamagi et al., 2017; Livesley et al., 2019).

The structures for QI in Uganda revolve around work improvement teams within each HIV clinic, supported by coaches from the district, regional and national levels (Broughton et al., 2018; Karamagi et al., 2017; Karamagi et al., 2018; MoH, 2016;). Work improvement teams are accountable for health care providers' QI, and accountable to coordination structures prescribed by the QIF&S, which include district, regional, and national QI coordination committees (Broughton et al., 2018; Lunsford et al., 2017; MoH, 2016). PEPFAR implementing partners play a significant role in engaging the work improvement teams and other QI structures to drive improvement efforts to meet targets within deadlines dictated by their project scope and work plans (Broughton et al., 2018; PEPFAR, 2019).

Quality Improvement Teams

The research on QI leans heavily towards evaluations of QI as an intervention, and not the mechanics of the discipline. QI teams are a group of people involved in the different steps in the process of care that makes up the prioritized performance gap (IHI, 2020; Rowland et al., 2018). The QI team (or work improvement team in Uganda) includes a team leader, who may or may not be the clinic leader, a team secretary, team members with technical expertise, and a team sponsor (Algurén et al., 2019; IHI, 2020). Where the clinic leader is the QI team leader, one of the team members needs to take on the role of championing the activities of the QI team on a day-to-day basis (Algurén et al., 2019; IHI 2020). The team leader is responsible for calling and chairing team meetings, the team secretary is responsible for recording meeting minutes and collecting data for the improvement aim, the team members participate in team meetings and drive

the activities of the team, and the team sponsor addresses issues of the QI team at the executive level (IHI, 2020). The team meets regularly to agree on an improvement priority for their unit, stated as an improvement aim, agree on the indicator they will use to monitor progress, use QI tools to pinpoint the root cause of the performance gap, come up with changes in their process and system to close the gap, implement changes that work at scale, and update the documentation journal (IHI, 2020; MoH, 2016). Over time, the activities of the QI teams are expected to lead to improved performance.

QI team diversity. While QI team diversity is prescribed for the success of QI teams (IHI 2020), research demonstrating its value is scarce. Rowland et al. (2018) therefore recommend research to understand the value of team diversity. The added value of a diverse team is important considering the complications of bringing together multiple professionals and people from different units (Rowland et al., 2018). In addition to difficulties in agreeing on time for team activities, different units have different dynamics which may hinder cross-unit collaboration. Although Engels, Gullickson, Hamoda, Kim, and Schiff (2019) demonstrated the success of one multidisciplinary team, there was no comparison to teams that were not multidisciplinary. Ersson et al. (2018) reported improved performance in the intensive care unit (ICU) using a 3-pronged QI intervention. The intervention included increasing the professions represented on the ICU team (Ersson et al., 2018). While this study demonstrated the value of team diversity in general, the authors did not describe the membership of the QI team, therefore it is not possible to tell if the QI team is as diverse as the ICU team (Ersson et al., 2018). In Uganda, with the context of limited resources, leadership challenges, and fragmented

service delivery, we need to know if QI team diversity is necessary to improve performance.

Two categories of leaders are expected on the QI team: the unit leader, and the day-to-day leader who drives the activities of the team. In addition to these two, the engagement of an executive leader as the QI project sponsor is recommended, but not as a team member (IHI, 2020). This study is about the unit leader. QI projects documented in literature have been implemented with and without the involvement of the unit leader (Algurén et al., 2019). These are mainly descriptive studies, which do not test for an association between the involvement of the unit leader and the success of the QI team.

QI team skill. QI skill is needed by all people in healthcare, as the need for efficient excellence increases (Worsley et al., 2016). People in healthcare are increasingly expected to perform both their professional role and the role of closing gaps in healthcare (Worsely et al., 2016). As such, QI training is now mandated for medical professionals in the USA (Massagli et al., 2018). In Uganda, although QI is not yet integrated into preservice training, post-graduate training in QI is available as part of the master's in health services research (MUSPH, n.d.). In addition, QI collaboratives and initiatives in the country incorporate a coaching structure to enable hands-on QI training of health care providers and QI teams by the coaches (Broughton et al., 2018). This is important to translate classroom training into practice. The skills needed for QI may be soft skills like change management, project management, and communication skills, or hard skills like the root cause analysis and the use of time series chart (Weggelaar-Jansen & van Wijngaarden, 2018). For example, the ability to draw a time series chart correctly is a

core skill included in tools to assess QI skill (Doupnik et al., 2017). Strong QI skill builds health workers' self-efficacy (Tweed & Gilbert, 2018). Studies on QI skill have focused on the effectiveness of training, and not on the association between QI skill and improvement in performance. This study will understand whether a lack of QI skill affects performance in Uganda.

QI team functionality. QI team functionality is a reflection of how active the team is. Specifically, a team's ability to continuously test and implement changes (Costa et al., 2019; Harvey & Lynch, 2017; Parchman et al., 2019). In literature, multiple terms have been used to refer to team functionality, including team capacity, sustained continuous QI, sustainable continuous improvement, lean management implementation, implementation of system and process changes (Costa et al., 2019; Gaiardelli et al., 2019; Harvey & Lynch, 2017; Parchman et al., 2019; Reed et al., 2018). Team functionality is more associated with some clinic quality measures like prior experience managing change than others like few clinicians (Parchman et al., 2019). While a dysfunctional QI team does not achieve its aim, functionality without other team attributes and contextual factors may not result in improvement (Rowland et al., 2018). This study therefore designed to understand the interaction between team functionality and some contextual factors (leadership involvement, QI team diversity, and QI team skill).

Summary and Conclusions

There are 1.4 million Ugandans living with HIV (UNAIDS, 2020). Although HIV related deaths have gone down by 56% over the years, the country still faces unacceptable gaps in the HIV program. Only 64% of Ugandans with HIV have

suppressed viral load, way below the UNAIDS target of 73% by 2020 (UNAIDS 2010). MoH in Uganda released revised guidelines to address these gaps, including change of first-line ART to DTG based regimen, and detailed instructions on the management of unsuppressed patients, including IAC and the application of QI methods to increase fidelity to the guidelines (MoH, 2018a). Uganda has extensive experience applying QI methods in HIV and other areas (Broughton et al., 2016; Broughton et al., 2018; Byabagambi et al., 2017; Karamagi et al., 2017; Livesley et al, 2019; Lunsford et al., 2017; Ssensalire et al., 2019). Although there are demonstrations of success as a result of involving healthcare leaders in care, their added value in QI for HIV is not known (Knobloch, et al., 2018; McClung et al., 2017; Morgan et al., 2019; Wanzira et al., 2018;). Leadership involvement is important for HIV clinics in Uganda because of the complexity of managing the challenges faced by HIV clinics in the country through the delivery of recommended service delivery models to improve patient outcomes (Figueoa et al., 2019; Costa et al., 2017; Lees, 2019; MoH 2017; MoH 2018a; Mukumbang et al., 2017; Pathmanathan et al., 2017; Spehar et al., 2017). In addition, the literature on QI focuses heavily on the effectiveness of the QI projects as interventions, and not the mechanics of the discipline. The dynamics of QI teams is one microsystem level category of factors responsible for the success or failure of QI teams in MUSIQ (Kaplan et al., 2012). While the MUSIQ is a robust model applying in many settings, there is a gap in the literature on the association between specific factors like QI team diversity, team skill, team functionality, and QI team success in Uganda and similar settings. Even in high-income settings, studies applying MUSIQ and the factors within have been self-

reported, descriptive, or qualitative. In the next chapter, I will explain the research methodology used for this study.

Chapter 3: Research Method

The purpose of this cross-sectional, quantitative study was to determine whether there was a significant association between HIV clinic leader involvement in QI teams, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda. In this chapter, I provide details of the rationale for this design, selection of study participants, methodology, data analysis plan using logistic regression, and threats to validity.

Research Design and Rationale

This was a cross-sectional quantitative study. I selected the cross-sectional design because the research is determining associations, and not causation, between the dependent and independent variables. Cross-sectional design is best suited for studies to compare different variables at a point in time (Creswell & Creswell, 2017; Elmore et al., 2020). In this study, I determined the association between independent and dependent variables at a point in time. The study did not involve an intervention, it was time-bound, and did not imply that the viral load suppression of the study participants was caused by the involvement of leaders, team skill, team diversity, or team functionality. The results can inform stakeholders on whether there is an association between viral load suppression and involvement of leaders, team skill, team diversity, and team functionality in Uganda. Viral load suppression was the dependent variable. Leadership involvement in QI, QI team diversity, QI team skill, and QI team functionality were independent variables. Patient age, patient sex, health facility type were control variables.

I conducted this study using cross-sectional design faster than a prospective design would have taken and with fewer resources than a randomized controlled trial design would have taken. Since I was a self-funded PhD student, time and resources were constraints. While QI science is widely applied in Uganda (Karamagi et al., 2017; Karamagi et al., 2018; Sensalire et al., 2019; Sweetser et al., 2019), there is no systematic study of the relationship between contextual QI factors like leadership involvement, QI skill, QI diversity, and viral load suppression.

Methodology

Population

I targeted people with HIV, on ART, with an unsuppressed viral load result. I targeted this population because the MoH has been implementing a nationwide QI initiative in Uganda. This initiative started in January 2019 to improve adherence to new national guidelines to manage unsuppressed patients in Uganda. There are 1,400,000 people with HIV in Uganda (PEPFAR, 2019; UNAIDS 2020). Of the people with HIV in Uganda, 84% know their HIV status, 72% are on treatment with ART, and 64% of these have achieved viral load suppression (UNAIDS 2020). This means that approximately 1,176,000 people with HIV know their HIV status, 1,008,000 people are on ART (85.7% of those who know their status are on ART), and 896,000 people are virally suppressed (88.8% of people on ART are virally suppressed; UNAIDS 2020). This translates into a target population of approximately 112,000 people in Uganda on ART who are virally unsuppressed.

Sampling and Sampling Procedures

I calculated the sample size using an effect size of 1.3 for logistic regression, power of 0.9, and an alpha level of 0.05. Using G*Power 3.1.9.2 (Faul et al., 2009). A minimum sample size of 783 was needed for this study. A power of 0.9 meant the probability of committing a type II error is 10% (Lipsey & Aiken, 1990). Type II error is not rejecting a null hypothesis when it is false (Lipsey & Aiken, 1990). Alpha (or significance) level means the probability of rejecting a null hypothesis when the null hypothesis is true (Lipsey & Aiken, 1990). Alpha level of 0.05 is usually used (Lipsey & Aiken, 1990). This means there is a 5% probability of stating that there is a statistically significant difference yet there is none (Lipsey & Aiken, 1990). I calculated the effect size using the odds ratio. This was appropriate because the dependent variable was categorical (Lipsey & Aiken, 1990). An effect size of 1.3 was reasonable considering that other similar studies have found higher odds ratios for predictors of viral load suppression in Uganda (Bulage et al., 2017). Assuming 20% of the patients will have missing data, the minimum sample size was increased by 20% from 783 to 939 patients.

I used multistage sampling to efficiently select at least 939 patient's representative of the 112,000 unsuppressed patients in the country. Three of the 12 regions were covered in this study to make the data collection process affordable. To ensure the 939 patients were representative of the country, the three regions were randomly selected. Within the three regions, six clinics with 53 or more unsuppressed patients were randomly selected to ensure at least 939 patients were included. All patients from the selected clinics who were unsuppressed in January 2019 were included in the

study. A total of 18 HIV clinics in three regions in Uganda were included in the study. Patients with missing data were excluded.

Data Collection

I conducted the study using secondary data. Data on viral load suppression was from the unsuppressed register in the HIV clinics of the 18 sampled clinics. A data abstractor transferred the data from existing tools at each health facility and emailed a completed data abstraction tool to me. At each health facility, the abstractor reviewed the register to identify patients who had an unsuppressed viral load in January 2019. Because all patients in the HIV clinic receive a viral load test once a year, the abstractor reviewed the register from January to December 2018 to identify patients who received an unsuppressed result. The abstractor reviewed the records of those with unsuppressed results from 2018 to determine if they had a more recent suppressed result. Those who had an unsuppressed result in 2018 and suppressed before January 2019 were excluded. The abstractor also excluded those with no viral load record between January 2019 and October 2019 and included all the rest. In addition to their viral load suppression data, they abstracted data on age, sex, and facility type for each patient.

The abstractor collected data on leadership involvement, team skill, team diversity, and team functionality from the QI documentation journal kept by each health facility. The abstractor excluded health facilities without QI journals from the study. To access the data, I sought permission from the MoH, and each hospital head. Data were collected from the unsuppressed register and the documentation journal using a data abstraction tool.

Operationalization of Variables

This study had eight variables. Viral load suppression was the dependent variable measured in copies per milliliter. It was categorical with two levels: suppressed or unsuppressed. A person has an unsuppressed viral load if they have 1000 or more copies of the virus per milliliter of blood. A person has a suppressed viral load if they have less than 1000 copies of the virus per milliliter of blood. Unsuppressed was coded zero, suppressed was coded one.

Leadership involvement in QI, an independent variable, was categorical with two levels: yes or no. Leadership referred to the HIV clinic leader, not the QI team leader, and not the leader of the health facility. An HIV clinic leader was involved in QI if they were a member of the QI team. I coded yes as one and no as zero.

QI team diversity was an independent variable. It was continuous and measured as full numbers from one to infinity. QI team diversity was the number of different professions or job titles represented on the QI team.

QI team skill was an independent variable. It was continuous and measured as full numbers from one to infinity. QI team skill was the number of correctly filled components of the documentation journal. A correctly filled journal had a correctly stated improvement aim, indicator, team members, root cause analysis, time series chart, and changes tested.

QI team functionality, a covariate variable, was a categorical variable with two levels: high or low. Teams with high functionality had tested four or more changes to improve viral load suppression. Teams with low team functionality had tested less than

four changes to improve viral load suppression. Four was chosen as the cut-off because the teams received four rounds of physical coaching from external coaches. During each coaching visit, teams are supported to come up with a new change. QI team functionality was documented in the documentation journal. I coded high team functionality one, and low team functionality zero.

I controlled for patient sex, and therefore analyzed it as an independent variable in binary logistic regression. It was categorical with two levels: male or female. I coded male zero, and female one.

I also controlled for patient age, which I therefore analyzed as an independent variable in binary logistic regression. Age was a continuous variable in full numbers from one to infinity.

Health facility type was the third variable controlled for in the study. I also analyzed it as an independent variable. Health facility type was a categorical variable with two levels: private or government. I coded private zero and government one.

Table 1

Operationalization of the Variables

Variable name	Variable type	Summary data point	Possible data point
HIV clinic leader's involvement in QI team	Nominal	Yes or No	Yes
QI team diversity (continuous)	Continuous	1 to infinity	3
QI team skill (continuous)	Continuous	1 to infinity	3
Team functionality	Categorical	High or low	High
Viral load suppression	Nominal	Suppressed or unsuppressed	Suppressed
Patient sex	Categorical	Male or female	Male
Patient age	Continuous	1 to infinity	10
Health facility type	Categorical	Private or government	Private

Data Analysis Plan

I cleaned and analyzed all the data of this study. The analysis was done using the Statistical Package for Social Sciences (SPSS) version 25. Data cleaning was done using two techniques: double entry and the use of queries. The data from the data abstraction tools sent to me were entered twice into excel, mismatch in the two databases identified, and corrected from the primary abstraction tools. I added queries to identify missing data, inconsistencies, and outliers to the database. When found, I reviewed primary data abstraction tools, and made appropriate corrections. Data curation from the 18 health facilities included in the study was done in Excel, transferred to SPSS, and set up for binary logistic regression analysis.

The research questions were:

RQ1: Is there a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

$H_0$1: There is no significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a1: There is a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

RQ2: Is there a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

H_0): There is no significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a2: There is a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

RQ3: Is there a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

$H_0$3: There is no significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a3: There is a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

I analyzed and presented data using frequencies for the viral load suppression leadership involvement, patient sex, and health facility type data, and mean and standard deviation for the QI diversity, QI skill, QI functionality, and patient age data. To test for the associations in the three research questions, I used binary logistic regression because

the dependent variable was categorical with two levels. Parchman et al (2019) showed that QI team functionality led to improved outcomes, and therefore I included it as a covariate. It was necessary to understand how it relates to viral load suppression and QI team skill, QI team diversity, and leadership involvement. Also, researchers have shown that sex, age, and facility type are predictors of viral load suppression (Bulage et al., 2017; Barnabas et al, 2020; Diress et al., 2020; Kiweewa et al., 2019; Musinguzi et al., 2017; Natukunda et al., 2019; Namale et al., 2019; Ssempijja et al., 2017). Interpretation of results from the logistic regression analysis was done using odds ratio and significance level. I used a significance level of 0.05 or less to determine statistically significance and reject the null hypothesis.

Threats to Validity

External Validity

External validity is a threat when results are generalized to settings, time, or people not covered by the study (Creswell & Creswell, 2017). The study was designed to be generalizable to people with HIV accessing care and treatment in Uganda, who have an unsuppressed viral load, regardless of sex, age, and health facility type. To ensure this, I used random sampling in two stages to select the patients to be included. Although missing data was expected, I mitigated it by working with a large sample size of 2,758 patients. A large sample size mitigates the effect of the missing data (Lipsey & Aiken, 1990). In order to achieve a high power of 0.9, I needed a sample size of at least 783. Recommendations for further study include the same study in a different location, or at a different time, or with participants whose viral load is suppressed.

Internal Validity

Internal validity poses a threat when the inferences drawn from the study may not be accurate (Creswell & Creswell, 2017). In this study, this may have been due to the selection of study participants with a pattern of bias, participants with missing data, or the presence of unknown confounders (Creswell & Creswell, 2017). According to Creswell & Creswell (2017), these can be minimized by applying random sampling, and the use of a large sample size. I used random sampling and a large sample size for this study. Known and unknown confounders were an important threat to the internal validity of this study. Known confounders can be controlled for by including them in the model at the analysis stage, while unknown confounders can be minimized by the random selection of study participants (Creswell & Creswell, 2017). I controlled for confounders identified during the study (patient age, patient sex, and health facility type) by including them in the model at the analysis stage. Unknown confounders were minimized by the randomized selection of study participants. Since this was a cross-sectional study, threats to validity due to changes over time, differences in experimental and control groups, and loss to follow-up were not expected. An inherent weakness of cross-sectional studies is that people who die or are lost to follow up before the study are automatically excluded (Creswell & Creswell, 2017). Specific to this study, all people who were unsuppressed in January 2019 but died or were lost to follow up before July 1, 2019 were excluded from the cross-sectional analysis. A large sample size was used to compensate for them.

Construct Validity

Construct validity is a threat if the power is inadequate, or assumptions of the statistical test are violated (Creswell & Creswell, 2017). The power of this study is 0.9 for an effect size of 1.3 and an alpha level of 0.05. The power is less than 0.9 whenever the effect size is less than 1.3 yet statistically significant. However, power of 0.8 is also adequate (Lipsey & Aiken, 1990). I used logistic regression analysis. Logistic regression analysis has assumptions including a dichotomous dependent variable, linear relationship between the logit of the dependent variable and each independent variable (linearity), there are no outliers in the continuous independent variables, and there is little or no correlation between the independent variables (multicollinearity) (Creswell & Creswell, 2017). According to Creswell and Creswell (2017) and Laerd Statistics (2017), linearity can be assessed for using the Box Tidwell approach, influential outliers using case diagnostics in SPSS, and multicollinearity by analyzing the variance inflation factor (vif) statistic generated by collinearity diagnostics in SPSS. I conducted these tests for assumptions and where assumptions were not met, the data was adjusted to ensure the analysis was conducted with data that meets all assumptions.

Ethical Procedures

I received Institutional Review Board (IRB) approval from Walden University (IRB # 05-06-20-0443331) and The AIDS Support Organization (TASO) IRB (TASOREC/037/2020-UG-REC009) in Uganda. The Uganda National Council of Science and Technology also approved the study (# HS686ES). I signed data agreement forms with the 18 participating health facilities whose data was used in this study. Since

the study used secondary data, there were no ethical concerns relating to speaking to study participants. No patient identifiers were shared so that the data remained anonymous. Data was collected using data abstraction tools, which were always locked. Electronic databases containing the study data was password protected. Data will be destroyed after 5 years. No other ethical issues applied to this study.

Summary

This was a quantitative cross-sectional study. A sample of at least 939 unsuppressed patients from 18 HIV clinics spread across three regions in Uganda was included in the study. I analyzed data using logistic regression to determine the association between HIV viral load suppression and team functionality, team skill, team diversity, and leadership involvement in QI, after controlling for patient age, patient sex, and health facility type. In chapter 4, I present the results of this study.

Chapter 4: Results

The purpose of this cross-sectional, quantitative study was to determine whether there was a significant association between HIV clinic leader involvement in QI teams, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda. The study had three research questions:

RQ1: Is there a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

$H_0$1: There is no significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a1: There is a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

RQ2: Is there a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

$H_0$2: There is no significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a2: There is a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

RQ3: Is there a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type?

H_03: There is no significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

H_a3: There is a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for patient age, patient sex, and health facility type.

In this chapter, I present the data collection, present the results, and summarize the chapter.

Data Collection

The 18 health facilities participating in this study emailed password protected completed data abstraction tools containing the secondary data from health management information system tools. This data abstraction process took about 1 month. In addition to the unsuppressed register and documentation journals used as data sources, some of the data were from patient files and the health facility monthly staff attendance list.

I used multistage probability sampling was used to identify 18 clinics with at least 53 unsuppressed patients to get the minimum sample size of 939 patients. Because all

patients at each of these clinics were included, the final dataset included 2,758 patients. SPSS excluded the 294 patients with missing data on viral load suppression leaving 2,464 patients included in the analysis. There are approximately 112,000 unsuppressed HIV positive patients in Uganda (UNAIDS 2020). I used the data to make conclusions about all these unsuppressed HIV positive patients in Uganda.

Results

The sample had eight variables. Viral load suppression had data for 2,464 patients, while all the other variables had data for 2,758 patients. Tables 2 and 3 include the descriptive data for each continuous and categorical variable, respectively. I analyzed viral load suppression, sex, team functionality, leadership involvement, and health facility type as categorical variables (Table 3). Team functionality was originally a continuous variable which I changed to a categorical variable because it did not meet the assumption of linearity. I analyzed age as a continuous variable measured in years, team skill as a continuous variable measured in number of skills, and team diversity as a continuous variable measured in number of professionals on the QI team.

Table 2

Descriptive Statistics of Continuous Variables

Variable (units)	Mean	Standard deviation	Min	Max
Patient age (years)	33.55	16.182	1	87
QI team diversity (number of professionals)	5.54	1.355	3	9
QI team skill (number of skills)	17.41	3.276	8	23

Table 3

Descriptive Statistics of Categorical Variables

Variable	Categories	Code	Frequency (percent of the total for the variable)
Viral load suppression	Unsuppressed	0	812 (29.4 %%)
	Suppressed	1	1,652 (59.9%)
Sex	Male	0	1,121 (40.6%)
	Female	1	1,637 (59.4%)
Team functionality	Low	0	1,895 (68.7%)
	High	1	863 (31.3%)
Health facility type	Private	0	770 (27.9%)
	Government	1	1,988 (72.1%)
Leadership involvement	No	0	1,644 (59.6%)
	Yes	1	1,114 (40.4%)

Evaluation of Statistical Assumptions for Binary Logistic Regression

The first four assumptions for binary logistic regression were met. The data met Assumption one for binary logistic regression, which requires a dichotomous dependent variable (Laerd Statistics, 2017). The dichotomous dependent variable was viral load suppression. A patient was either suppressed or unsuppressed. The data also met assumption two for binary logistic regression which requires continuous or nominal independent variables. Each research question had five independent and control variables. The independent and control variables for RQ1 were leadership involvement, team

functionality, age, sex, and health facility type. The independent and control variables for RQ2 were team diversity, team functionality, age, sex, and health facility type. The independent and control variables for RQ3 were team skill, team functionality, age, sex, and health facility type. The data met assumption three. Assumption three requires independence of observations and all categorical variables to be mutually exclusive and exhaustive (Laerd Statistics, 2017). The data had independence of observations, with 2,758 participants, each only counted once. The categories of viral load suppression, leadership involvement, sex, and health facility level were mutually exclusive and exhaustive. All patients in the study either had a suppressed or unsuppressed viral load suppression. Patients who were lost, died, or transferred out were treated as missing data because their viral load suppression was not known by the participating health facility. All patients in the study either had leaders involved (categorized as yes) or leaders not involved (categorized as no) in the QI work of the health facility where they accessed care. All patients in the study were either male or female. Finally, each patient either belonged or did not belong to each health facility type. I categorized health facility type data categorized as private for patients from a private health facility, or government for patients from a government health facility. Assumption 4 that requires at least 50 cases per independent variable was met (Laerd Statistics, 2017). There were 2,758 cases with data on leadership involvement, sex, age, team functionality, team diversity, team skill, and health facility type.

Assumption 5 required a linear relationship between the continuous independent variables and the logit transformation of viral load suppression (Laerd Statistics, 2017).

This is the assumption of linearity. I used the Box Tidwell approach to test the data for (age, team functionality, team diversity, and team skill for this assumption. The Box Tidwell approach requires a Bonferroni correction using all the terms included in the model (Box & Tidwell, 1962; Fox, 2016; Guerrero & Johnson, 1982; Tabachnick & Fidell, 2014). The cut-off for statistical significance changed from 0.05 to 0.005556 after applying a Bonferroni correction using the nine terms in the model Team skill, team diversity, and age were linearly related to the logit of viral load suppression. Team functionality did not meet this assumption because the *p*-value was less than 0.005556. To correct for this, I converted team functionality to a categorical variable.

The data met assumption 6 and 7. Assumption 6 required that independent variables are not highly correlated with each other. This is multicollinearity. This assumption was met because the variance inflation factor (VIF) for all the independent variables ranged from 1.014 for sex to 2.477 for health facility type, with an average VIF of 1.711. VIF less than 10 means the assumption of multicollinearity is met (Laerd Statistics, 2017). Assumption 7 required that the data did not have any unusual points, that is, outliers, leverage, or influential points (Laerd Statistics, 2017). The test for unusual points using case diagnostics in SPSS did not identify any outliers. The data met the assumption on outliers.

Statistical Analysis by Research Question

RQ1: Is there a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex?

$H_0$1: There is no significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling health facility type, patient age, and patient sex.

H_a1: There is a significant association between HIV clinic leader's involvement in the QI team, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex.

RQ1 was answered using binomial logistic regression to test for an association between viral load suppression, leadership involvement, and team functionality, controlling for age, sex, and health facility type. The model was statistically significant at χ^2 (2,464) = 78.821, $p < .001$. The model explained 4.4% (Nagelkerke R^2) of the variance in viral load suppression and correctly classified 67.1% of cases. Table 4 shows that all five of the independent and control variables were statistically significant. Increasing age was associated with an increased likelihood of the viral load being suppressed, males had a 1.234 times higher likelihood of being suppressed than females, patients accessing care from private facilities were 2.783 times more likely to be suppressed than patients accessing care from government facilities, patients accessing care from clinics where leaders were involved in the QI teamwork were 1.366 times more likely to be suppressed than patients accessing care from clinics where leaders are not involved in the QI team, and patients accessing care from clinics with high team functionality were 1.393 times more likely to be suppressed than patients accessing care from clinics with low team functionality.

Table 4

RQ1: Variables in the Equation

							95% C.I.for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Age	.010	.003	14.247	1	.000	1.010	1.005	1.015
Sex	.210	.089	5.538	1	.019	1.234	1.036	1.470
Facility type	1.024	.131	60.893	1	.000	2.783	2.152	3.599
Team functionality	.331	.108	9.376	1	.002	1.393	1.127	1.722
Leadership involvement	.312	.110	8.042	1	.005	1.366	1.101	1.695
Constant	-.876	.225	15.124	1	.000	.417		

Reference categories: sex = female, Facility type = public, team functionality = low, leadership involvement = no

RQ 2: Is there a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex?

$H_0$2: There is no significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex.

H_a2: There is a significant association between QI team diversity, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex.

RQ2 was answered using binomial logistic regression to test for an association between viral load suppression, team diversity by profession, and team functionality, controlling for age, sex, and health facility type. The model was statistically significant at

χ^2 (2,464) = 70.833, $p < .001$. The model explained 3.9% (Nagelkerke R^2) of the variance in viral load suppression and correctly classified 67.2% of cases. Table 5 shows that four of the five independent and control variables were statistically significant. Increasing age was associated with an increased likelihood of the viral load being suppressed, males had a 1.210 times higher likelihood of being suppressed than females, patients accessing care from private facilities were 2.232 times more likely to be suppressed than patients accessing care from government facilities, and patients accessing care from clinics with high team functionality were 1.293 times more likely to be suppressed than patients accessing care from clinics with low team functionality.

Table 5

RQ2: Variables in the Equation

							95% C.I.for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Age	.010	.003	13.040	1	.000	1.010	1.004	1.015
Sex	.191	.089	4.623	1	.032	1.210	1.017	1.441
Facility type	.803	.110	52.973	1	.000	2.232	1.798	2.771
Team functionality	.257	.115	5.018	1	.025	1.293	1.033	1.619
Team diversity	-.013	.034	.141	1	.707	.987	.923	1.056
Constant	-.386	.300	1.648	1	.199	.680		

Reference categories: sex = female, Facility type = government, team functionality = low

RQ3: Is there a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex?

$H_0$3: There is no significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex.

H_a3: There is a significant association between QI team skill, QI team functionality, and HIV viral load suppression in HIV clinics in Uganda, controlling for health facility type, patient age, and patient sex.

RQ3 was answered using binary logistic regression to test for an association between viral load suppression, team skill, and team functionality, controlling for age, sex, and health facility type. The model was statistically significant at χ^2 (2,464) = 71.874, $p < .001$. The model explained 4.0% (Nagelkerke R^2) of the variance in viral load suppression and correctly classified 67.1% of cases. Table 6 shows that four of the five independent and control variables were statistically significant. Increasing age was associated with an increased likelihood of the viral load being suppressed, males had a 1.212 times higher likelihood of being suppressed than females, patients accessing care from private facilities were 2.239 times more likely to be suppressed than patients accessing care from government facilities, and patients accessing care from clinics with high team functionality were 1.386 times more likely to be suppressed than patients accessing care from clinics with low team functionality.

Table 6

RQ3: Variables in the Equation

							95% C.I.for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Age	.010	.003	13.602	1	.000	1.010	1.005	1.015
Sex	.192	.089	4.664	1	.031	1.212	1.018	1.442
Facility type	.806	.107	56.806	1	.000	2.239	1.816	2.761
Team functionality	.326	.117	7.835	1	.005	1.386	1.103	1.742
Team skill	-.016	.015	1.181	1	.277	.984	.955	1.013
Constant	-.230	.287	.642	1	.423	.795		

Reference categories: sex = female, Facility type = government, team functionality = low

Summary

This cross-sectional quantitative study includes secondary data from 18 participating health facilities in Uganda. The results of this study showed that there was a significant association between HIV viral load suppression, team functionality, and leadership involvement in HIV clinics in Uganda, after controlling for sex, age, and type of health facility. There was also a significant association between HIV viral load suppression, team functionality, and team diversity in HIV clinics in Uganda, after controlling for sex, age, and type of health facility. Finally, there was a significant association between HIV viral load suppression, team functionality, and team skill in HIV clinics in Uganda, after controlling for sex, age, and type of health facility. In chapter 5, I will include an interpretation of findings, limitations, significance, and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this cross-sectional, quantitative study was to determine whether there is a significant association between HIV clinic leader involvement in QI teams, QI team functionality, QI team diversity, QI team skill, and HIV viral load suppression rates in Uganda. Recent studies on predictors of viral load suppression in Uganda and other countries showed that the clinic managing a patient on ART is significantly associated with the patients' viral load suppression (Kiweewa et al., 2019). In this study, I focused on patients accessing care from ART clinics participating in a national QI initiative, looking for associations between different QI team characteristics and patient viral load suppression 6 or more months after QI was started. The QI team characteristics I studied were team functionality, leadership involvement in QI team meetings, team skill, and team diversity. Key findings of this study were that the model consisting of leadership involvement in QI, team functionality, patient age, patient sex, and facility type (government or private) predicts viral load suppression (χ^2 [2,464] = 78.821, p>0.01); the model consisting of team diversity, team functionality, age, sex, and facility type predicts viral load suppression (χ^2 [2,464] = 70.833, p>0.01); and the model consisting of team skill, team functionality, age, sex, and facility type predicts viral load suppression (χ^2 [2,464] = 71.874, p>0.01).

Interpretation of the Findings

Several patient-level characteristics are now known predictors of viral load suppression. These include patient age, adherence to ART, infections like TB, duration

on ART, time of initiation on ART, time of switching ART regimen for patients with virological failure, and belonging to specific populations like fisher folks (Bulage et al., 2017; Kiweewa et al., 2019; Musinguzi et al., 2017; Namale et al., 2019; Natukunda et al., 2019; Omooja et al., 2019; Ssempijja et al., 2017). In this study, I focused on understanding QI team characteristics as structural factors associated with viral load suppression while controlling for patient factors. I used the CCM in the conceptual framework of this study. The CCM hypothesizes that patient outcomes are affected by structural factors like organization characteristics and support from the leaders (Kadu & Stolee, 2015; Wagner et al., 1999). The CCM has been successfully applied in Uganda to improve outcomes of patients with HIV (Broughton et al., 2016). Although the authors of this Ugandan study used CD4 to measure the wellness of people with HIV, the findings are comparable to a study that measures HIV patient wellness using viral load suppression. Overall, viral load suppression was significantly associated with leadership involvement, after controlling for patient age, patient sex, health facility type, and team functionality ($p < 0.01$). Viral load suppression was also significantly associated with team functionality after controlling for leadership involvement patient age, patient sex, health facility type, and team functionality ($p < 0.01$). These findings are important because many interventions to improve viral load suppression are applied at the health system level (MoH 2017; MoH, 2018a; MoH, 2019).

Unlike other studies on QI that have focused more on evaluating QI as an intervention, this study is about the mechanics of a QI team. In this study, I found that leadership involvement improves viral load suppression. Patients accessing care from

clinics where leaders were involved in the QI teamwork were 1.366 ($p < 0.01$) times more likely to be suppressed than patients accessing care from clinics where leaders were not involved in the QI teamwork. Other researchers have also found that involving leaders improves patient outcomes like reduction in the incidence of hospital-acquired infections, the success of indoor residual spraying and mass drug administration for malaria prevention, and improvement in patients with dementia (Hijazi et al., 2018; Kaplan et al., 2013; Knobloch et al., 2018; McClung et al., 2017; Morgan et al., 2019; Wanzira et al., 2018). These findings have mostly been based on qualitative studies and health worker self-reported surveys on the value of health facility leadership. Lyatuu et al. (2018) used a controlled quantitative study to show that the involvement of community leaders significantly improves outcomes, including HIV couple testing. The findings on the potential of involving HIV clinic leaders on QI teams to improve outcomes of their patients are in line with these previous studies.

One of the models in the conceptual framework, the MUSIQ, hypothesizes that microsystem leaders, HIV clinic leaders, in this case, contribute to the success of the QI team depending on their knowledge and skill of the science of improvement and the extent of their involvement in the QI efforts (Kaplan et al., 2012). Microsystem leaders like HIV clinic leaders on QI teams have the position power needed to support decision making, problem-solving, and making changes (IHI 2020). The microsystem leader is not necessarily the person leading the day-to-day activities of the QI team since their busy schedule may affect the success of the team. However, the involvement of the microsystem leader on a QI team is associated with success. QI initiatives in Uganda and

similar settings should therefore intentionally keep microsystem leaders engaged in the QI work either through involvement in team meetings or other meaningful ways.

Team functionality in this study is a measure of how active a team is, evidenced by the number of changes tested or implemented to improve viral load suppression for people with unsuppressed results in January 2019. Studies on the association between team functionality and patient outcomes have been inconclusive. Parchman et al. (2019) included assessment for the presence of a regular QI process in their QI capacity assessment tool (QICA) and found a moderate association with two of the three outcomes measured, and no association with the third. As shared in the results section, team functionality was a significant contributor to the association between leadership involvement, team functionality, and viral load suppression, controlling for age, sex, and facility type. In this model, patients accessing care from clinics with high team functionality were 1.393 times more likely to be suppressed than patients accessing care from clinics with low team functionality ($p > 0.01$). Team functionality was also a significant contributor to the two other models analyzed in this study. Interviews of staff from 71 nursing homes found that change in QI is influenced by several factors like the magnitude and complexity of the change, presence or absence of leadership support, adequate knowledge and skill, and getting early positive results (Tappen et al., 2017). Consequently, while change is necessary for improvement, not all changes lead to improvement (Rowland et al., 2018). Therefore, for team functionality to improve outcomes, its interaction with other factors, including QI team characteristics, need to be considered.

Team diversity is another QI team characteristic I studied in this dissertation. Team diversity in this study refers to the number of professions represented on the QI team, including laboratory professionals, nurses, community health workers, counsellors, and administrators. While the effect of team diversity on patient outcomes has not been studied much, the few studies found did not consistently find a statistically significant association between team diversity and the patient outcome. Kaplan et al. (2013) found that QI teams indirectly associated diversity with improved team success, although this association was not statistically significant. Other studies have found improvement in outcomes when diverse teams apply QI (Engels et al., 2019; Ersson et al., 2018). However, these studies did not compare the diverse team to control sites and did not isolate team diversity to measure its effect on team success but instead documented the success of a comprehensive intervention that included a multidisciplinary team. This study, therefore, presents additional information that team diversity did not contribute to the statistically significant association with viral load suppression when combined with team functionality, age, sex, and facility type into one model. While diversity, in general, may be a good thing, it interacts with other factors like team tenure, team skill, and team QI experience (Kaplan et al., 2013). In addition, Rowland et al. (2018) explained the challenges diverse teams face, including failing to meet because of different time schedules across departments, different priorities, and different team dynamics. This suggests that diverse teams need time and intentional action to build tenure, skill, and experience before they benefit from diversity.

Team skill has mostly been studied as an increase in knowledge and skill after a training. Doupnik et al. (2017) found that after conducting such trainings, participants had better knowledge and skill than they did before the training. This shows that the training approach is effective but does not provide information on whether the patient outcomes will improve after the training. Other studies show improvement in patient outcomes when intervention packages include skill-building activities like didactic QI trainings or QI skills (Broughton et al., 2018). This research added the team skill score to the model to check for an association with viral load suppression. While the model was significantly associated with the outcome, team skill did not contribute to this association. Referring to the MUSIQ model, team skill is one of the team characteristics that can potentially influence patient outcomes (Kaplan et al., 2012). QI skills may be soft skills like change management, project management, and communication skills, or hard skills like the root cause analysis and the use of time series chart (Weggelaar-Jansen & van Wijngaarden, 2018). In the MUSIQ model, team skill refers to the ability to apply QI science to test changes, implying that it includes both soft and hard QI skills (Kaplan et al., 2013). In this study, team skill referred to the number of correctly filled components of the documentation journal, a proxy measure of hard skills, like other tools used to measure hard QI team skill (Doupnik et al., 2017). With their broader definition, Kaplan et al. (2013) found a statistically significant association between team skill and two of the three team success measures used, based on their survey of individuals participating in 74 QI teams. This implies that soft skills like change management, project management, and

communication may play an important role in translating QI team trainings into improved patient outcomes.

Limitations of the Study

The use of a large sample size and random sampling of regions and health facilities included in the study improved its internal and external validity. The study can be generalized to HIV patients with unsuppressed viral load, accessing care from HIV clinics in Uganda and settings similar to Uganda. This study was not designed to measure the effect of each QI team characteristic in isolation. This is because the data is secondary and from real-life settings. It is difficult to have controlled studies or time-series studies to measure the effect of these QI team characteristics because, in practice, they are implemented together with multiple other interventions to improve team performance (Mery et al., 2017). This makes it hard to isolate the effect of one team characteristic on the success of the team. Studies, therefore, use focus group discussions or self-reporting questionnaires to capture the views of the stakeholders on the effect of the different team characteristics on patient outcomes. These studies also have the limitation of potential over or underestimation, or incomparable understanding of the team's performance due to lack of a vision of what can be achieved (Mery et al., 2017).

Recommendations

Overall, the findings of this study are that QI team characteristics can influence viral load suppression in Uganda. One of my recommendations for future researchers is to use other study designs that can qualify and quantify the added value of each team characteristic. Where possible, interventions to improve each team characteristic should

be implemented, tested, and compared to control sites. It is hard to find associations between health process and system factors and patient outcomes. This may be because these associations are indirect. I recommend study designs that can explain the interactions between the different internal and external factors affecting team success in Uganda and similar settings. Considering that microsystem leaders may be too busy to participate in meetings and other QI activities, there is a need for further research on innovations to successfully engage them in QI work in Uganda and similar settings. The effect of team diversity on viral load suppression should also be studied for teams that have been working together for longer periods. The teams in this study had only worked together for 6 to 12 months. This may not have been enough time to build tenure and start performing as diverse teams. Finally, studies on team skill need to differentiate the soft and hard team skills. Future studies to understand how the soft and hard team skills independently contribute to patient outcomes will be useful for Uganda and similar countries.

Implications

Social change includes efforts for new ideas to improve individuals, their communities, cultures, and the institutions structuring their lives (Walden University, 2020). Specifically, Walden University (2020) describes positive social change as intentional. It involves improving the lives of people, their communities, and society through action. In Uganda and elsewhere, the current QI culture focuses more on the presence or absence of improved outcomes and less on the mechanics of QI teams. I designed this study to stimulate interest in understanding the characteristics of QI teams,

and consequent deliberate investment in improving those that are associated with the success of the QI work. The study has the potential to influence the way the MoH guides QI work in the country, and the type of QI activities funded by development partners like USAID.

This study also impacts social change because it provides information to improve healthcare delivery for people diagnosed with HIV, especially in resource-limited settings. HIV care and treatment work in Uganda and other sub-Saharan African countries where HIV is most prevalent is heavily funded by PEPFAR and Global Fund (Banigbe et al., 2019). As this research adds evidence to the literature on the association between context and patient outcomes, these funders can adjust their funding amounts, scopes, and expectations based on context and not only numbers.

The recommendation for practice is QI teams in resource-limited settings should intentionally improve the engagement of microsystem leaders to improve patient outcomes. In addition, considering that functional teams perform better than nonfunctional teams, HIV clinics in resource-limited settings should work on the mechanics of their QI teams to improve their functionality, and consequently improve patient outcomes.

Conclusion

The involvement of microsystem leaders and high functionality of QI teams improved patient outcomes in Uganda and similar settings. While patient factors like patient age, patient numbers, and patient sex are important, they interact with context factors like leadership. These real-world interactions need to be understood to maximize

investments and have the best outcomes for patients. QI team characteristics need to be considered and studied when designing and implementing QI projects in resource-limited settings. In this study, leadership involvement and team functionality improved patient outcomes after controlling for patient age, patient sex, and health facility type, while team diversity and team skill did not. More studies are needed to understand how all the team characteristics interact with each other, with patient factors, and with other factors external to the team to improve patient outcomes in resource-limited settings.

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