QUALITY IMPROVEMENT AND PATIENT SAFETY TRAINING AMONG UNDERGRADUATE MEDICAL STUDENTS

by

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(Under the Direction of JOEL LEE)

ABSTRACT

This manuscript style dissertation explored the Quality Improvement (QI) and Patient Safety (PS) needs of the United States healthcare system and assessed the types of QI/PS training currently provided to U.S. medical students. The first study utilized secondary data to examine physicians' adherence to the Centers for Disease Control and Prevention's (CDC) recommended Human Immunodeficiency Virus (HIV) screening protocol; while the second evaluated the types, content, and outcomes of existing peer-reviewed and published QI/PS training curricula for undergraduate medical students.

The first manuscript identified a potential quality improvement gap in healthcare quality by assessing adherence to a specific evidence-based treatment protocol. It entailed using 2008-2009 State Medicaid Research Files (SMRF) from 29 states (representing 80% of the entire U.S. Medicaid enrollees) to identify persons diagnosed with urogenital sexually transmitted diseases (STD's) such as gonorrhea, chlamydia, pelvic inflammatory disease and syphilis, and then measuring the proportion subsequently screened for HIV. Descriptive, bivariate, and multivariate analyses were conducted including logistic and binomial regressions, and an elaborate report provided. In the second manuscript, a systematic review of the literature was conducted using the

Preferred Reporting Item for Systematic review and Meta-Analyses (PRISMA) guidelines. A systematic search for published, peer-reviewed articles on existing QI/Ps training for undergraduate medical students through selected databases from July 2010 to July 2014 was performed to identify gaps in literature, and to inform the development of future curricula.

The first study showed that less than half (42.9%) of STI-diagnosed patients were screened for HIV, far less than the expected proportion of STI-diagnosed persons screened for HIV based on CDC guidelines. While in the second study, sixteen articles were analyzed with mean study quality scores ranging from six to 17 for the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) directives. Quality of studies were rated as low (n = 3), moderate (n = 9), or high (n = 4).

Overall, this dissertation calls attention to the gaps in quality of healthcare in the U.S. health system today. It demonstrates the dire need for the incorporation of QI/PS strategies across settings and processes of the healthcare system, especially in undergraduate medical education.

INDEX WORDS: Quality Improvement, Patient Safety, Undergraduate Medical Students, Curriculum, Training

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DEDICATION

I dedicate my dissertation work to my family. I am grateful to Titi, my wife and greatest cheerleader. Thanks for your patience, understanding, and most importantly your words of encouragement. To our lovely kids, Temidayo and Teniola, you both remain my motivation to work even harder.

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CHAPTER 1

INTRODUCTION

OVERVIEW

This manuscript style dissertation aims to explore the Quality Improvement (QI) and Patient Safety (PS) needs of the United States healthcare system, and to assess the types of QI/PS training currently provided to U.S. medical students. To achieve these outcomes, this research project will: (1) Utilize secondary data to examine physicians' adherence to the Centers for Disease Control and Prevention's (CDC) recommended Human Immunodeficiency Virus (HIV) screening protocol; (2) Determine the types, content (where applicable), and outcomes of existing peer-reviewed and published QI/PS training curricula for medical students.

HEALTH DISPARITIES

The term health disparities refer to "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic groups; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion."[1] Similarly, healthcare disparities refer to "differences in access to or availability of facilities and services."[2] The U.S. has well documented health and health care disparities, many of which are due to avoidable barriers or inequities within the health care delivery system. [3] Eliminating these

disparities by improving the quality of care provided by our healthcare system was estimated to reduce direct medical care expenditure by nearly $230 billion between 2003 and 2006.[3]

The Patient Protection and Affordable Care Act (ACA) signed into law in 2010,[4] has brought intense focus on quality in healthcare. As a result of provisions of the ACA, providers and health systems are beginning to modify the way that care is delivered to patients, and there are increased incentives aligning payment with the quality of care provided.[5] The Institute of Medicine (IOM) defines quality of care as "the degree to which healthcare services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[6] In this research study, the quality of care provided to patients will be explored in the first manuscript, where the prevalence of HIV screening among Medicaid patients diagnosed with Sexually Transmitted Infections (STI's) will be assessed, and appropriate quality improvement recommendations proffered. The second manuscript will report on a systematic review of existing quality improvement and patient safety curricula for medical students. It will assess the quality of identified studies, the strength of effect, and propose recommendations for future research.

STATEMENT OF THE PROBLEM

The Patient Protection and Affordable Care Act (ACA), signed into law in 2010,[4] is designed to improve access to quality healthcare, and reduce healthcare costs.[4] As a result, there has been an increased focus on the need to train healthcare providers on the application of the principles of quality improvement, since the law directly links the payment of providers to the quality of care provided.[4] Unfortunately, there is a major dissociation between the expectations of the law, and the process of achieving such expectations.

Currently, there is not a standardized or mandated curriculum for the teaching of quality principles and practices for medical students, who upon graduation will be expected to provide a certain standard of quality healthcare. Postgraduate medical education programs are required to include competencies encompassing six clinical quality measures (CQM) in their curriculum. These quality measures for healthcare include: effective, safe, efficient, patient-centered, equitable, and timely care,[7] but high patient volume and limited interaction time with patients makes these training components a less common component of their training experience than expected.[8] Currently, the Association of American Medical Colleges (AAMC), a not-for-profit organization "founded in 1876 and based in Washington, D.C., represents all 141 accredited U.S. and 17 accredited Canadian medical schools; nearly 400 major teaching hospitals and health systems, including 51 Veterans Affairs medical centers; and 90 academic and scientific societies. Through these institutions and organizations, the *AAMC* represents 148,000 faculty members, 83,000 medical students, and 115,000 resident physicians" [9] works to ensure the highest standards of medical education for U.S. medical schools encourages, but does not require quality improvement training in the medical school curriculum. The AAMC has a goal of ensuring that undergraduate medical education is staffed by faculty that are "*ready, able, and willing to engage in, role model, and lead education in QI/PS, and in reduction of excess health care costs*." [10]

PURPOSE

This dissertation seeks to utilize a multipronged approach guided by research questions to: first, highlight an example of a preventable lapse in healthcare quality that exists in the United States healthcare system, and second, assess existing quality improvement curricula for medical students through performance of a systematic review.

The overarching goal of this formative research study is to provide the necessary data to enable the researcher to develop a comprehensive quality improvement curriculum for medical students as a future project. This future project will incorporate the evaluation of patient satisfaction and patient experience, as components of QI that will satisfy the quality measures of patient-centeredness.

RESEARCH QUESTIONS OR HYPOTHESIS

For this study, there will be one broad research question guiding each study.

1. As a measure of healthcare quality, do physicians screen Medicaid patients who are diagnosed with Sexually Transmitted Diseases (STD's) such as Chlamydia, Gonorrhea, Pelvic Inflammatory Disease (PID) and Syphilis for Human Immunodeficiency Virus (HIV)?
2. Do existing medical school quality improvement curricula provide medical students with adequate knowledge, skills and experiences?

STUDY SIGNIFICANCE

This study will provide the researcher with the necessary information to develop a comprehensive quality improvement curriculum for medical students, that will satisfy the clinical quality measures required by the Patient Protection and Affordable Care Act (PPACA) signed into law in 2010. This law has increased the focus on quality in healthcare, alignment of payment of providers with the quality of care provided[4]. The law is intended to help realign the US healthcare system in order to reduce the costs while simultaneously improving quality[4].

Since improving the quality of healthcare is a clear priority in the U.S. healthcare system, a comprehensive medical school quality improvement curriculum is critical to ensuring that future physicians are well prepared to meet the needs of the changing healthcare system.

Training at this stage is especially important because engaging physicians in quality improvement practice changes is more difficult the further along they are in their careers.[12] It is imperative that medical students benefit from formal quality improvement (QI) training prior to residency training, as data suggests that early training of medical students can help prevent medical errors. [13] Despite this evidence, most medical school curricula do not include QI training, as it is usually deferred until post-graduate medical education.[8]

The proposed study will provide information necessary to inform the future development of QI/PS curricula that will serve as a core component of the proposed Quality Improvement (QI) curriculum for medical schools.

SUMMARY OF METHODOLOGY

A two-pronged methodological approach will be employed in this study. The first approach is designed to identify a potential quality improvement gap in healthcare quality by assessing adherence to a specific evidence-based treatment protocol. It will entail using 2008-2009 State Medicaid Research Files (SMRF) from 29 states (representing 80% of the entire U.S. Medicaid enrollees) to identify persons diagnosed with urogenital sexually transmitted diseases (STD's) such as gonorrhea, chlamydia, pelvic inflammatory disease and syphilis, and then measure the proportion subsequently screened for HIV. Descriptive, bivariate and multivariate analyses will be conducted including logistic and binomial regressions, and an elaborate report provided.

The second approach will entail conducting a systematic review of the literature using the Preferred Reporting Item for Systematic review and Meta-Analyses (PRISMA) guidelines, where possible. A systematic search for published, peer-reviewed articles on existing QI/Ps training for undergraduate medical students through selected databases from July 2010 to

July 2014 was performed to identify existing gaps in literature, and to inform the development of future curricula.

CHAPTER TWO

REVIEW OF LITERATURE

INTRODUCTION

The Institute of Medicine (IOM) defines quality of care as "the degree to which healthcare services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge." [6] In healthcare, it is imperative for providers to continuously review evidence-based practice guidelines with the aim of improving services to patients, while reducing costs. Quality improvement has been a concept designated in response to the need to prevent and reduce errors, improve patient safety, and support systems of care that advance the delivery of high-quality care. This process of quality improvement in healthcare is defined as an "effective management tool in impelling clinical healthcare staff to provide quality care service to the patients." [5]

The IOM has emphasized the need for improved quality and safety in its landmark "To Err is Human: Building a Safer Health System," report and others that followed, clearly outlining the consequences of safety gaps in the U.S. health system .[14] This report documented for the first time the large number of preventable deaths due to medical errors. [14] The same report revealed that approximately 44,000 to 98,000 people die annually in American hospitals as a result of preventable errors. [15] About a decade later, in 2010, the Office of the Inspector General for the U.S. Department of Health and Human Services reported that the death toll due to medical errors in Medicare patients was 180,000 in a single year. [16] Less than a year ago, it was reported that the mortality associated with preventable medical errors ranged from approximately 210,000 to

440,000 people in the U.S. [16] If preventable medical errors were included as a category of death in 1999, it would have been categorized sixth among all causes of death in the U.S. that year. [17] Today, data suggests that preventable medical errors could be the third leading cause of death in the U.S. after heart disease and cancer. [17] A study conducted by Weingart, et al., (2000) [18] showed that 18% of patients were injured during their stay in the hospital, many of which were fatal or life threatening. [18] In 2012, Makary et.al., reported that "surgeons in the United States left a foreign object such as a sponge or towel inside a patient's body after an operation about 39 times a week, performed the wrong procedure on a patient about 20 times a week, and performed operations on the wrong body site approximately 20 times a week." [19]

Preventable medical errors are also referred to as "never events," events that should have never taken place. [20] The high rates of errors have prompted some hospitals to place pharmacists in the emergency room in an attempt to reduce never events. [21] Many other hospitals are searching for new methods to improve health care quality and reduce medical errors. [21] As the spectrum of these errors becomes more apparent and providers are held responsible for both the health, and cost impact of these errors, health care quality and quality improvement has become an increasing focus across the healthcare delivery system.

Quality Improvement has played a tremendous role in the improvement of healthcare in the U.S. Since the purposeful incorporation of standardized quality measures for hospitals early in the 21st century, hospitals have achieved higher levels of performance on these measures. [16] For example, the national average of performance by hospitals on discharging acute myocardial infarction patients on beta blockers rose from 87% in 2002 to 98% in 2009, in the same year, 96% of hospitals exhibited rates of performance over 90%, compared to 75% in 2006.[16]

In 2001, another seminal IOM report, "Crossing the Quality Chasm: A New Health System for the 21st Century," [6] showed that the U.S. health system was failing to provide "consistent, high quality medical care to all." [6] The IOM defines Quality Improvement (QI) as adequate health services given to individuals and populations, which are congruent with current knowledge, and promote the desired outcome for the general population, [4] and patient safety as "the prevention of harm to patients." [14]

STRIDES IN QUALITY IMPROVEMENT/PATIENT SAFETY

Despite the availability of the highest standards of care and the ability to perform the most complex procedures, the U.S. healthcare system faces challenges of "underuse, overuse, and misuse of available resources."[22, 23]The causes of these issues are multilayered and complex.[23] However, a review of the historical progression of quality improvement reveals that the progress achieved over the past century is commendable. [5, 24]Numerous productive steps toward aiding providers to improve the quality of care, such as legislative action, improved research strategies, and educational interventions, [5, 24] have been successful.

Quality improvement in conjunction with patient safety has made important strides forward in the recent years and is supported by a number of provisions in the Affordable Care Act (ACA). The ACA has begun aligning provider payments with the quality of care. [4] This includes opportunities for increased payments for providers meeting quality benchmarks as well as fines for hospitals with preventable medical errors or high readmission rates; however, a lot more can be done. [25] As a result of the ACA, there is new funding for quality improvement research through creation of the Patient-Centered Outcomes Research Institute (PCORI) to improve funding for patient-centered comparative clinical effectiveness research, which will lead to improved quality of care and reduce the cost of care provided to patients. [26] The focus on the

physician in the advancement of quality improvement has led to various programs and initiatives. Some of these programs include the Physician Quality Reporting System (PQRS)[11] which is a program founded under the Tax Relief and Health Care Act of 2006 (TRHCA). [11] The program was set to provide incentive payment of 1.5% bonus on total allowed Medicare Part B fee-for-service (FFS) charges for successful reporting on at least three quality measures, or 1 of 14 measures group for the reporting period July 1, 2007 through December 31, 2007 [11]. Another noteworthy program is the Medicare Improvement for Patients and Providers Act of 2008 (MIPPA) [27], during this period the incentives were increased to 2% for participation in both 2009 and 2010 program years, and public reporting became mandatory. [28] Other healthcare programs that exemplify QI include the quality reporting and hospital value-based purchasing program, which incentivizes hospitals, based on clinical performance and patient experience measures. [4] These programs, among others, are designed to improve quality, reduce medical errors and unnecessary care, and improve health outcomes and patient satisfaction.

QI/PS TRAINING IN MEDICAL EDUCATION

Over the past half century, efforts in QI/PS have increased in academic health centers. These efforts have exposed the deficiencies in the U.S. healthcare delivery system, leading to various innovative, multidimensional efforts to improve QI/PS. [29] These efforts consist of the reorganization of health systems, improved methods of healthcare delivery, strengthening the peer-review process, and incentivizing providers and organizations who administer quality healthcare. It also included development and evaluation of QI measures, public reporting of quality data, and the redesign of professional medical education. [29]

Health care quality and quality improvement constitute a critical part of medical practice that is increasingly emphasized in health systems and medical schools. [30] Quality improvement

has become extremely prevalent in healthcare due to its focus on patient care and emphasis on education. [31]

STRIDES IN QI/PS IN THE CLINICAL ENVIRONMENT

Over the past fifteen years, there have been significant changes in QI/PS in the clinical environment. Most of these changes can be attributed to the previously described IOM reports.[6,14] These reports have led to the prioritization of QI/PS by major stakeholders across the nation. The Agency for Healthcare Research and Quality (AHRQ) became the authorized lead federal research agency for QI/PS.[32, 33] This led to the development of the patient safety Indicators (PSIs) which are "a set of indicators providing information on potential in-hospital complications and adverse events following surgeries, procedures, and childbirth. The PSIs were developed after a comprehensive literature review, analysis of ICD-9-CM codes, review by a clinician panel, implementation of risk adjustment, and empirical analyses." [31] The PSIs are QI/PS measures that are utilized to identify and assess potential adverse events in hospitals. [31] Other Organizations that have made contributions to QI/PS definitions and expectations include the Joint Commission, an organization responsible for the accreditation and certification of over 20,000 healthcare organizations and programs in the U.S. The Joint Commission developed the National Patient Safety Goals in 2002, [34] as part of its commitment to QI/PS. The Centers for Medicare and Medicaid Services (CMS) has contributed to improving QI/PS by defining pay for performance clinical quality measures. [35] After the passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, the CMS was mandated to "implement the electronic health records ad redefine meaningful use criteria with financial incentives and penalties." [36] The National Quality Forum and the Veterans Health Administration have ensured that QI/PS remain not only organizational, but also national priorities. [37-40]

STRIDES IN QI/PS IN THE ACADEMIC ENVIRONMENT

In 2005, new criteria were introduced by National educational and Accreditation organizations, for Continuing Medical Education (CME) for physicians. It required the QI/PS demonstration of physician practice environment or professional development. [41] The Accredited Council for Graduate Medical Education (ACGME) is the governing force in educating physicians in health care quality and safety. [42] Its programs are designed to educate physicians to provide patient-centered, efficient, safe, effective, equitable, and timely care. [43] There is a consensus in the medical field that the Graduate Medical Education competencies, including quality improvement training, mandated the ACGME are necessary for patients to acquire adequate health care service and by doing so health care providers are more equipped to handle patient concerns and illnesses. [42] Building upon the 2003 recommendations for quality and safety in the education of health professionals, [44] both the ACGME and the Specialty Residency Review Committees require QI/PS within residency programs. In fact, various publications have documented the incorporation and assessment of QI/PS in residency

Unfortunately, medical schools have not been as prompt in adopting quality improvement training. This is partly attributed to the Liaison Committee on Medical Education (LCME) guidelines. [45] The LCME is recognized by the U.S. Department of Education as "the reliable authority for the accreditation of medical education programs leading to the MD degree." [45] The LCME provides the standards for medical schools and requires training institutions to incorporate quality improvement courses, but it has not provided adequate guidelines to facilitate this process. [45]

The American Association of Medical Colleges (AAMC), a not-for-profit organization "founded in 1876 and based in Washington, D.C., represents all 141 accredited U.S. and 17

accredited Canadian medical schools; nearly 400 major teaching hospitals and health systems, including 51 Veterans Affairs medical centers; and 90 academic and scientific societies. Through these institutions and organizations, the AAMC represents 148,000 faculty members, 83,000 medical students, and 115,000 resident physicians" [9] As far back as 2001, the AAMC released a Medical School Objectives Report on Quality Improvement teaching, [46] and in 2003 another report on patient safety and graduate medical education. [47] In 2008, the Integrating Quality Initiative (IQ) was launched by AAMC on the principle that "clinical excellence, patient safety, and quality improvement education are essential, and essentially linked to high-quality health care, and that these principles are best expressed in a seamless continuum of education. [48] AAMC has over the years encouraged medical schools and teaching hospitals to incorporate QI/PS into medical education. [28] By 2011, the IQ initiative encompassed collaborations from various organizations with a focus on quality of care as a team based effort. [49]

A collaborative effort between AAMC and United Health Care led to the development of "Best Practices for Better Care", a national initiative aimed at "improving the quality and safety of patient care through a unique collaboration of medical education, clinical care, and research." [28] In 2011, The AAMC constituted a committee to develop the best practices for netter care and integrating quality initiatives. This committee included multidisciplinary experts and organizations from the U.S. and Canada. The committee released a report in 2013 with recommendations on QI/PS initiatives for medical education. The goal of the report is to ensure that by 2022, undergraduate medical education is staffed by faculty that are "ready, able, and willing to engage in, role model, and lead education in QI/PS, and in reduction of excess health care costs." [28] Other innovative programs have also established and implemented QI/PS strategies and curricula that are focused on medical students. For the example, in 2007, the

Institute for Health Improvement (IHI), an organization founded in 1991, with a commitment to "redesigning health care into a system without errors, waste, delay and unsustainable costs," developed a framework "that describes an approach to optimizing health system performance." This design termed the "Triple Aim" is focused on "improving the patient experience of care (including quality and satisfaction); improving the health of populations; and reducing the per capita cost of health care." in 2008, IHI launched an open school to supplement the education of health professionals. [50]

Even though healthcare organizations and providers are attempting to move forward; there are several gaps hindering their progress. [48] According to Headrick, et al. "Knowing what to do and wanting to do the right thing were necessary but not sufficient." [49] For example, studies show that there is no correlation between how medical residents perform on exams and the quality of care they provide to their patients. [9] Barriers that have impeded QI/PS training in undergraduate medical education include the short duration of medical school rotations, experience difficulties in creating meaningful experiences for medical students to partake in clinical improvement projects. Despite these challenges, medical schools have reported that QI/PS is a part of their required curricula.[16, 50,51] Even with these attempts at improving the quality of care and incorporating QI/PS into undergraduate medical education, research shows limited evidence that current educational methods have clinical benefits. [9] Therefore, quality improvement training programs should provide standardized training goals while implementing an experiential aspect to evaluate the success of those goals that must enhance future physicians' knowledge, skills, and behavior. [9]

CHAPTER THREE

HIV SCREENING RATES AMONG MEDICAID ENROLLEES DIAGNOSED WITH OTHER SEXUALLY TRANSMITTED INFECTIONS[1]

[1] Adekeye O.A. To be Submitted to Journal of American Medical Association

ABSTRACT

INTRODUCTION - Approximately 20 million new sexually transmitted infections (STIs) are diagnosed yearly in the United States costing the healthcare system an estimated $16 billion annually in direct medical costs. The co-occurrence of other STIs increases the risk of HIV transmission. The Centers for Disease Control and Prevention (CDC) has long recommended routine HIV screening in individuals with a diagnosed STI toward improving quality of care. Unfortunately, HIV testing rates among STI patients are still sub-optimal due to the failure to adhere to these recommendations in many healthcare settings (STI clinics, emergency departments [ED], and physician outpatient clinics), especially ED settings.

METHODS - A retrospective cohort design was utilized to identify and analyze HIV screening rates among Medicaid enrollees in 29 states with a primary STI (chlamydia, gonorrhea, and syphilis) or pelvic inflammatory disease claim. Frequencies and descriptive statistics were conducted to characterize the sample in general, and by STI diagnosis. Univariate and multivariate logistic regression were conducted to estimate odds ratios (ORs), adjusted odds ratio (AOR), respectively, and their associated 95% confidence intervals (CI). Multivariate logistic regression models that included the independent variables and covariates were created to examine the independent associations with HIV screening. A two-tailed level of statistical significance was set at 0.05, and all analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC).

RESULTS- This study showed that less than half (42.9%) of STI-diagnosed patients were screened for HIV, far less than the expected proportion of STI-diagnosed persons screened for HIV based on current CDC guidelines.

CONCLUSION- HIV screening among STI-diagnosed persons is a cost-effective, yet underutilized public health strategy. This study revealed poor adherence to quality improvement measures leading to “missed opportunities” for HIV screening and the identification of HIV-infected persons among persons diagnosed with another STI.

Key Words: Sexually Transmitted Diseases, Human Immunodeficiency Virus, Screening Rates

INTRODUCTION

Sexually transmitted infections (STIs) increase the risk of HIV transmission. [52,53] Persons who are infected with STIs are two-five times more likely than uninfected persons to acquire HIV during unprotected sexual contact. [54] The Centers for Disease Control and Prevention (CDC) has long recommended routine HIV screening in individuals with a diagnosed STI [54] toward improving quality of care. Approximately 20 million new STIs are diagnosed every year in the United States, and this costs the American healthcare system an estimated $16 billion annually in direct medical costs. [55,56] Medical encounters at the time of STI diagnosis and treatment represent critical opportunities for HIV testing in patients who are high risk, both because of their sexual behaviors and because STIs themselves increase the risk of HIV transmission (via genital ulceration, increased HIV viral load in semen, enhanced HIV replication, and altered immune responses).[52,54,57]

While the CDC now recommends universal "opt-out" screening for HIV, HIV testing at the time of specific medical indications is also an important public health strategy. More than half of adults between 18 and 55 years have never been tested for HIV. [58] Evidence shows that HIV testing is cost effective, [59, 60] can identify patients infected with HIV and facilitates the prompt initiation of antiretroviral therapy (ART), which in turn inhibits progression to AIDS, and prevents transmission of the virus. HIV-infected persons are also more likely to adopt safer sexual behaviors if they are aware of their HIV status.[59,60] Screening for HIV at the time of STI diagnosis is a teachable moment for patients, providing sexual risk reduction counseling to at-risk persons, safe sex resources like condoms or pre-exposure prophylaxis, as well as informing them of their HIV status. [60]

Although these screening recommendations were introduced over 15 years ago, HIV testing rates among STI patients are still sub-optimal. Despite the guidelines by the CDC and the merits of HIV screening among STI-diagnosed persons, evidence shows that there is a failure to adhere to these recommendations in many healthcare settings (STI clinics, emergency departments [ED], and physician outpatient clinics), especially ED settings. Studies have shown that despite high STI and HIV rates in ED settings,[61] HIV screening is less commonly performed there than in outpatient clinics.[62]

Medicaid enrollees represent a sub-population made up predominantly of persons of low socio-economic status with disproportionate representation of racial/ethnic minorities – demographic groups that are disproportionately burdened by HIV. Medicaid provides insurance coverage that eliminates cost barriers to screening. A previous study of Medicaid enrollees with a non-blood-borne STI (gonorrhea and chlamydia) showed that only 15% were screened for HIV.[63] This low proportion represents a missed opportunity not only at the individual patient level, but also in the use of Medicaid claims data for STI/HIV public health surveillance, and in population-based quality improvement or disease management which could translate claims-based diagnosis of STIs into interventions to improve provider performance of HIV screening at moments of opportunity. Therefore, we undertook this study to determine the proportion of STI-diagnosed persons in the Medicaid population who are screened for HIV, examine correlates of HIV screening, and to suggest critical intervention points and quality improvement strategies for public health and health care delivery systems to increase HIV screening among STI-diagnosed persons. At a time when many states are expanding Medicaid and Patient Protection and Affordable Care Act (ACA) prevention provisions have removed cost barriers to HIV screening

among many private insurance plans, this study has implications for both publicly and privately insured populations.

METHODS

STUDY DESIGN, INCLUSION CRITERIA, AND VARIABLES

A retrospective cohort design was utilized to identify and analyze HIV screening rates among Medicaid enrollees with a primary STI (chlamydia, gonorrhea, and syphilis) or PID claim. PID was included in the analysis because most PID cases are caused by untreated STIs, and some healthcare providers may present this claim when a complicated STI is identified. Our study population was drawn from a convenience sample of available Medicaid claims data from 29 states (Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Washington, and Washington, D.C.) between January 1, 2009 and December 31, 2009. Persons from these states make up 90% of all people enrolled in Medicaid and 80% of all black or African American and Hispanic or Latino Medicaid enrollees in the entire U.S. Eligibility criteria for the study required participants to; (1) be enrolled in Medicaid for 12 months (1/1/2009-12/31/2009), (2) receive a Medicaid claims diagnosis for at least one STI (chlamydia, gonorrhea, and syphilis) or PID, (3) receive this diagnosis in a physician's office or the emergency department, and (4) be between 15 and 49 years of age. Participants who did not meet all inclusion criteria were excluded.

Using the *International Classification of Diseases, Ninth Revision (ICD-9), Clinical Modification* diagnosis codes, individuals who had claims for an STI diagnosis or PID were extracted and evaluated to determine whether they were screened for HIV. HIV screening was

defined as having an HIV test performed within 60 days of the primary STI or PID diagnosis. We focused on STIs in the physician's office and the ED since these are the venues in which there is a moment of opportunity for clinicians to engage in guideline-concordant screening behaviors. The study's independent variables were STI diagnosis (gonorrhea, chlamydia, syphilis, and PID), race (white, black, Hispanic, and other [Asian, Native American or Pacific Islander, multiple races or unknown]), and healthcare setting (physician's office and ED). Participants who identified as Asian, American Indian, Alaska Native, Pacific Islander, multiple races or unknown were categorized as other because of their small sample size.

Gender (male and female), residential status (large metropolitan, small metropolitan, and rural), age (15-19, 20-24, 25-29, 30-39, and 40-49), and states were included as covariates because of their role as conceptual confounders in HIV screening. Participating states were included as covariates because of the varying state eligibility criteria for Medicaid enrollment. Determination of residential status was made by merging each enrollee's county of residence data from their personal summary file with county-level data from the Area Resource File (ARF).[64] The ARF is a publicly available federal health data file that includes environmental and geographical descriptors from which information can be used to characterize a geographical area as large metropolitan, small metropolitan, or rural. The reference group for the independent variables, race, STI diagnosis, and healthcare setting, were White, PID and physician's office respectively. The reference groups for the covariates were male (gender), rural (residential status), 40-49 years (age) and Georgia (state). The outcome variable was HIV screening within 60 days of the STI diagnosis (yes or no). Because a 60-day window was used to determine HIV screening post-STI diagnosis, STI diagnoses made in the first and last 60 days of the calendar

Year were excluded to ensure that there was a 60 day window for participants to get screened for HIV.

ANALYSIS

Frequencies and descriptive statistics were conducted to characterize our sample in general, and by STI diagnosis. Univariate and multivariate logistic regression were conducted to estimate odds ratios (ORs), and adjusted odds ratio (AOR) respectively and their associated 95% confidence intervals (CI). Multivariate logistic regression models that included the independent variables and covariates were created to examine the independent associations with HIV screening. A two-tailed level of statistical significance was set at 0.05, and all analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC).[65]

RESULTS

Table 3.1 describes the socio-demographic and STI characteristics of the study participants. The study sample size was made up of 27,040 participants. Most of the study respondents were female (78%), black (63%), resided in a large metropolitan area (57%), and were between 15 and 19 years (44%). The mean age of respondents was 23.2 years. Chlamydia was the most diagnosed STI (74%) while gonorrhea (19%), syphilis (5%), and PID (2%) were not as frequently diagnosed as chlamydia. The majority of STI diagnoses were made in the physician's office (87%). Table 3.2 characterizes the sample by STI diagnosis. The proportion of chlamydia and gonorrhea cases were highest among participants between 15 and 19 years while the proportion of syphilis and PID cases were highest among participants between 40 and 49 years, and 25 and 29 years respectively. All STIs (chlamydia, gonorrhea, syphilis, and PID) were more likely to be diagnosed among blacks, females, participants who resided in large

metropolitan areas, and in a physician's office. Only patients with a diagnosis of syphilis were more likely to receive HIV screening.

The results of univariate and multivariable logistic regressions are presented in Table 3.3. Overall, 42.9% of participants with a diagnosis of STI were screened for HIV. Several factors were associated with HIV screening in the univariate model. Participants aged 15-19 (OR=1.14, 95% CI=1.03-1.26, p=.0138) compared to the reference group of 40-49, female (OR=1.28, 95% CI=1.20-1.35, p<0.0001) compared to males, and received a diagnosis of syphilis, (OR=1.22, 95% CI=1.16-1.79, p=0.0009) were more likely to be screened for HIV than participants diagnosed of other STI's. Compared to white participants, Hispanic participants were less likely to be screened for HIV (OR=0.87, 95% CI=0.79-0.96, p=0.0075). Persons who received a diagnosis of STI in the ED were less likely to be screened for HIV. (OR=0.38, 95% CI=0.35-0.41, p<0.0001) compared to persons who received a diagnosis of STI in the physician's office and residing in a large metropolitan area (OR=0.61, 95% CI=0.57-0.66, p<0.0001) or small metropolitan area (OR=0.62, 95% CI=0.58-0.68, p<0.0001) compared to a rural area. To control for the cofounders identified in univariate analyses, multivariate models were tested. In the multivariable analysis, differences in HIV screening remained noteworthy by STI diagnosis and healthcare setting but not by race. There were no significant differences in HIV screening between White participants (reference group) and Black (AOR=0.95, 95% CI 0.89-1.02, p=0.1858), Hispanic (AOR=1.12, 95%CI 1.00-1.26, p=0.0510) and other (AOR=1.09, 95% CI 0.98-1.21, p=0.1061) participants. Of all participants with an STI diagnosis, participants who received a diagnosis of syphilis were significantly more likely to be screened for HIV (AOR=1.52, 95% CI 1.21-1.91, p=0.0003) compared to participants diagnosed of other STIs. Participants who received an STI diagnosis in the ED, were significantly less likely to be

screened for HIV (AOR=0.41, 95% CI 0.38-0.45, p<0.0001), compared to participants who received an STI diagnosis in the physician's office. Among the covariates, females, compared to males, participants living in large metropolitan areas, compared to rural areas, and participants aged 15-19, 20-24, and 25-29, compared to the age group 40-49, were more likely to be screened for HIV.

DISCUSSION

Our results show that less than half (42.9%) of STI-diagnosed patients were screened for HIV, far less than the expected proportion of STI-diagnosed persons screened for HIV based on current CDC guidelines. This gap between usual-care and guideline-appropriate screening behaviors affects a large number of persons at increased risk for HIV. For example, an estimated 2.8 million chlamydial infections occurred in the U.S. in 2012.[66] The CDC estimates that about 820,000 incident infections of gonorrhea occur annually. The syphilis case rate in the past decade has almost doubled. [66] There were about 50,000 new syphilis cases in 2012, about the same as the number of new HIV cases in the same year.[67] The failure to screen for HIV when syphilis is diagnosed is especially troubling since both are blood-borne infections, and the diagnosis of syphilis involves a clinical decision to send the patient to the lab for a blood-draw. This suggests that system-level interventions (e.g., a standing lab order to reflex-test for HIV in all samples with positive results on syphilis testing unless declined by the patient) might be effective in increasing HIV-screening at least in persons diagnosed with syphilis.

These failures to screen for HIV among at-risk persons represent important missed opportunities to identify persons who are HIV-positive, make them aware of their HIV status, and promptly connect them with HIV care. HIV-infected persons unaware of their HIV status are 3.5 times more likely to transmit HIV than persons who are aware their status.[68] Several studies

have examined HIV screening rates in STI-diagnosed person with varying results. A 2005 survey of 80 commercial health plans showed an overall HIV screening rate of 19.5%;[69] a 2009-2010 study using STD surveillance network data reported a 51% HIV screening rate;[70] a 2006-2007 survey of six health insurance plans indicated an overall HIV screening rate of 32.7%;[59] and a survey of Veterans Health Administration (VHA) administrative data showed a 45% HIV screening rate.[60] Still, our data show a rather sizable improvement from the 15% HIV screening rate we found in a four-state Medicaid cohort in 1998.[63] This may reflect improvement in clinician practice behaviors specific to high-risk patients, or may represent a halo effect from the CDC universal ("opt-out") HIV-screening recommendation made in 2006.[71]

This study did not detect differences in HIV screening rates by race, a finding similar to other cohort studies that have utilized Medicaid data.[72,73] The failure to detect racial differences may be due to the relative socioeconomic homogeneity of low-income Medicaid populations. Furthermore, all study participants presumably had the same level of health insurance coverage and access to health care during the study period. In any case, Medicaid appears to be an equalizing force with regard to health disparities.[72] Study participants diagnosed with syphilis were most likely to be screened for HIV. This finding is consistent with the findings of Tao et al (2008) and Chen et al (2011),[59,69] both of whom showed that persons with a syphilis diagnosis reported the highest HIV screening rate of all STI-diagnosed persons.

Despite the comparatively high HIV infection rates documented among persons with a syphilis diagnosis, [70] only half of the participants diagnosed with syphilis were screened for HIV in this study. The screening rate among participants with a diagnosis of gonorrhea and chlamydia were both less than 45%, despite their established associations with HIV. Interventions that focus on providers may be critical to increasing HIV screening rates among

patients with a diagnosed STI. Provider education that increases and emphasizes awareness of the association between STIs and HIV, as well as those that increase HIV screening among patients with any STDs in all healthcare settings may be needed to address the disparate screening rates by STI. Similarly, emphasizing the increased risk of HIV among any STI-diagnosed person irrespective of the type of STI may also be beneficial. At the same time, system-level interventions at the practice-level (e.g., standing orders or reflex-testing) and at the population-level (e.g., viewing Medicaid as a public health surveillance and intervention system in addition to a payer of insurance claims) are likely to have greater impact than traditional clinician feedback and education interventions.[74]

Data from this study also identified differential screening rates by practice setting. Persons diagnosed with an STI in a physician's office were almost twice as likely to be screened for HIV as those who received their diagnosis in the ED. The study by Chen et al., (2011)[59] documented a lower HIV screening rate among STI-diagnosed persons in the ED. This finding may be a result of the increased familiarity and relationship that physicians may develop with their patients in an office setting, which may in turn influence HIV screening rates. The prospect of additional demand (pre-test counseling, HIV screening, and post-test HIV counseling) on ED providers' time, especially in a time-pressured ED environment, may discourage HIV screening in the ED. The difficulty with follow-up is another key barrier to HIV screening in the ED.[75] Insurers may also be unwilling to pay for HIV tests in the ED if they are considered unrelated to the primary complaint. Many ED providers may also be averse to HIV screening among STI-diagnosed persons because they are trained to focus on acute illness or life-threatening injuries. These barriers may be mitigated by integrating HIV screening and case management within the ED, or case referrals from EDs to settings primarily focused on HIV screening and case

management. Programs that facilitate rapid HIV screening such as expanding the availability of rapid HIV testing in the ED may also be indicated. Institutional changes, such as electronic health record (EHR) prompts and ED provider education regarding HIV screening, are also effective.[76] Finally, prevention provisions of the Affordable Care Act that mitigate HIV screening test costs to patients may facilitate HIV screening rates across healthcare settings.[77]

LIMITATIONS

Limitations of this study are those inherent in Medicaid claims data research. Our findings are primarily generalizable to the Medicaid-enrolled population at the time of the study, and to the sites that accept Medicaid as payment for care. Because of the categorical as well as needs-based requirements for Medicaid participation in the study year (2009), the population sampled was disproportionately younger, racial and ethnic minority, and female, relative to the general U.S. population. We also only had access to events that were paid for in Medicaid claims, and, therefore, could not include STI-diagnosed patients who may have been screened for HIV elsewhere. We also could not account for patients who were offered an HIV test but declined. While we only used Medicaid claims data from 29 states, because these are population-dense states, they represent all claims on 90% of all U.S. Medicaid enrollees, and 80% of minority Medicaid enrollees in the nation. In addition, our study's greatest strength is that it reflects screening behaviors without response bias, in contrast to self-reported behaviors or studies in which clinicians or patients know they are being observed.

CONCLUSION

HIV screening among STI-diagnosed persons is a cost-effective, yet underutilized public health strategy. This study revealed poor adherence to quality improvement measures leading to "missed opportunities" for HIV screening and the identification of HIV-infected persons among

persons diagnosed with another STI. In the broader U.S. population, this study adds to the weight of evidence supporting the urgent need for the development and implementation of standard quality improvement protocols that will support adherence to the CDC recommendation for routine HIV screening. These include provider HIV/STI education and awareness, integrated HIV/STI services and case management, collaborative partnerships with HIV/STI public health departments, as well as ensuring EHR prompts for HIV screening. Other strategies include training and encouraging healthcare providers to engage routinely in discussions with their STI-diagnosed patients about HIV screening,[78] and wider adoption of rapid, non-invasive HIV screening tests at the point of care.[79] Our results also demonstrate the specific ability of Medicaid claims as well as other payer claims data to provide on-going surveillance of STIs that can be used by state Medicaid programs and public health departments to significantly improve HIV-screening behaviors at the population level. This may require a greater level of collaboration and /or integration between traditional public health units and state Medicaid programs than currently exists in many states. Concerted efforts are needed to increase HIV screening rates in all health care settings among this at-risk population.

Table 3.1 - Demographic Characteristics of STI-diagnosed Persons (15-49 years) Enrolled in Medicaid (n=27,040): Medicaid Claims Data, United States, 2009

Characteristic	Frequency	(%)
Age, m (sd)	23.2 (7.9)	
15-19	12,019	44
20-24	6,366	24
25-29	3,755	14
30-39	3,220	12
40-49	1,680	6
Total	27,040	100
Race		
Black	16,903	63
White	5,193	19
Hispanic	2,173	8
Other	2,771	11
Total	27,040	100
Gender		
Male	6,031	22
Female	21,009	78
Total	27,040	100
Residential status		
Big metropolitan area	15,654	57
Small metropolitan area	7,548	28
Rural area	3,838	14
Total	27,040	100
STI diagnosis		
Chlamydia	19,906	74
Gonorrhea	5,219	19
PID	439	2
Syphilis	1,476	5
Total	27,040	100
Practice setting (where first STI was diagnosed)		
Physician's office	23,638	87
ED visit	3,402	13
Total	27,040	100

Table 3.2 - Characteristics of STI-diagnosed Persons (15-49 years) Enrolled in Medicaid (n=27,040) by specific STI: Medicaid Claims Data, United States, 2009

Characteristic	Chlamydia	Gonorrhea	Syphilis	PID[a]
Overall	19,906	5,219	1,476	439
	n (%)	n (%)	n (%)	n (%)
Age				
15-19	9,269 (46.6)	2,361 (45.2)	307 (20.8)	82 (18.7)
20-24	4,746 (23.8)	1,331 (25.5)	190 (12.9)	99 (22.6)
25-29	2,707 (13.6)	749 (14.4)	190 (12.9)	109 (24.8)
30-39	2,196 (11.0)	587 (11.2)	334 (22.6)	103 (23.5)
40-49	988 (5)	191 (3.7)	455 (30.8)	46 (10.4)
Race				
Black	12,119 (60.9)	3,795 (72.7)	798 (54.1)	191 (43.5)
White	3,998 (20.1)	754 (14.4)	300 (20.3)	141 (32.1)
Hispanic	1,719 (8.6)	253 (4.9)	134 (9.1)	67 (15.3)
Other	2,070 (10.4)	417 (8)	244 (16.5)	40 (9.1)
Gender				
Male	4,404 (22.1)	1,029 (19.7)	596 (40.4)	N/A
Female	15,502 (77.9)	4,190 (80.3)	880 (59.6)	437 (100)
Residential status				
Big metropolitan area	11,238 (56.5)	3,099 (59.4)	1,043 (70.7)	274 (62.4)
Small metropolitan area	5,645 (28.4)	1,504 (28.8)	313 (21.2)	86 (19.6)
Rural area	3,023 (15.1)	616 (11.8)	120 (8.1)	79 (18)
Practice setting (where first STI was diagnosed)				
Physician's office	17,472 (87.8)	4,484 (85.9)	1,320 (89.4)	362 (82.5)
ED visit	2,434 (22.2)	735 (14.1)	156 (10.6)	77 (17.5)
HIV screening (≤60 days)				
Yes	8,539 (42.9)	2,116 (40.5)	759 (51.4)	186 (42.4)
No	11,367 (57.1)	3,103 (59.5)	717 (48.6)	253 (57.6)

[a]Pelvic inflammatory disease

Table 3.3 Univariate (Unadjusted) and Multivariable (Adjusted) Logistic Regression Model Predicting HIV Screening Rates Among STI-diagnosed Persons (15-49 years): Medicaid Claims Data, United States, 2009

		Univariate (unadjusted) model		Multivariable (adjusted) model[a]	
Variable	**% HIV screened**	**Unadjusted OR (95% CI)**	**P Value**	**Adjusted OR[a] (95% CI)**	**P Value**
Overall	42.9 (42.3-43.5)	N/A	N/A	N/A	N/A
Age					
15-19	**43.7 (42.8-44.6)**	**1.14 (1.03-1.26)**	**0.0138***	**1.14 (1.02-1.28)**	**0.0246***
20-24	43.0 (41.8-44.2)	1.11 (0.99-1.23)	0.0699	**1.16 (1.03-1.31)**	**0.0135***
25-29	42.2 (40.6-43.7)	1.07 (0.95-1.20)	0.2625	**1.15 (1.01-1.31)**	**0.0297***
30-39	41.8 (40.1-43.5)	1.05 (0.93-1.19)	0.4049	1.13 (1.00-1.29)	0.0596
40-49	40.5 (38.2-42.9)	ref	N/A	ref	N/A
Race					
Black	42.5 (41.8-43.2)	0.94 (0.89-1.00)	0.0676	0.95 (0.89-1.02)	0.1858
Hispanic	40.5 (38.5-42.6)	**0.87 (0.79-0.96)**	**0.0075**	1.12 (1.00-1.26)	0.0510
Other	45.3 (43.5-47.2)	1.06 (0.97-1.16)	0.2304	1.09 (0.98-1.21)	0.1061
White	43.9 (42.6-45.3)	ref	N/A	ref	N/A
Gender					
Female	**44.2 (43.6-44.9)**	**1.28 (1.20-1.35)**	**<0.0001***	**1.17 (1.10-1.25)**	**<0.0001***
Male	38.3 (37.1-39.5)	ref	N/A	ref	N/A
Residential status					
Big metropolitan area	**41.0 (40.3-41.8)**	**0.61 (0.57-0.66)**	**<0.0001***	**1.23 (1.12-1.36)**	**<0.0001***
Small metropolitan area	**41.5 (40.4-42.6)**	**0.62 (0.58-0.68)**	**<0.0001***	0.95 (0.86-1.04)	0.2357
Rural area	53.2 (51.7-54.8)	ref	N/A	ref	N/A
STI diagnosis					
Chlamydia	42.9 (42.2-43.6)	1.02 (0.84-1.24)	0.8251	0.93 (0.76-1.14)	0.4890
Gonorrhea	40.5 (39.2-41.9)	0.93 (0.76-1.13)	0.4548	0.92 (0.75-1.14)	0.4479
Syphilis	**51.4 (48.9-54.0)**	**1.22 (1.16-1.79)**	**0.0009***	**1.52 (1.21-1.91)**	**0.0003***
PID	42.4 (37.8-47.0)	ref	N/A	ref	N/A
Practice setting (where STI was initially diagnosed)					
ED visit	**23.9 (22.5-25.4)**	**0.38 (0.35-0.41)**	**<0.0001***	**0.41 (0.38-0.45)**	**<0.0001***
Physician's office	45.6 (45.0-46.3)	ref	N/A	ref	N/A

[a]adjusted for state; OR=odds ratio; AOR=Adjusted odds ratio; 95% CI= 95% confidence interval

Table 3.4. Medicaid Income Eligibility Limits for Adults as a Percent of the Federal Poverty Level for 29 states in the United States, 2009[62]

Location	Parents of Dependent Children (%FPL)	Childless Adults (%FPL)
United States	N/A	N/A
Alabama	18	0
Arizona	138	138
Arkansas[2]	138	138
California	138	138
Colorado	138	138
Connecticut	201	138
Florida	34	0
Georgia	38	0
Illinois	138	138
Indiana[1]	138	138
Louisiana	24	0
Maryland	138	138
Massachusetts[3]	138	138
Michigan[1]	138	138
Mississippi	28	0
Missouri	23	0
New Jersey	138	138
New Mexico	138	138
New York	138	138
North Carolina	45	0
Ohio	138	138
Oklahoma[4]	46	0
Pennsylvania[1]	138	138
South Carolina	67	0
Tennessee	103	0
Texas	19	0
Virginia	45	0
Washington	138	138
Washington, D.C	138	138

[2] Arkansas, Indiana, Michigan, and Pennsylvania have approved section 1115 waivers for their Medicaid Expansions

[3] Massachusetts also provides subsidies to parents and childless adults with incomes above 133% FPL and up to 300% FPL to purchase Marketplace coverage through its ConnectorCare program. In addition, HIV positive individuals with incomes between 13%-200% FPL, are eligible for coverage or premium assistance through MassHealth (Medicaid)

CHAPTER FOUR

QUALITY IMPROVEMENT AND PATIENT SAFETY TRAINING AMONG UNDERGRADUATE MEDICAL STUDENTS[5]

[5] Adekeye O.A. To be submitted to Journal of Academic Medicine

ABSTRACT

The Patient Protection and Affordable Care Act (ACA) signed into law in 2010 is designed to improve access to quality care, and reduce healthcare costs. The law has important provisions linking payment of providers to the quality of care provided. Unfortunately, there is a major dissociation between the alignment of payment and quality and the training and capacity-building necessary to achieve this, since quality improvement/patient safety (QI/PS) is not currently mandated in the undergraduate medical curriculum.

A systematic literature review was conducted to assess studies with any QI/PS training for medical students, published in the United States since 2010, where the impact of the training on their knowledge, skills, and practices were measured, or patient outcomes assessed. Formal methods for literature search were employed using "The Preferred Reporting Item for Systematic review and Meta-Analyses (PRISMA)" guidelines. The methodological quality of the studies was analyzed with Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) directives. Sixteen studies were analyzed, and mean study quality scores ranged from six to 17 for the STROBE. Quality of studies was rated as low (n = 3), moderate (n = 9), and high (n = 4). The tools categorized the majority of the studies in similar tertiles for quality

Recommendations were proffered towards the future development of QI/PS curricula. Researchers concluded that to advance QI/PS training in undergraduate medical education, the AAMC will need to mandate QI/PS curricula in undergraduate medical training.

KEY WORDS: Quality Improvement, Patient Safety, undergraduate medical students

INTRODUCTION

The Patient Protection and Affordable Care Act (ACA) signed into law in 2010,[4] is designed to improve access to quality care, and reduce healthcare costs.[4] As a result, there has been an increased focus on the need to train healthcare providers about the application of the principles of quality, since the law directly links the payment of providers to the quality of care provided.[4] Unfortunately, there is a major dissociation between the expectations of the law, and the process of achieving such expectations. Undergraduate medical students, who upon graduation are expected to provide a certain standard of quality healthcare, are not currently taught quality improvement/patient safety (QI/PS) principles and practices using any mandated or standardized curriculum.

To achieve an improved standard of healthcare quality, it is imperative that medical students are trained to identify unsafe conditions, systematically report errors, investigate and develop protocols that will improve the quality of care provided to patients, reduce medical errors, and disclose errors to patients.[81] Medical students should be trained early in their medical careers about the types and causes of human errors, and factors that influence adverse effects.[82] Training at this stage is essential because the further along physicians are in their careers, the more difficult it is to engage them in quality improvement practice changes.[10] Incorporating additional content into the already packed undergraduate medical curriculum is challenging, yet achieving this, is an urgent necessity.[83] The traditional medical school curriculum focuses on medical knowledge, clinical skills, and clinical decision-making.[83] Other competencies such as situational awareness, teamwork, leadership, communication, cultural competency, and risk management are rarely taught in a structured format. Instead, they are included into the three aforementioned core competencies.[83]

The Institute of Medicine's (IOM) 1999 Report, Crossing the Quality Chasm, recommends a restructuring of clinical education to match the principles of 21st century health systems.[6] This is consistent with the goals of healthcare reform, which is structured around changing the culture of healthcare organizations to be more focused on patient-centeredness and quality of care.[84] The IOM report, along with the ACA has led medical educators to recognize the need for major curriculum reform that prepares medical students to meet the needs of the evolving U.S. healthcare system.[85] Physician leadership is essential to the success of quality improvement initiatives in healthcare. Unfortunately, it is often a struggle to engage clinicians in healthcare improvement efforts, and there is often resistance from physicians.[10,85]

There has been demand for early integration of curricular content about patient safety and medical errors into both undergraduate and graduate medical education for several years,[86-88] but incorporation of quality improvement (QI) and patient safety (PS) training into the undergraduate medical curriculum is a fairly new, but necessary concept.[89] A curriculum that is capable of turning the "art of medicine" into the new "science of medicine"[89] a phenomenon sometimes referred to as "healthcare in its right mind,"[90,91] is needed to achieve quality healthcare in the U.S. It is imperative that medical students are formally trained about quality improvement prior to residency training, as data suggests that early training of medical students can help prevent medical errors.[11]

Currently, the Association of American Medical Colleges (AAMC), a not-for-profit organization "founded in 1876 and based in Washington, D.C., represents all 141 accredited U.S. and 17 accredited Canadian medical schools; nearly 400 major teaching hospitals and health systems, including 51 Veterans Affairs medical centers; and 90 academic and scientific societies. Through these institutions and organizations, the *AAMC* represents 148,000 faculty

members, 83,000 medical students, and 115,000 resident physicians" [9] works to ensure the highest standards of medical education for U.S. medical schools, encourages but does not require quality improvement training in the medical school curriculum. The AAMC has a goal of ensuring that undergraduate medical education is staffed by faculty that are "*ready, able, and willing to engage in, role model, and lead education in QI/PS, and in reduction of excess health care costs*." [10]

The goal of this study is to evaluate the peer-reviewed literature on QI/PS training designed for undergraduate medical students, published since the enactment of the ACA. Based on the findings, recommendations will be made to inform the development of a comprehensive QI/PS curriculum for medical students.

METHOD

ELIGIBILITY CRITERIA

A systematic literature review was conducted to assess studies with quality improvement or patient safety training for medical students, where the impact of the training on their knowledge, skills, and practices was measured, or patient outcomes assessed. Formal methods for literature search were employed using "The Preferred Reporting Item for Systematic review and Meta-Analyses (PRISMA)" guidelines.[92]

Articles were selected from abstract lists generated by the electronic and hand searches, based on pre-specified inclusion and exclusion criteria. Eligible studies had to be; (1) peer-reviewed articles published from January 2010 to January 2015; (2) represent original studies with undergraduate medical students; (3) include medical student QI/PS training; and/or (measure specific patient-centered outcomes especially patient satisfaction). Studies that were not in English; did not have original learner/patient data; had learners/students from medical

schools outside the U.S. were excluded from the study. Reviews, editorials, unpublished abstracts, and conference proceedings were also excluded.

INFORMATION SOURCES

A systematic search through MEDLINE, PUBMED, PsycINFO, Education Resources Information Center (ERIC), Education Research Complete, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Library, and Web of Science databases was conducted.

SEARCH

Using MEDLINE and PubMed, an initial search strategy template was developed and applied to the databases to maximize sensitivity. The search terms included; ("Quality Improvement" OR "patient safety" OR "healthcare improvement" OR "QI" OR "Continuous Quality Improvement" OR "CQI,") AND ("Total Quality Management" OR "TQM,") AND ("Medical School,") AND ("Quality Improvement Curriculum" OR "Medical School Curriculum" OR "Medical School Education" OR "Curriculum Development" OR "Education" OR "Health Care Education" OR "training OR teaching,") AND ("patient outcomes" OR "outcome assessment" OR "health care quality assurance.")

STUDY SELECTION

The author (OA) reviewed all abstracts from the database searches and retrieved full-text articles for further review. OA independently reviewed each abstract list and then retrieved articles for final article selection and quality assessment. The bibliographies of the retrieved full-text articles were hand-searched, and authors contacted for additional information where needed. The author (OA) reviewed each full-text article for quality assessment. To rate and report the studies, several criteria were considered. This systematic review was conducted based on

Preferred Reporting Items for Systematic Reviews and Meta-analysis statement (PRISMA) criteria. [93-98] Items 5-16 from the PRISMA checklist[98] included information sources, eligibility criteria, data items, data collection process, search, study selection, and additional analyses, as key constructs. The methodological quality of the studies was analyzed with Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) directives.

DATA COLLECTION PROCESS

Standardization of data abstraction and rating reliability optimization were achieved to accomplish rating for individual scale items. Studies were ranked as low, moderate or high quality based on predetermined tertiles of scores for the STROBE.

The author assessed the overall impact and attainment of study goals of curricular interventions on learners and patient-centered outcomes, (where applicable)-as 0 (not achieved/done), 1 (Partially achieved/done), or 2 (well achieved/done).

RESULTS

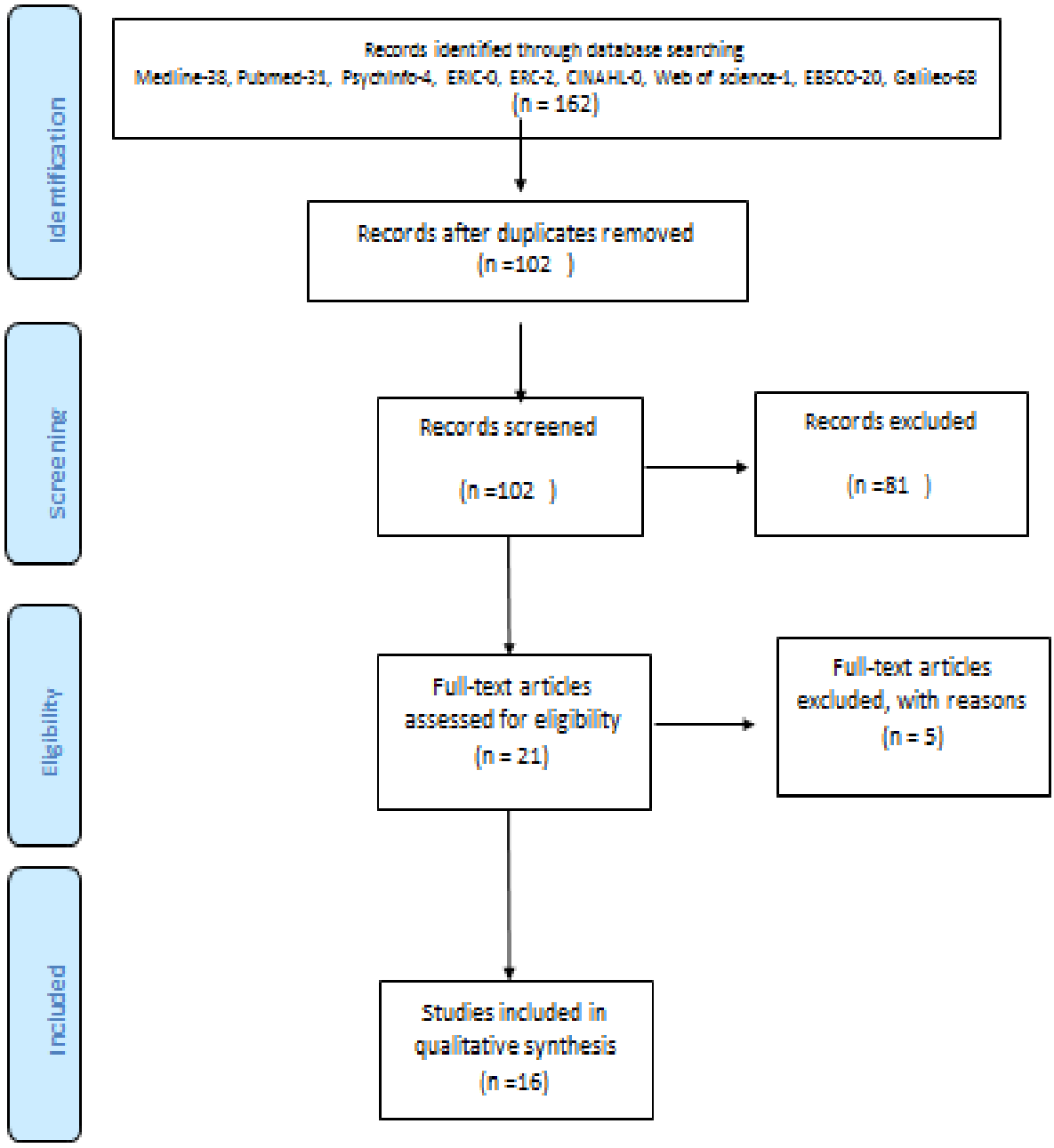
STUDY SELECTION

All **s**tudies identified based on the initial search methods were judged, and upon applying the inclusion and exclusion criteria, 162 studies were considered. (Figure 4.1)

STUDY CHARACTERISTICS

SEARCH RESULTS AND DATA ABSTRACTION

The electronic search yielded 36 abstracts from MEDLINE, 31 from PUBMED, 4 from PsycINFO, none from Education Resources Information Center (ERIC), 2 from Education Research Complete, none from Cumulative Index of Nursing and Allied Health Literature (CINAHL), 1 from Web of Science databases for articles in English, 20 from EBSCO, and 68 from Galileo. The reviewer decided on the abstraction of articles for full text review.



Articles that met criteria from database searches for abstract review

- Includes bibliography search and author contacts
- Excluded due to no curricular intervention or no outcomes measured

Figure 4.1 Summary of Literature Search and Selection[93]

Duplicated abstracts were eliminated, leaving 102 articles for screening. Subsequent bibliographic review of these and the previously conducted reviews led to the exclusion of 81 articles. Twenty-one of the remaining articles underwent full-text review, five were excluded from further quality assessment because of (1) having no curricular intervention (n = 4), and (2) being interim reports with results pending (n = 1), leaving 16 studies in the final quality analysis.

STUDY DESIGNS AND OUTCOMES

Learner's knowledge, skills and/or practice change endpoints were some of the outcomes of interest in all 16 studies. Table 4.1 presents some of the basic information including study designs, characteristics of the learner, teaching content, strategy, and outcomes respectively. All The studies included in this review were designed as elective courses or were incorporated into clinical rotations instead of being a core part of the formal undergraduate medical curriculum. The duration of the course, course contents, and teaching strategies varied across all studies. Table 4.2 summarizes the study designs, and educational content. The results of the studies that included an evaluation component are described in Table 4.1. Prospective pre-post study design (62.5%) was the most common study design among articles reviewed, while retrospective pre-post design, cross-sectional and randomized controlled trials were less common at 6.25%, 12.5%, and 18.75% respectively. Only three studies described curricula implementation at multiple sites (18.75%) of which two were prospective studies, and only one was a Randomized Controlled Trial. All other studies utilized single sites (81.25%). The number of participants ranged between 1 to 1,187 learners.

STUDY QUALITY ANALYSES

Mean study quality scores ranged from six to 17 for the STROBE. Quality of studies was rated as low (n = 3), moderate (n = 9), and high (n = 4). The tools categorized majority of the studies in similar tertiles for quality.

Table 4.1. Relevant Study Characteristics

Source (First author, year)	Learner and Site Characteristics (N)	Study Design	Educational Content	Teaching Methods	Study Duration	Main Findings
Headrick et al., 2011[94]	Undergraduate Medical Students United States N = 1	Prospective study Direct feedback through collaborative huddles/learning	Leaders knowing, valuing, and practicing improvement Patients and families informing process Changes Health professionals Competently engaging in and teaching about care and Improvement Data transforming into useful Information Learners engaging in care and improvement	Experiential Activities	Not provided	Improvement in learner's knowledge and awareness, attitudes and skills.
Dudas, R, et al., 2011[95]	Undergraduate Medical Students N=108, United States	Retrospective Pre/Post study	Medication administration error examples Learning from Defects tool to investigate the defect	Online, Didactic, Group Exercises Learning from Defects	One Year	Reported changes in student knowledge and attitudes about safety were significant, especially an increased awareness that medical errors that are potentially harmful to patients will occur, and that disruptions in continuity of care pose a

						detrimental effect on patients' safety
Headrick LN, et al., 2012[96]	Undergraduate medical students N=660 Multisite, United States	Prospective, pre-post study	Core QI concepts, examples, and experience in a hand hygiene case describing a medical error and made recommendations structured communication tools such as Situation, Background, Assessment, and Recommendation, also known as SBAR	Didactic and Simulation exercises	Varied by site	All sites measured students' reactions to the learning experiences and showed improvements in students' knowledge and attitudes, but were unable to measure behavioral changes in organizational practice, or benefits to patients or clients
Gonsenhauser I, et al., 2012[97]	Undergraduate medical students N=25,United states	Prospective, pre-post study	Preliminary education in QI, patient safety, leadership, teamwork, and patient-centered care.	Online course work Didactics	Not provided	Results showed an 18% improvement in knowledge of QI methods and evidence (72% v 90%; $p<0.001$). Improvements in awareness (2.4 v 4.2; $p<0.002$), Improvements in skills (3.75 v 4.27;$p<0.02$)

Mookherjee S, et al., 2013[98]	Undergraduate medical students N=6,United States	Prospective, pre-post study Convenience sample	QI project Identification of stakeholders Root cause analyses	Online course work and readings Didactics, Experiential activities Institutional QI and PS activities	2 weeks	The results showed an improvement in knowledge scores (7.3 vs 8.2; p=0.19), high motivation for future QI/PS involvement, and improved methods of performance among participants. Changes in skill were not significant (12.9v12.3; p=0.60)
Miller R, et al., 2014[99]	Undergraduate medical students N=110, United States	Prospective, pre-post study	PS/QI concepts, competencies in PS/QI, and the ability to identify PS issues, defining team role members, and characteristic culture of patient safety	Didactic sessions	1 week	Significant improvement in all 16 concepts (p=0.05) examined in the project
Shaw TJ, et al, 2012[100]	[6]Medical Interns N= 369, Multiple sites, United States	Randomized Controlled Trial	QI simulation cases	Online Spaced Education	Not Provided	Improved learners satisfaction (p<0.05), Behavioral improvements by site/specialty {Medical

[6] Study utilized Incoming interns who had not received any graduate medical training since completion of undergraduate medical education.

						interns/site (4.79 & 4.17;p=0.09)}{surgical interns/site (5.67 & 17.9; p=0.015)}
Blasiak RC, et al, 2014[101]	Undergraduate Medical Students N= 450 United States	Cross sectional Study	PS and QI education	Online	Variable (Range – one day – One semester)	Scores on patient safety education and QI education = 56% and 58%; p = 0.02)
Teigland CL, et al, 2013[102]	Undergraduate Medical Students N=450, United States	Cross sectional study	QI projects, Disclosing Medical errors, independent study	Online	Not stated	Results from QI projects and simulation tests = mean scores 4.2/5 & 3.9/5. Knowledge on PS, mean scores were 4.5/5 and 4.1/5
Levitt DS, et al., 2012[103]	Undergraduate medical students N= 8 United States	Prospective, pre-post study	Project identifying a quality gap in practice, describing existing efforts to address the gap, quantify measures and propose QI intervention	Experiential activities	One year	QI knowledge (5.9 v 6.6; p=0.20), attitudes (9.9 v 12.6; p = 0.03), Skills (13.4 v 16.1; p = 0.05)
Stahl K, et al., 2011[104]	Undergraduate Medical Students N=110, United States	Randomized Controlled Trial	QI theories, PS clinical training	Didactic Experiential activities	One year	Improved scores on knowledge and skills among experimental group (82.9% v 75.5%; p= <0.001), and (77% v 61%;p = 0.05)
Martinez W,	Undergraduate	Prospective, pre-	QI and PS experience,	Online	One year	Improved effects

et al., 2014[105]	Medical Students N=1187 Multisite, United States	post study	medical error identification training, error disclosure behaviors			on attitudes (0.32, p= <0.001), and behavior (1.37, 95%CI 1.15-1.64; p<0.001)
Vinci LM, et al., 2014[106]	Undergraduate Medical student N=245 United States	Prospective, pre-post study	Introduction to QI and PS, QI conferences, IHI open school, Project completion	Experiential, Didactic	Three years	Results showed 7% QI knowledge, 6% skills among participants
Dysinger WS, et al., 2011[107]	Undergraduate Medical students N=510, United States	Prospective, pre-post study	PS, primary Care, Employee Wellness, Surgical Care	Experiential activities	Two years	Curriculum rating were excellent = 53%, average = 34%, fair to poor = 13%
Logan CA, et al., 2012[108]	Undergraduate Medical Students N=14, United States	Prospective, pre-post study	Direct Observation using standardized tools	Experiential activities	One year	Statistically significant improvements in surgical QI and PS were noted
Hall LW, et al., 2010[109]	Undergraduate Medical students N=146, United States	Randomized Controlled Trial	Root cause analyses, principles of safety and human error in clinical care	Didactic	2 hours	Improved knowledge compared to control group {E(3.66 v 3.72) C(3.58 v 3.27); p=0.05}

Table 4.2 Features of Reviewed Studies

Characteristic	16 Undergraduate Medical Education QI/PS curricula interventions N (%)
Study Designs	
Prospective pre-post study	10 (62.5)
Retrospective pre-post study	1 (6.25)
Cross sectional study	2 (12.5)
Randomized Controlled Trials	3 (18.75)
Number of Implementation Sites	
Single	13 (81.25)
Multiple	3 (18.75)
Teaching Methods	
Online	4 (25)
Didactic	2 (12.5)
Experiential	4 (25)
Combination	6 (37.5)
Curriculum Content Focus	
Knowledge Only	3 (18.75)
Attitudes Only	0 (0)
Skills/Behavior Only	0 (0)
Knowledge and Attitudes Only	1 (6.25)
Knowledge and Skills/Behavior Only	3 (18.75)
Knowledge, Attitudes, Behaviors	9 (56.25)

STUDY OUTCOMES

Evaluation of reviewed studies targeting undergraduate medical students focused more on measuring knowledge of QI/PS components compared to attitudes and skills or behavioral components. “Knowledge only” based curricula accounted for 18.75% of all curricula reviewed while there were no “attitudes only” (0), or “skills/behavior only” (0) curricula reviewed. 56.25% of all reviewed interventions incorporated knowledge, attitudes and skills/behavior components in the curricula, while knowledge and attitude based curricula, and knowledge and skills/behavior curricula comprised 6.25% and 18.75% of all reviewed curricula respectively. None of the reviewed studies reported direct benefits to patients.

LEARNERS SATISFACTION

All three of the 16 studies included in this review that measured learners’ satisfaction showed high curriculum satisfaction ratings by learners.

KNOWLEDGE ACQUISITION

All the studies included in this review had a knowledge-based component. Most of these were evaluated using pre and post study surveys. Overall results were statistically significant, showing an improvement on the knowledge of the learners.

LEARNERS ATTITUDES AND OVERALL BENEFITS TO PATIENTS

Ten studies measured changes to learners’ attitudes to QI/PS. Overall, the outcome of this measure was positive. None of the studies included evaluated direct benefits to patients.

BEHAVIORAL CHANGE

Twelve of the reviewed studies had skills or behavioral change components that were evaluated using self-reported surveys or independent observer assessments. Nine of the studies that incorporated skill building and behavior changes as an objective reported statistically significant

improvements in QI/PS skills and behaviors, while two studies reported no significant improvements and one study reported the inability to measure behavioral changes.

DISCUSSION

Overall, this study reviews the published literature since 2010 regarding incorporation of QI/PS training into the standard medical school curriculum. It adds to the growing body of literature on QI/PS for undergraduate medical students by reviewing curricular interventions published since the implementation of the ACA and evaluating the research quality of such studies.

The existing literature has a number of limitations. Most of the studies lacked any empirical evidence guiding the development of the QI and PS training implemented. Most of the studies did not provide adequate information on the curriculum, provider, and learners to allow for replication. They also lacked essential details of potential variables that might have impacted the study results. For example, learner details such as age, gender, race/ethnicity, baseline knowledge, attitudes, skills and the motivation to incorporate QI/PS into learning and practice were not provided. It was also challenging to generalize findings due to the heterogeneity in study sites, settings, and participants.

Despite these limitations, all the studies reviewed demonstrated changes in learners' knowledge and skills and some showed potential for learners' behavioral changes that may yield improved patient benefits. While some reports suggest that educational interventions have the potential to change behavior or improve health outcomes, most studies lack good evidence to support their findings. Evidence suggests that educational studies that utilize randomized controlled designs proved to have the highest quality, because they yielded high response rates and objective data, employed valid instruments and statistical methods with analyses of

appropriate subgroups while accounting for confounding variables. Only three of the studies analyzed in this review employed randomized controlled designs, and they were highly rated in methodological quality.

Learners' improved QI/PS knowledge and skills demonstrated in these studies may not translate directly into improved patient outcomes, due to the complex and sometimes-unpredictable variables that exist in practice, thereby presenting a challenge to such curricula. However even with high quality delivery of QI/PS educational content, the degree to which organizational or patient outcomes might improve remains unclear.

This review identified important barriers to the development, implementation, and evaluation of QI/PS training, both unique and not unique to undergraduate settings. These include competing curricular demands and the difficulty of introducing new curricular initiatives into an already tightly packed undergraduate medical education curriculum.[110] Some reports highlighted the need for increased clinical faculty prepared to teach QI and PS topics in medical student curricula. For example, most studies involved a few faculty interested in QI/PS concept, often resulting in burdensome time commitments. The inclusion of undergraduate medical students who are in the preclinical stages has been shown to preclude a complete comprehension of the need and methods of achieving QI/PS practice changes, [111, 112] reflecting the importance of clinical experience as a necessary precursor for appreciating the relevance of QI/PS training. Lack of learner buy-in regarding the importance of QI/PS training presented major issues for learners at all levels.

Curricula that incorporate experiential content may require a greater time and resource commitment thereby posing a greater barrier to the incorporation of such curricula while also increasing attrition rates of learners in elective programs. To address some of these issues, some

programs incorporate QI/PS training into less busy clinical rotations or research years.[113] Such curricula also required having adequate personnel, financial, and technological resources to support the added experiential components.

RECOMMENDATIONS

Programs undertaking the development of curricula in QI/PS must recognize the need for adequate time commitment, resources, and engagement of faculty with appropriate expertise and interest in QI/PS training. The curriculum development must also be guided by empirical evidence. For the successful implementation of a QI/PS curriculum, cross-disciplinary stakeholder engagement, including organizational and educational stakeholders, should be included. Future research should entail a more detailed description of the learner, including their demographic characteristics, study participants' baseline QI/PS training, knowledge and skills, and a description of the healthcare setting and willingness to integrate QI/PS concepts in practice. Efforts should also be made to influence the culture of faculty and institutional factors that facilitate or hinder the promotion of sustained educational efforts focused on QI and PS for medical students. Finally, the curriculum and study presented should be described in detail to support replicability.

LIMITATIONS

This systematic review had several limitations. The heterogeneity of the literature examining the effectiveness of QI/PS interventions/trainings in terms of content, methods and study design, learners targeted and learning outcomes reported, limited the quality of this review. In addition, some of the studies utilized weak methodological designs, implemented at single sites with few participants. Therefore, this research did not employ a quantitative synthesis of studies reviewed. Only qualitative analyses were conducted with results reflecting factors that

influence the development and implementation of the curricula. Since the identification of facilitators and challenges to implementation were not identified in these studies as primary goals, researchers did not identify or report such challenges in a defined format. Sustainability and reproducibility of curricula were not reported in any of the studies reviewed.

CONCLUSION

The implementation of the ACA has reinforced the importance of QI/PS as a core component and value of the U.S. health care system. Medical students will be expected to have acquired core concepts in QI/PS in order to apply them to improve patient outcomes. In compliance to the goal of the AAMC which is to ensure that undergraduate medical education is staffed by faculty that are "*ready, able, and willing to engage in, role model, and lead education in QI/PS, and in reduction of excess health care costs*," [10] QI/PS training should be broadly taught to trainees early in their careers. In addition, the AAMC should be encouraged to mandate QI/PS curriculum in medical training since existing literature indicates that such curricula are effective in improving knowledge, attitudes and practices of students leading to improved patient outcomes.

CHAPTER FIVE

SUMMARY OF PROJECT

This dissertation aimed to explore the quality improvement needs of the United States healthcare system and to assess the types of quality improvement training currently provided to U.S. medical students. These aims were achieved through the implementation of two independent research projects. The first project utilized a retrospective cohort design, to identify and analyze HIV screening rates among Medicaid enrollees in 29 states with a primary STI (chlamydia, gonorrhea, and syphilis) or PID claim. This research was prompted by an interest in assessing the sub-optimal HIV testing rates among STI patients, and the failure of providers to adhere to the CDC recommended HIV screening protocol in many healthcare settings (STI clinics, emergency departments [ED], and physician outpatient clinics), especially ED settings.

The results of this study showed that less than half of STI-diagnosed Medicaid-enrolled patients were screened for HIV. This is far less than the expected proportion of STI-diagnosed persons screened for HIV if providers adhere to the current CDC guidelines. This study concluded that HIV screening among STI-diagnosed persons is a cost-effective, yet underutilized public health strategy. It also revealed, "missed opportunities" for HIV screening and the identification of HIV-infected persons among persons diagnosed with another STI. Based on this, several recommendations were proposed to improve HIV screening among individuals diagnosed with STIs. The results of this study are evidence of providers' poor adherence to recommended quality improvement measures.

The second study conducted was to assess the types, content, and outcomes of existing peer-reviewed and published quality improvement training curricula for medical students. This project was prompted by the need to bridge the gap between the expectations of the Affordable Care Act and the methods to accomplish such expectations. Components of the ACA were designed to improve access to quality care, and reduce healthcare costs. It directly links the payment of providers to the quality of care provided. Unfortunately, there is a major dissociation between the expectations of the law, and the process of achieving such expectations since QI/PS is not currently mandated in the standard undergraduate medical curriculum.

To achieve this aim, a systematic literature review was conducted to assess studies with any QI/PS training for medical students, published in the U.S. since 2010, where the impact of the training on their knowledge, skills, and practices was measured, or patient outcomes assessed. Formal methods for literature search were employed using "The Preferred Reporting Item for Systematic review and Meta-Analyses (PRISMA)" guidelines. The methodological quality of the studies was analyzed using Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) directives.

Sixteen studies were analyzed with mean study quality scores ranging from 6 to 17 for the STROBE. Quality of studies was rated as low (n = 3), moderate (n = 9), and high (n = 4). The tools categorized the majority of the studies in similar tertiles for quality

The conclusion made at the end of this study is that to advance QI/PS training in undergraduate medical education, well-designed and standardized curricula must be employed. The recommendation to encourage the AAMC to mandate QI/PS curriculum in undergraduate medical training was also made.

LIMITATIONS

Findings in the first study were primarily generalizable to the Medicaid-enrolled populations at the time of the study, and to the Medicaid programs that pay for their care. Claims accessed were limited to those paid by Medicaid, and, therefore, did not include STI-diagnosed patients who may have been screened for HIV elsewhere. Patients who were offered an HIV test but declined could also not be accounted for in this study. Data used in the first study was collected in 2009, before the implementation of the ACA, which may have changed screening rates of STI diagnosed Medicaid enrollees due to the direct linkage of quality of care to physicians payments and changes in the demographics of the covered populations in states that expanded Medicaid.

The second study identified a limited number of published reports that described the implementation of QI/PS initiatives among undergraduate medical students in the U.S. since the implementation of the ACA. The small number of studies analyzed were of low to moderate quality based on the assessment of the methodological rigor employed. Assessment of these studies was also made more challenging by the diverse study designs, learners targeted, and the variety of learning outcomes targeted. Most of the studies reviewed did not provide enough details on vital variables to allow the assessment of sustainability and replicability.

CONCLUSION

This research highlights the importance of QI/PS training among undergraduate medical students. It identifies the gap between the expectations of the ACA, and the process of achieving these expectations. The study identifies significant steps made towards the incorporation of QI/PS training into undergraduate medical education. It also fosters the conversation on the need

for specific guidelines and mandates to ensure complete integration of QI/PS concepts and practices into undergraduate medical education.

This project also calls attention to the gaps in quality of healthcare that exists in the U.S. health system today. It demonstrates the dire need for incorporation of quality improvement and patient safety strategies across settings and processes of the healthcare system. For example, providing training and incorporating systems that will improve compliance with evidence-based guidelines, like HIV screening for patients diagnosed with an STI, is essential. The project also elaborates on the standard of published curricula implemented across medical schools in the U.S. and emphasizes the need for the development of a curriculum that utilizes a high quality design.

RECOMMENDATIONS

The results of this study demonstrate the specific ability of Medicaid claims to provide on-going surveillance of STIs, which could be used by state Medicaid programs to significantly improve HIV-screening behavior at the population level. Improved collaboration and /or integration between traditional public health units and state Medicaid programs is required. Concerted efforts are needed to increase HIV screening rates in all health care settings, especially among at-risk populations.

Future research focused on developing QI/PS curricula must be made to ensure that such curricula are guided by empirical evidence. The dissemination of these curricula should also entail a more detailed description of the learner, study participants' baseline QI/PS training, knowledge and skills, healthcare setting and willingness to integrate QI/PS concepts in practice. Efforts should also be made to influence the culture of faculty, and institutional factors that facilitate or hinder the promotion of sustained educational efforts focused on QI and PS for

medical students. Finally, the curriculum and study presented should be described in detail for replicability.

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