2017

Differences in Outcomes for Incarcerated and Non-Incarcerated Patients Hospitalized in the Commonwealth of Massachusetts, 2011-2013: Is “Adequate Care” in Criminal Justice Institutions Enough?

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DIFFERENCES IN OUTCOMES FOR INCARCERATED AND NON-INCARCERATED PATIENTS HOSPITALIZED IN THE COMMONWEALTH OF MASSACHUSETTS, 2011-2013: IS "ADEQUATE CARE" IN CRIMINAL JUSTICE INSTITUTIONS ENOUGH?

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A doctoral project submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree Doctor of Health Administration in the College of Health Professions

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Acknowledgements

First, I give praise and thanks to my Lord and Savior, Jesus Christ, for giving me the drive, focus, and perseverance to set and achieve high goals throughout my life. To Him, I give all the glory!

I thank my parents, Donald and Janice Doering, for raising me, along with my three brothers, from birth to manhood. Their years of life education ensured we all learned the highest core values and the tools necessary to survive in an ever-changing and challenging world. We were able to emulate integrity, excellence, work ethic, and patriotism, all necessary qualities to be successful and productive Americans.

My children, Ashlee and Dennis, and my step-son and daughter-in-law, Christopher and Kimberly, make me so proud. Their individual achievements and successes push me to keep raising the bar and pursuing my own aspirations. Thank you for being wonderful "children" and adults!

I want to thank Dr. Annie Simpson, Dr. Richard Hicks, and Dr. Trudie Milner for their mentorship, professionalism, and willingness to share their expertise with me. Without their support and encouragement, I would not have been able to complete a thorough and meaningful research project. I also want to thank Daniel Brinton, Research Associate, for his expertise in statistics, editorial prowess, and willingness to teach me while simultaneously learning himself.

Finally, I want to thank my wonderful wife, Lisa Parramore Doering, whose steadfast support and religious faith opened my eyes to how life should be—trusting in God and loving one another unconditionally are what matter most. Lisa…I love you so much!

Abstract of Doctoral Project Presented to the
Executive Doctoral Program in Health Administration & Leadership
Medical University of South Carolina
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Health Administration

DIFFERENCES IN OUTCOMES FOR INCARCERATED AND NON-INCARCERATED PATIENTS HOSPITALIZED IN THE COMMONWEALTH OF MASSACHUSETTS, 2011-2013: IS "ADEQUATE CARE" IN CRIMINAL JUSTICE INSTITUTIONS ENOUGH?

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Objective: This study used data from the Healthcare Cost and Utilization Project State Inpatient Databases to identify whether inmates in Massachusetts had any differences in morbidity, mortality, cost, length of stay, and ambulatory care sensitive conditions as compared to a propensity-score matched (1:1 ratio) group of non-inmate patients.

Methods: Differences were examined using *t* tests for continuous variables and Chi-square (χ^2) tests for categorical variables. Multiple linear and logistic regression models were used to investigate relationships between the outcome variables and inmate/non-inmate status, controlling for age, Charlson Comorbidity Index score, gender, primary payer, race, psychological conditions, suicide, and injuries.

Results: On average inmates stayed 2.48 days longer in the hospital (10.40 vs. 7.92; p = < .0001), their bill was $1,691 more ($10,226 vs. $8,535; p = < .0001), and they had more chronic conditions (4.46 vs. 4.31; p = .0019) compared to non-inmate counterparts.

Conclusion: The provision of healthcare to inmates is required by law, paid for by taxpayers, and managed differently at each correctional institution. Findings indicate care may not be adequate, requiring collaborative efforts to improve the provision and management of healthcare at correctional institutions.

Key Words: Retrospective analysis, propensity-score matching, Healthcare Cost and Utilization Project (HCUP), Massachusetts, hospital admission, criminal justice, inmate, prisoner, incarcerated, prison, jail, outcomes, ambulatory care sensitive conditions.

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1. INTRODUCTION

Background and Need

By the end of 2004, the rate of incarceration in state prisons, local jails, federal prisons, and other facilities was 737 per 100,000 in the United States, which is 6.7 times the rate before 1974 (Patterson, 2010). More recently, the Bureau of Justice Statistics and the International Center for Prison Studies reported there were over 2.3 million people incarcerated in prisons and jails in 2014, with the year end custody populations of the Bureau of Prisons and 18 states exceeding the maximum measure of their prison facilities' capacities (Carson, 2015; Grohs, 2013; Minton & Zeng, 2015). Fazel and Baillargeon (2011) suggest as a result of burgeoning prison populations and an increasing number of disease epidemics, prison healthcare services have become increasingly complex and are in need of improvement.

Prison healthcare systems throughout the nation are facing fiscal challenges due to a growing and aging prison population, rising healthcare costs, and decreasing funding appropriations (Friedman, 1992; Schneider, Harzke, Ivanitskaya, & Murray, 2014). The values of the criminal justice system (prisons and jails) prioritize security, and are therefore unlikely to sufficiently overlap with health values that would prioritize resources for the level of healthcare offenders need (Fazel & Baillargeon, 2011). For many inmates, prison is the first time in their adult lives they have had

consistent access to medical or mental healthcare. Nevertheless, with security a paramount concern in prisons, timely access to treatment can sometimes be impeded (Linder & Meyers, 2015).

The term *prisoner* is defined in 45 CFR 46.303(c) as follows:

> A prisoner means any individual involuntarily confined or detained in a penal institution. The term is intended to encompass individuals sentenced to such an institution under criminal or civil statutes, individuals detained in other facilities by virtue of statutes or commitment procedures which provide alternatives to criminal prosecution or incarceration in a penal institution, and individuals detained pending arraignment, trial, or sentencing (US Department of Health and Human Services, Office for Human Research Protections, 2016).

Included in this definition are those individuals in hospitals who are under court order. Terms used throughout this document which should be considered synonymous with prisoner include inmate, offender, and the incarcerated.

Problem Statement

Inmates in prisons and jails have poor health and have been shown to have a higher burden of chronic diseases such as hypertension, diabetes, asthma, chronic liver disease, and HIV than the general population (Espinosa & Regenstein, 2014; Hollenbeak, Schaefer, Penrod, Loeb, & Smith, 2015; Maruschak & Berzofsky, 2015). Unfortunately, access to proper screenings and medical care within detention centers and correctional institutions, particularly jails, remains poor (Kulkarni, Baldwin,

Lightstone, Gelberg, & Diamant, 2010). In 2011-2012, 50% of inmates reported having a chronic disease and nearly 75% were overweight (46%), obese (26%), or morbidly obese (2%) (Maruschak & Berzofsky, 2015). Among those who reported ever having a chronic condition, 73% of prisoners and 77% of jail inmates reported they had a condition at admission. Chronic conditions include cancer, high blood pressure, stroke-related problems, diabetes, heart-related problems, kidney-related problems, arthritis, asthma, and cirrhosis of the liver.

The prevalence of mental illness compounds the problem. Espinosa and Regenstein (2014) reported the jail- and prison-involved population experiences an exorbitantly high rate of mental illness and substance abuse disorders. According to a Bureau of Justice Statistics Special Report (James & Glaze, 2006), at mid-year 2005 more than half of jail and prison inmates had a mental health problem. The percentage of mental illness in inmates continues to be high. A 2011-2012 National Inmate Survey estimated 36.6% of prison inmates and 43.7% of jail inmates reported being told by a mental health professional they had a mental health disorder, as specified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (Beck, Berzofsky, Caspar, & Krebs, 2013).

Some data suggest curative and life-prolonging approaches are limited for inmates (Mathew, Elting, Cooksley, Owen, & Lin, 2005). Decreased access to medical care and mental health services caused by custody and medical manpower shortages, competing priorities for scarce financial resources, inmate perceptions and grievances, and long-term incarceration may exacerbate patients' medical problems, resulting in the

need for hospitalization (Alexander, & Rich, 2013; Dumont, Allen, Brockmann, Linder & Meyers, 2015; Morgan, Steffan, Shaw, & Wilson, 2007; Schneider et al., 2014).

Objective of the Study

The objective of this study is to identify whether there are any differences in morbidity (including level of patient acuity), mortality, cost, length of stay (LOS), and ambulatory care sensitive conditions for incarcerated individuals hospitalized for inpatient care in the Commonwealth of Massachusetts as compared to a matched group of non-incarcerated patients. Massachusetts is one of the 18 states exceeding the designed capacity of their Department of Correction (DOC) prison facilities, reporting 130.1% of average daily population capacity in 2014 (Carson, 2015). When data are added for non-DOC facilities (e.g., Federal prisons, inter-state contract, and houses of correction), the total average daily population increased to 137% of capacity in 2014 (Papagiorgakis, 2015).

Identifying whether there are any differences in morbidity (including level of patient acuity), mortality, cost, length of stay (LOS), and ambulatory care sensitive conditions is the first step in making evidence-based recommendations to improve the quality and level of acute, chronic, and mental healthcare services provided by the criminal justice system (prisons and jails) in order to reduce the amount of hospital admissions. Little is known about hospital admissions for prisoners compared to what would be expected for admissions for the general population. With a better understanding of prisoners' hospital use, it will enhance targeting of improvement efforts where they may do the most good.

Research Question

Are there any differences in morbidity (including level of patient acuity), mortality, cost, length of stay, and ambulatory care sensitive conditions for hospitalized patients admitted from court or law enforcement sources as compared to patients from other sources?

Research Hypotheses

Null hypothesis

There are no differences in morbidity, mortality, cost, length of stay, and ambulatory care sensitive conditions between incarcerated and non-incarcerated patients.

Alternative hypothesis

Incarcerated patients have higher morbidity, mortality, costs, lengths of stay, and ambulatory care sensitive conditions compared to non-incarcerated patients.

Population

The study population was drawn from all inpatient hospital stays in Massachusetts for the years 2011-2013. These data are part of the Statewide Inpatient Databases (SID) of the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP). Massachusetts was chosen because the admission source data specifically identify individuals admitted from court or law enforcement sources, thereby allowing comparisons of incarcerated and non-incarcerated patient cohorts. The study population was restricted to records of adult patients, 18 years old or older, who reside in Massachusetts.

Statewide Inpatient Databases

The AHRQ HCUP Website (2016, June 24) provides access to the SID, which includes inpatient discharge records from community hospitals in Massachusetts and 28 other states. The SID files encompass all patients, regardless of payer, providing a unique view of inpatient care in a defined market or state over time. The SID contains the universe of the inpatient discharge abstracts from participating states that are translated into a uniform format to facilitate multi-state comparisons and analyses. Together, the SID files encompass almost 90 percent of all U.S. hospital discharges. Some states include discharges from specialty hospitals, such as acute psychiatric hospitals. Forty-seven states and the District of Columbia participate in sharing data with the AHRQ HCUP, with only 29 states and the District of Columbia providing data for the SID. See Appendix A for a listing of participating partners in HCUP.

There are 242 data elements in the 2011 SID file for Massachusetts, and 240 in each of the 2012 and 2013 SID files. Of the available data elements, only 168 were being used by Massachusetts hospitals in 2011, and 166 for 2012 and 2013. Examples of data elements include: principal and secondary diagnoses and procedures, admission and discharge status, patient demographics (e.g., sex, age, and race), expected payment source, total charges, and length of stay. The AHRQ HCUP database (2016, February) data elements included in the 2005-2013 SID are structured in files as follows: Core file, Charges file, AHA (American Hospital Association) Linkage file, Diagnosis and Procedure Groups file, and Disease Severity Measures file.

The Core file contains state-specific data elements intended for limited use and are needed for traditional applications (e.g., length of stay, patient age).

The Charges file contains detailed charge information. There are three kinds of Charges files: 1) summarized detail in which charge information is summed within the revenue center; 2) collapsed detail in which charge information is summed across revenue centers; and 3) line item detail in which a submitted charge pertains to a specified revenue center and there may be multiple charges reported for the same revenue center.

The AHA Linkage file contains data elements that allow the SID to be used in conjunction with the AHA Annual Survey of Hospitals data files. These files contain information about hospital characteristics and are available for purchase through the AHA. Because the data organizations in participating states determine whether the AHA linkage data elements may be released through the HCUP Central Distributor with the SID, not all SIDs include AHA linkage data elements.

The Diagnosis and Procedure Groups file includes discharge-level records which contain data elements from AHRQ software tools designed to facilitate the use of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic and procedure information in the HCUP databases. The unit of observation is an inpatient stay record.

The Disease Severity Measures file contains discharge-level data that contain information from the AHRQ Comorbidity Software. Information from the severity file is to be used in conjunction with the Inpatient Core files. The unit of observation is the inpatient stay record.

In addition to the SID files, HCUP Cost-to-Charge Ratio files and Prevention Quality Indicator (PQI) data were also used. The HCUP Cost-to-Charge Ratio files

assist with determining estimated hospital costs. According to the 2011 Central Distributor State Inpatient Database User Guide (2013, August 7), the Cost-to-Charge Ratio file provides HCUP data users with ratios which will allow the conversion of charge data to cost estimates. The file is constructed using all-payer, inpatient cost and charge information from the detailed reports by hospitals to the Centers for Medicare & Medicaid Services (CMS).

The PQI data consist of specific sets of diagnoses (and rules for usage), where the result is a binary indicator of whether a patient has or does not have a given PQI. The ICD-9-CM codes, found within hospital inpatient records, identify specific admission rates and determine levels of quality of care for "ambulatory care sensitive conditions (ACSC)." ACSCs are conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease (AHRQ , 2015). The PQIs represent the current state of the art in assessing quality of health services in local communities using inpatient discharge data (AHRQ, 2001). These indicators measure the outcomes of preventive care for both acute illness and chronic conditions, reflecting two important components of the quality of preventive care—effectiveness and timeliness.

According to Best (1999), the use of secondary data sources is an efficient and economical means by which to analyze data on outcome measures. Secondary data sources are databases which contain variables originally collected for other purposes. By using an established database, researchers can analyze existing data without the time and expense of collecting the data independently. Strengths of HCUP data include the very large size (allows for analysis of small area variation, such as within a county),

the capture of charges (can be converted to estimated costs), and the capture of encounters by the uninsured (a population not usually included in Medicare or Medicaid claims data) (Mutter & Stocks, 2014). The strengths of PQI and ACSC data include: 1) they can be used as tools for identifying potential quality problems in outpatient care that help to set the direction for more in-depth investigation; 2) they are based on readily available data—hospital discharge abstracts, resulting in minimal resource requirements; and 3) uniform definitions allow for comparisons across states, regions, and local communities over time.

Propensity-Score Matching

To ensure a comparable matching between incarcerated and non-incarcerated groups and to balance baseline characteristics between the two groups, propensity-score matching was conducted. The term *matching* is defined broadly to be any method that aims to equate the distribution of covariates in the treated and control groups (Stuart, 2010). When matching is performed, the covariates of the two groups are balanced, with the goal to minimize bias (Hanna et al., 2012; Nosyk, Sun, Li, Palepu, & Anis, 2006; Stuart, 2010).

The propensity score, defined as "the probability of receiving the treatment given the observed covariates (Rosenbaum & Rubin, 1983)," facilitates the construction of matched sets with similar distributions of the covariates, without requiring close or exact matches on all of the individual variables (Stuart, 2010). Propensity-score matching is a technique used in the design of non-randomized studies to select "control" subjects who are matched with "treated" subjects on a designated number of controlled background covariates. When uncontrolled for, such covariates can lead to

biased estimates of treatment effects (Hanna et al., 2012). Stuart (2010, p. 6) states there are two key properties of propensity scores:

> The first is propensity scores are balancing scores: at each value of the propensity score, the distribution of the covariates *X* defining the propensity score is the same in the treated and control groups. Thus, grouping individuals with similar propensity scores replicates a mini-randomized experiment, at least with respect to the observed covariates. Second, if treatment assignment is ignorable given the covariates, then treatment assignment is also ignorable given the propensity score. This justifies matching based on the propensity score rather than on the full multivariate set of covariates. Thus, when treatment assignment is ignorable, the difference in means in the outcome between treated and control individuals with a particular propensity score value is an unbiased estimate of the treatment effect at that propensity score value.

The key concept in determining which covariates to include in the matching process is that of strong ignorability. Matching methods rely on ignorability, which assumes there are no unobserved differences between the treatment and control groups, conditional on the observed covariates (Stuart, 2010). To satisfy the assumption of ignorable treatment assignment, it is important to include in the matching procedure all variables known to be related to both treatment assignment and the outcome (Glazerman, Levy, & Myers, 2003; Hill, Reiter, & Zanutto, 2004; Rubin & Thomas, 1996).

Rubin (2004) describes the use of propensity scores for medical research as follows:

> Observational studies should be designed in analogy with the way randomized experiments are designed. Randomized experiments are designed to have balance between treatment and control groups, often within blocks (i.e., within strata, subclasses, or matched pairs) on all covariates. Blocking assures balance on the observed covariates used to create the blocks, and randomization implies balance (at least on average) on all other covariates, both observed and unobserved. Due to the absence of randomization in observational studies, we cannot force balance on unobserved covariates, but we must attempt to balance the observed ones (at least on average), and propensity score technology, often combined with blocking on especially important covariates, is an important tool for achieving this balance in observed covariates.

Stuart (2010) concurs with Rubin and recommends when estimating causal effects using observational data it is desirable to replicate a randomized experiment as closely as possible by obtaining treated and control groups with similar covariate distributions. In addition to estimating causal effects, matching can also be used for non-causal questions, for example to investigate racial disparities (Schneider, Zaslavsky, & Epstein, 2004).

Even if the outcome values are available at the time of the matching, the outcome values should not be used in the matching process. This precludes the selection of a matched sample that leads to a desired result, or even the appearance of

doing so (Rubin, 2007; Stuart, 2010). Given that all potential confounders are included, propensity-score matching is a useful tool for causal inference in non-randomized studies (Bjertnaes, 2014).

According to Stuart (2010), when there are large numbers of control individuals, it is sometimes possible to get multiple good matches for each treated individual, called *ratio matching*. For this study, the ratio matching method was used with a ratio of 1 incarcerated patient to 1 non-incarcerated patient (1:1). Selecting the number of matches involves a "bias to variance" trade-off. Stuart (2010) suggests selecting multiple controls for each treated individual will generally increase bias since the 2nd, 3rd, and 4th closest matches are, by definition, further away from the treated individual than is the first closest match. On the other hand, utilizing multiple matches can decrease variance due to the larger matched sample size. Utilizing the 1:1 matching ratio should mitigate concerns with the "bias to variance" trade-off.

Matching methods have four key steps, with the first three representing the "design" and the fourth the "analysis" (Stuart, 2010):

1. Defining "closeness": the distance measure used to determine whether an individual is a good match for another. Defining closeness involves determining which covariates to include and combining those covariates into one distance measure.
2. Implementing a matching method, given that measure of closeness.
3. Assessing the quality of the resulting matched samples, and perhaps iterating with steps 1 and 2 until well-matched samples result.

4. Analysis of the outcome and estimation of the treatment effect, given the matching done in step 3.

The next chapter discusses findings obtained from a thorough literature review.

2. REVIEW OF THE LITERATURE

Over 11 million people cycle through jails and prisons in the United States annually, reflecting the highest rate of incarceration in the world (Minton & Zeng, 2015). Healthcare in correctional settings is mandated by law; however, the scope of these services is generally left to the discretion of local authorities (Espinosa & Regenstein, 2014). This chapter begins by covering landmark court cases which set precedent for laws mandating inmate healthcare, and then transitions to discuss concerns regarding issues impacting the delivery and quality of mental health and medical services provided in correctional institutions.

Legal Perspective

The Supreme Court of the United States and the United Nations have both weighed in on the issue of incarceration. The Supreme Court affirmed governmental responsibility to provide healthcare services to people incarcerated in correctional institutions. The basis for the Supreme Court's position stems from its determination that failure to provide "adequate medical care" to the incarcerated may violate the 8th Amendment to the U.S. Constitution (*Estelle v. Gamble*, 1976; Schneider et al., 2014). Prisoners are protected by the Eighth Amendment to the U.S. Constitution, which is a component of the U.S. Bill of Rights (1791, December 15; Archives.gov Website, 2016), and specifically states, "Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted." Through the protections of the

Eighth Amendment and the due process requirements of the Fifth and Fourteenth Amendments, prisoners and pre-conviction detainees have a right to humane treatment and the supply of adequate medical care while incarcerated prior to and after conviction (Bondurant, 2013; Genty, 1996; Posner, 1977).

The Supreme Court entered the debate regarding constitutional standards for prison healthcare and improving prison conditions in *Estelle v. Gamble* (1976). In this case, J. W. Gamble, an inmate of the Texas Department of Corrections, was injured when a 600-pound bail of cotton fell on him while he was unloading a truck. He filed a civil rights suit against W. J. Estelle, Jr., Director of the Department of Corrections, under 42 U. S. C. § 1983, complaining he was subjected to cruel and unusual punishment in violation of the Eighth Amendment for inadequate treatment of a back injury in which he claimed he sustained while he was engaged in prison work (Bondurant, 2013; *Estelle v. Gamble*, 1976). Other defendants in the suit included the warden of the prison and the medical director of the prison hospital. Although Gamble eventually lost his case, the resulting opinion from Justice Marshall did set precedent by finding "deliberate indifference" by prison personnel to a prisoner's serious illness or injury constitutes cruel and unusual punishment contravening the Eighth Amendment (*Estelle v. Gamble*, 1976).

In *Estelle v. Gamble* (1976) the Eight Amendment right as a freedom from cruel and unusual punishment is interpreted by the Court to impose a duty on the government to provide a minimal standard of medical care (Bondurant, 2013). In his formal opinion, Justice Marshall stated:

> An inmate must rely on prison authorities to treat his medical needs; if the authorities fail to do so, those needs will not be met. In the worst cases, such a failure may actually produce physical "torture or a lingering death," the evils of most immediate concern to the drafters of the Amendment. In less serious cases, denial of medical care may result in pain and suffering which no one suggests would serve any penological purpose. The infliction of such unnecessary suffering is inconsistent with contemporary standards of decency as manifested in modern legislation codifying the common law view that "it is but just that the public be required to care for the prisoner, who cannot, by reason of the deprivation of his liberty, care for himself" (*Estelle v. Gamble*, 1976, p. 104).

According to Rold (2008), by the time of *Estelle*, the Supreme Court had before it the common law precedents from *Spicer* and other state courts, statutory authority in some 22 states for the same proposition, development of parallel Eighth Amendment jurisprudence by the lower federal courts, and the standards of numerous organizations, including the U.S. Department of Justice, the National Sheriffs' Association, and the United Nations.

For more than 4 decades after the Supreme Court's ruling in *Estelle v. Gamble* (1976), the courts have protected the constitutional right of prisoners to healthcare (Rold, 2008). In the hundreds of published cases following *Estelle*, three basic rights have emerged: the right to access to care, the right to care that is ordered, and the right to a professional medical judgment (Posner, 1992; Rold, 2001). Winner (1981) suggests a well-monitored and well-run access system is the best way to protect

prisoners from unnecessary harm and suffering and, concomitantly, protect prison officials from liability for denying access to needed medical care. Regarding ordered care, *Estelle* imposes a legal duty on administrative and custodial staff to honor medical orders and extends liability to those who interfere with ordered care (*Estelle v. Gamble*, 1976; Rold, 2008). Finally, regarding professional medical judgment, the courts seek to "ensure decisions concerning the nature and timing of medical care are made by medical personnel, using equipment designed for medical use, in locations conducive to medical functions, and for reasons that are purely medical" (Neisser, 1977).

Mental health needs of the incarcerated have also been and continue to be addressed by the US judicial system. The landmark case, *Bowring v. Godwin* (1977), was the first case to consider whether prisoners have a right to psychiatric and psychological treatment, as well as to treatment for physical conditions. The Federal District Court answered in the affirmative.

In *Brown v. Plata* (2011), the Supreme Court upheld a decision by a three-judge court empowered by the Prison Litigation Reform Act (PLRA), which mandated the release of thousands of California inmates (PLRA, 1996). Two previous cases, *Coleman v. Brown* (1990) and *Plata v. Brown* (2014), established a history of problems in the California prison system and were specifically referenced in the *Brown v. Plata* decision. In *Coleman v. Brown,* filed in 1990, the District Court found prisoners with serious mental illness did not receive minimal, adequate care. In *Plata v. Brown* (2014), filed in 2001, the State conceded that deficiencies in prison medical care violated prisoners' Eighth Amendment rights and stipulated to a remedial injunction. The court mandated a population cap since no remedial action had taken place over

several years and conditions were deteriorating as a result of overcrowding. California's prisons were designed to house approximately 85,000 inmates. At the time of the U.S. Supreme Court's 2011 decision in *Brown v. Plata*, the California prison system housed nearly twice its designed capacity—approximately 156,000 inmates. The judges determined overcrowding was the primary cause of the inmates' inadequate medical and mental healthcare which violated inmates' Eighth Amendment rights (*Brown v. Plata*, 2011). Newman and Scott (2012) suggest nobody has argued inmates experience benefits from overcrowding. Rather, overcrowding most likely adds to the already stressful experience of being incarcerated.

Posner (1992) summarized the constitutional standard for prisoner healthcare by stating the prisoner will not receive treatment significantly divorced from what society as a whole receives. However, the courts have made it clear inmates have no right to perfect or optimal healthcare, or to the treatment from preeminent providers (Friedman, 1992). While a court may correctly note a prisoner is not guaranteed exactly the same care as free citizens, it must also recognize a prisoner's medical care right is substantially related to the medical care provided in society in general (Posner, 1992).

According to the United Nations *Health Rights of Prisoners* (Appendix B), every prison should have proper health facilities and medical staff to provide for a range of health needs, including dental and psychiatric care. Sick prisoners who cannot be treated in the prison, such as prisoners with mental illness, should be transferred to a civilian hospital or to a specialized prison hospital (United Nations Office of the High Commissioner for Human Rights, 2005). Lines (2008) reports there is consensus in international law that the state has an obligation to protect the lives and well-being of

people it holds in custody. Prisoners have the right to health, including medical care, mental healthcare, and living conditions that do not jeopardize their health or promote disease. As reviewed above, international jurisprudence widely agrees on the minimum legal standards of healthcare rights afforded to prisoners—which provides direction to our Nation and each of its States (Lines, 2008).

Mental Health and Medical Concerns in Correctional Institutions

Many people involved with the criminal justice system—those who have been in jail or prison or who are on probation or parole—have substantial health needs and much of this population has either gone without care or received only sporadic care in jails, prisons, or emergency departments in the community (Boutwell & Freedman, 2014; Rich, Wakeman, & Dickman, 2011). For almost 200 years, advocates have worked diligently to improve prison and jail conditions. One advocate who made significant progress was Dorothea Dix.

In the 1840s, Dorothea Dix traveled the country confronting state legislatures about the unconscionable treatment of prisoners and urging, in particular, the building of hospitals for those with psychiatric illness (Rubinow, 2014). By the 1880s, there were 75 psychiatric hospitals in the United States, and a survey estimated that less than 1% of prisoners had mental illness (Torrey et al., 2014). For the next 90 years, it was widely accepted in the United States that people with mental illness belonged in hospitals rather than prisons. Unfortunately, support for hospitalizing the mentally ill started to wane. In 1955, approximately 560,000 patients occupied state hospital beds, whereas today the number is approximately 35,000 (Torrey et al., 2014). It is no mystery where the patients went: in 1880, 0.7% of U.S. prisoners had a serious mental

illness (Rubinow, 2014). In the 1970s the rate had increased to approximately 5%, and today it is likely more than 20% (Rubinow, 2014).

Beginning in the early 1990s, many states redoubled their efforts to close or substantially downsize their remaining state hospitals, to include state mental institutions (McGrew, Wright, Pescosolido, & McDonel, 1999; Upshur et al., 1997). The lack of available inpatient beds forced many less acute mental health patients into the public sector and diverted many into the criminal justice system (Newman & Scott, 2012). It also created a concentration of highly acute, disruptive, and violent patients within the state-run facilities, resulting in an increase of assaults. Assault within public psychiatric facilities has long been, and continues to be, a critical problem for mental health policy makers, staff, and patients (Davis, 1991; Depp, 1983; Flannery, Fisher, & Walker, 2000; Noble & Rodger, 1989; Tardiff, 1983). Policy makers and providers have struggled with how best to treat assaultive patients while ensuring the safety of staff and other patients. Their attempts to address this problem have given rise to unusual and arguably inappropriate arrangements (Brown, Fishbein, & Fisher, 2001). An example of one of these arrangements occurred in Massachusetts.

Between 1976 until 1989, the Massachusetts Department of Mental Health transferred certain assaultive male patients who were committed to Department of Mental Health hospitals under civil statutes to Bridgewater State Hospital, a secure facility operated by the Massachusetts Department of Correction servicing primarily mentally ill inmates and individuals awaiting trial (Fein, 1983). Given a lack of adequate space to provide necessary treatment and a long-standing culture of securing assaultive patients in a very restrictive manner by corrections officers, this practice was

declared illegal by state statute in 1989. After legal actions, the Department of Mental Health initiated a program to improve the treatment and management of mentally ill persons with violent behaviors (Brown, Fishbein, & Fisher, 2001).

Although the United Nations Basic Principles for the Treatment of Prisoners states prisoners "shall have access to the health services available in the country without discrimination on the grounds of their legal situation" (United Nations Office of the High Commissioner for Human Rights, 2016), the quality, comprehensiveness, and organizational infrastructure of healthcare delivery within correctional institutions varies substantially (Ross, 2009). Prisons and the largest jails (e.g., the Los Angeles County jail or the New York City system) generally provide a wide range of health services of their own, while most county and municipal jails more frequently rely on arrangements with local providers. According to Dumont, Allen, Brockmann, Alexander, and Rich (2013), there is a dearth of information regarding the extent to which health services have been outsourced or privatized, and this information compels one to question whether the private versus public provision of care is correlated at all with the quality and extent of care.

In general, an episode of care is initiated by an inmate who submits a paper request to see a provider. The request may be given to a correctional officer to hand-carry to medical staff or it may be placed in a collection box by the inmate for the medical staff to retrieve. However, few data are available on the percentage of requests granted or average wait time. It is uncertain whether all correctional officers deliver the appointment requests, or whether all medical staff act upon the requests. It appears actual medical treatment is consistently provided for only a fraction of those needing it,

whether for HIV, chronic conditions, mental health, or substance abuse (Dumont et al., 2013).

Based upon the length of incarceration and the type of correctional facility, the types of acute or chronic medical and mental health services provided may be very different. At Maricopa County Jail in Arizona, like all large jails, healthcare is short-term and for the acute cases, where prisons deal more often with chronic, extended care (Cohen, 2015). Cohen suggests we need to recognize jails are de facto healthcare emergency facilities with a limited amount of chronic care issues. Jails as detention-punishment facilities were not built or staffed to reflect that reality. Sheriff Greg Champagne, of St. Charles, Louisiana—who serves as President of the National Association of Sheriffs—recently said, "Chillingly, jail cells have become America's new asylums. It is a revolving door of neglect, incarceration, and further society sidelining" (Chanen, 2016). Concomitantly, prisons have also become the de facto mental health setting for persons with mental illness (James & Glaze, 2006; Morgan et al., 2007).

Those wanting to improve population health within their communities must realize the vast majority of prisoners will be released during their lifetimes (Hughes & Wilson, 2003) and their medical and mental health needs while incarcerated far exceed those found in the general population (Maruschak & Berzofsky, 2015; National Commission on Correctional Health Care, 2002). Poor integration between prison and public health systems results in poor continuity of care for individuals transitioning to community-based healthcare after release from prison. Such fragmentation of care affects prisoners with various disorders—such as HIV, mental illness, diabetes, and

asthma—and can result in delayed treatment and costly use of healthcare (Fazel & Baillargeon, 2011).

Medical services have typically been limited and substandard in prisons and jails. A recommendation made by the 2005 Commission on Safety and Abuse of Prisoners was that since county and state jails and prisons had failed to provide necessary healthcare, the services should be taken over by local public health services and by the United States Public Health Service (Ashe, 2014; Ross, 2009).

Aspects of Imprisonment Affecting Healthcare

Correctional healthcare is difficult, both to provide and to evaluate. Institution overcrowding and conditions, staffing problems, extensive and costly use of healthcare services, competing nonmedical institutional concerns, and society's unwillingness to "reward" prisoners all complicate the delivery of inmate medical and mental health services (Bondurant, 2013; *Brown v. Plata*, 2011; Friedman, 1992; Genty, 1996; Newman & Scott, 2012).

As previously mentioned, many people with mental disorders are arrested and imprisoned, causing mental problems to be imported from the outside world into the prisons (Dumont et al., 2013). In other cases, people without mental disorders develop mental health problems during their imprisonment due to the deprivation they encounter in the prisons (World Health Organization, 2007). According to a World Health Organization (2007) report, other factors which often exist in prisons and could adversely affect mental health include overcrowding, dirty and depressing environments, poor food, inadequate healthcare, aggression (which may take many forms, such as physical, verbal, racial, or sexual), lack of purposeful activity, the

availability of illicit drugs, and either enforced solitude or lack of privacy and time for quiet relaxation and reflection.

Overcrowding conditions

According to Justice Marshall in *Brown v. Plata* (2011), overcrowding had overtaken the limited resources of prison staff, imposed demands well beyond the capacity of medical and mental health facilities, and created unsanitary and unsafe conditions that made progress in the provision of care difficult or impossible to achieve. He also emphasized concerns about prisoners living in crowded, unsafe, and unsanitary conditions which can cause prisoners with latent mental illnesses to worsen and develop overt symptoms.

Many states across the country are dealing with similar issues of overcrowding in their prisons and jails (Carson, 2015; Friedman, 1992; Ross, 2009). Their facilities were designed to meet the needs of 100% occupancy. Having to manage populations beyond full capacity considerably stresses their already strained systems. The courts are becoming increasingly involved in improving conditions within the criminal justice system. *Estelle v. Gamble* (1976) was historically significant because it established the principle that prison conditions can amount to cruel and unusual punishment (Genty, 1996).

Staffing problems

Correctional healthcare systems are not attractive employment prospects for healthcare providers and staff. Many facilities are gloomy, poorly ventilated, inadequately equipped, and run down (Newman & Scott, 2012). Another barrier to adequate staffing is low salary (Friedman, 1992). Budgetary concerns create problems

including difficulties with recruiting physicians and providing them clinical space and the necessary resources to administer effective clinical care.

In *Plata v. Brown* (2014), the three-judge panel determined conditions related to overcrowding, including violence and large caseloads, made it challenging to hire and retain competent physicians. The panel went so far as to accuse the California prison system of hiring any physician who had "a license, a pulse, and a pair of shoes" (Newman & Scott, 2012). In addition to financial, aesthetic, and safety issues, collegiality with large numbers of fellow doctors is often less common because, historically, prison healthcare has been isolated from the larger medical community, and prisons are often located in remote rural places far from large tertiary care centers and medical campuses (Rold, 2008)

Availability and cost of health services

The significant increase of the incarcerated in America has required changes in correctional institutions to appropriately deal with a "graying" population (Davoren et al., 2015); communicable diseases like tuberculosis and HIV, which thrive in crowded facilities; and pregnancy and parenting needs of females. Prisons are being asked to take on the medical and social work responsibilities traditionally borne by hospitals, nursing homes, day care centers, and social services agencies (Genty, 1996; Newman & Scott, 2012). Malingerers and other "frequent flyers" utilize services four times higher than national rates, accounting for a disproportionate amount of medical visits and creating delays in appointment visits for others in need (Lindquist & Lindquist, 1999).

Obtaining funds for prison healthcare is a monumental challenge because legislative pressures to reduce spending and voter reluctance to pay for prisons

compound the cost difficulty (Friedman, 1992). Friedman (1992) points out medical services, like other non-security functions, are often low priorities. However, many courts refuse to consider cost as a factor in determining the adequacy of healthcare for the incarcerated.

Competing non-medical institutional concerns

Rold (2008) and Friedman (1992) describe the difficulties for medical staff when working in a correctional setting—the institutional environment produces continual pressure to tailor the choice and quantity of medical treatment to demands of institutional security, productivity, discipline, and administrative convenience. Such institutional influence means health staff will be under constant pressure not to exercise the discretionary functions delegated to them. "The risk of retaliation for the medical professional who dares to intrude on the turf of the deputy warden for operations is very real" (Nathan, 1985).

Because of security and safety concerns, inmates cannot self-treat minor ailments such as headaches, upset stomachs, or colds. Common items such as aspirin, dental floss, antacids, and Band-Aids typically must be obtained from the medical staff, which greatly increases the demands on medical staff and influences the handling of sick call and specialty referrals (Rold, 2008).

Society's discontent for prisoners and their access to healthcare

Genty (1996) bluntly describes those who are incarcerated as "the others" because they are considered by most people as condemned, sent to remote rural locations, hidden from view, and forgotten. It is likely a significant portion of society is indifferent or actively opposed to prisoners and willing to write them off entirely

(Friedman, 1992; Genty, 1996). Friedman (1992) says there is a common perception that society's criminals should not be treated more favorably than this country's worst-off non-criminals, and that criminals are somehow receiving rewards when they receive free medical care. Politicians and policy-makers increasingly use terminology such as "animals" and "sub-humans" to describe street criminals with the intended result to demonize those in prison, implicitly relieving society of any obligation to supply decent living conditions or medical care (Berkman, 1995).

Standards of Care

Standards for correctional healthcare are variable across prison healthcare systems because systems can choose to use or not use different and multiple guidelines and standards from correctional, medical, and public health organizations like the National Commission on Correctional Health Care (NCCHC), American Correctional Association (ACA), The Joint Commission, American Diabetes Association, and the U.S. Department of Justice which includes the Federal Bureau of Prisons (Wang et al., 2014). The NCCHC standards are significant because they represent the most comprehensive set of correctional health standards in the United States (MacDonald, Parsons, & Venters, 2013). The quality of care in prison is also variable, in part due to profit motives of private, contracted healthcare companies or limited state budgets (Bedard & Frech, 2009; Friedman, 1992; MacReady, 2009; Newman & Scott, 2012; Rold, 2008). Many state and county governments do enforce basic standards of medical care provided in prisons and jails, though these do not include public reporting of health outcomes nor is receipt of state or county funding for correctional institutions dependent on patient outcomes, as it is in the community (Wang et al., 2014).

In Massachusetts, like many other states, the overall health authority for the Department of Correction is the Director of Health Services. As health authority, the Director of Health Services is responsible for arranging and providing accessible quality medical, dental, and mental healthcare to all prison inmates, according to the standards of the ACA, NCCHC, and applicable regulations (Commonwealth of Massachusetts Department of Correction, 2016). The Department of Correction Policy Development and Compliance Unit conducts annual audits at each facility including health services to measure compliance with ACA and NCCHC standards.

Jails are separate entities and are not managed as a healthcare system. Most correctional healthcare systems fall under the security authority such as a state Department of Correction or the local sheriff (MacDonald, Parsons, and Venters, 2013). Within the 14 counties in Massachusetts, the jails and houses of correction are managed autonomously by the county sheriffs (Massachusetts Sheriffs' Association, 2016).

Accreditation

The absence of rudimentary healthcare for prisoners at the time of *Estelle v. Gamble* (1976) and in its early wake prompted the creation of the National Commission on Correctional Health Care out of the American Medical Association and the promulgation of national standards and accreditation (Rold, 2008). While accreditation is voluntary for correctional institutions, some states may write into general statute whether they want accreditation to be required. For example, Massachusetts has nearly 40 facilities accredited with the ACA, including Department of Correction, Federal, and county jail facilities; and one large prison hospital is also accredited with The Joint

Commission (ACA, 2016). Florida, California, and Texas have 129, 57, and 151 institutions accredited, respectively. In contrast, North Carolina has only four facilities (one Federal prison, one private contractor prison for Federal inmates, one county jail, and one military brig) accredited with the ACA; with facilities housing federal inmates also being accredited with The Joint Commission. None of the 55 prison facilities within the North Carolina Division of Adult Correction and Juvenile Justice, or 99 of the state's 100 county jails, are accredited by any of the accreditation agencies (North Carolina Department of Public Safety Website, 2016; North Carolina Sheriffs' Association, 2016). Similar to North Carolina, Alabama has nine accredited facilities, none of which include any of the 28 Alabama Department of Corrections facilities.

Information on accreditation of facilities by the NCCHC is confidential; therefore, data on accreditation of facilities were unavailable (NCCHC, 2016). Like the ACA and The Joint Commission, the NCCHC accreditation process uses external peer review based on approved standards for the agency to determine whether correctional institutions meet the standards in their provision of health services. Each accreditation organization renders a professional judgment and assists in the improvement of services provided (ACA, 2016; NCCHC, 2016; Rold, 2008; The Joint Commission, 2016).

Quality of Care

Assessing quality of care is challenging, and should focus on not only the performance of the practitioners, but also the contributions of patients and of the healthcare system (Donabedian, 1988). Unfortunately, healthcare provided in criminal justice institutions tends to be fragmented and uncoordinated, which negatively impacts quality and makes it difficult to achieve the Triple Aim—improving the experience of

care, improving the health of populations, and reducing per capita costs of healthcare (Berwick, Nolan, & Whittington, 2008; Boutwell & Freedman, 2014).

Donabedian (1988) stated information from which inferences can be drawn about the quality of care can be classified into three categories, "structure," "process," and "outcome." Definitions for each category are as follows:

- Structure: "denotes the attributes of the settings in which care occurs. This includes the attributes of material resources (such as facilities, equipment, and money), of human resources (such as the number and qualifications of personnel), and of organization structure (such as medical staff organization, methods of peer review, and methods of reimbursement)" (Donabedian, 1988, p. 1745).
- Process: "denotes what is actually done in giving and receiving care. It includes the patient's activities in seeking care and carrying it out as well as the practitioner's activities in making a diagnosis and recommending or implementing treatment" (Ibid.).
- Outcome: "denotes the effects of care on the health status of patients and populations. Improvements in the patient's knowledge and salutary changes in the patient's behavior are included under a broad definition of health status, and so is the degree of the patient's satisfaction with care" (Ibid.).

Donabedian's quality model (Figure 1) is very useful when attempting to assess quality of care and the impacts on patient morbidity (including level of patient acuity), mortality, cost, and hospital length of stay. However, researchers should also consider

Figure 1. Donabedian's Model for Process Improvement (Kumar, 2016).

other factors including patient characteristics (e.g., age, sex, race/ethnicity, diagnoses, and severity of illness) and social or family environment characteristics (e.g., number of people living in household, patients' family preferences) (Lu, Sajobi, Lucyk, Lorenzetti, & Quan, 2015).

When determining length of stay, disease groupers, disease severity indexes, and comorbidity indexes are commonly used. Disease groupers or "diagnosis-related groups" (DRGs) refer to the various methods of classifying inpatients by main diagnosis or procedure. Among the large varieties of disease severity indexes and comorbidity indexes, the Charlson Index is the most commonly used.

Morbidity and Patient Acuity

The Charlson Comorbidity Index is a method for measuring patient comorbidity based on the International Classification of Diseases (ICD) diagnosis codes of individual patients using administrative data, such as hospital abstracts data. Each comorbidity category has an associated weight, based on the adjusted risk of one-year mortality, and the sum of all the weights results in a single comorbidity score for a patient (Charlson, Pompei, Ales, & MacKenzie, 1987). Since the publication of Charlson et al.'s original article in 1987, the paper has been cited nearly 5,500 times, and the index has been validated in multiple studies for its ability to predict mortality in

various disease groups, including cancer, renal disease, stroke, intensive care, and liver disease (Baldwin, Klabunde, Green, Barlow, & Wright, 2006; Goldstein, Samsa, Matchar, & Horner, 2004; Hemmelgarn, Manns, Quan, & Ghali, 2003; Lee et al., 2005; Myers, Quan, Hubbard, Shaheen, & Kaplan, 2009; Poses, McClish, Smith, Bekes, & Scott, 1996; Quach et al., 2009). These studies consistently demonstrate the Charlson index is a valid prognostic indicator for mortality.

It is important to note advances in effectiveness of treatment and disease management have required updates to the index. Table 1 depicts a comparison of the original Charlson Comorbidity Index weights with updated index weights from Quan et al. (Charlson et al., 1987; Quan et al., 2011). According to Quan et al. (2011), the updated weight was lower than the Charlson weight for diabetes with chronic complications, renal disease, and AIDS/HIV but higher for congestive heart failure, dementia, mild liver disease, and moderate or severe liver disease. The increase in weight for these comorbidities may be related to an aging population and the increasing severity of disease in hospitalized patients. Quan et al. (2011) eliminated from their index myocardial infarction, peripheral vascular disease, cerebrovascular disease, peptic ulcer disease, and diabetes without chronic complications since their analysis showed those comorbidities were not associated with mortality within 1 year after hospital admission. The updated index of 12 comorbidities, validated by studies from Elixhauser et al. (1998) and van Walveran et al. (2009), showed good-to-excellent discrimination in predicting in-hospital mortality in data from 6 countries and may be more appropriate for use with more recent administrative data (Quan et al., 2011). A score of zero indicates no comorbidities, which predict one-year mortality, were found.

The higher the score, the more likely the predicted outcome will result in higher resource use or mortality (Charlson, Pompei, Ales, & MacKenzie, 1987; University of Manitoba Website, 2016).

Table 1

Charlson Comorbidity Index with Updated Weights

Clinical Condition	***Charlson Weight***	***Quan et al. Updated Weight***
Myocardial infarction	1	0
Congestive heart failure	1	2
Peripheral vascular disease	1	0
Cerebrovascular disease	1	0
Dementia	1	2
Chronic pulmonary disease	1	1
Rheumatologic/Connective tissue disease	1	1
Peptic ulcer disease	1	0
Mild liver disease	1	2
Diabetes without chronic complications	1	0
Diabetes with chronic complications	2	1
Hemiplegia or paraplegia	2	2
Renal disease	2	1
Any malignancy, including leukemia and lymphoma	2	2
Moderate or severe liver disease	3	4
Metastatic solid tumor	6	6
AIDS/HIV	6	4
Maximum comorbidity score	**33**	**28**

Note: Weights are assigned for each condition a patient has. The total equals the score. Example: Chronic pulmonary disease (1) and lymphoma (2) = total score (3).

Some researchers (Charlson et al., 1987; Hutchinson, Thomas, & MacGibbon, 1982) consider age as a factor in determining mortality and have included age-equivalence index scores with the Charlson comorbidity scores for an overall predictor of mortality for longitudinal studies. According to Hutchinson, Thomas, and

MacGibbon (1982), each decade of age over 40 would add 1 point to risk. The age points would be added to the score from the comorbidity index; therefore, a patient 50 years old with a comorbidity score of 5 would be rated as a 6.

The Charlson Comorbidity Index with the Quan et al. (2011) updated weighting was used for this study. As previously stated, because of advances in chronic disease management and improvements in treatments and technology, patients now survive longer than they did in 1984 when the original Charlson weights were developed (Quan et al., 2011). Therefore, Quan et al. (2011) felt it was time to reevaluate the Charlson comorbidities and weights for use with more recent data. The age-equivalence index was not used since propensity-score matching utilized the covariates for age and Charlson score.

Prevention Quality Indicators and Ambulatory Care Sensitive Conditions

According to the Agency for Healthcare Research and Quality (AHRQ, 2001), in healthcare, as in other arenas, that which cannot be measured is difficult to improve. Providers, consumers, policy makers, and others seeking to improve the quality of healthcare need accessible, reliable indicators of quality which they can use to flag potential problems, follow trends over time, and identify disparities across regions, communities, and providers. A team of researchers from the AHRQ's Evidence-Based Practice Center (EPC) at the University of California San Francisco (UCSF) and Stanford University developed Prevention Quality Indicators (PQIs) to meet research needs. The rigorous evaluations performed by the UCSF-Stanford EPC, based on literature review and empirical testing of indicators, resulted in 16 indicators that reflect ambulatory care sensitive conditions (ACSCs). These ACSCs have been reported and

tested in a number of published studies involving consensus processes involving panels of expert physicians, using a range of methodologies and decision criteria (AHRQ, 2001).

The 16 ambulatory care sensitive conditions, which are measured as rates of admission to the hospital, are as follows:

- Bacterial pneumonia
- Dehydration
- Pediatric gastroenteritis
- Urinary tract infection
- Perforated appendix
- Low birth weight
- Angina without procedure
- Congestive heart failure
- Hypertension
- Adult asthma
- Pediatric asthma
- Chronic obstructive pulmonary disease
- Diabetes short-term complication
- Diabetes long-term complication
- Uncontrolled diabetes
- Lower-extremity amputation among patients with diabetes

See Appendix C for detailed definitions of each ACSC used in this study. Please note pediatric gastroenteritis, low birth weight, and pediatric asthma were not examined in this study as only adult cases were analyzed.

Ambulatory care sensitive condition-related hospitalizations are often viewed as indicators of lack of proper access to primary care (AHRQ, 2001; Basu, Friedman, & Burstin, 2002). Garnering a better understanding of ACSCs can help criminal justice system leaders, both custodial and medical, better manage scarce resources by identifying ways to reduce unnecessary admissions, target interventions as effectively as possible, and reduce the risks of hospitalization by either preventing the onset of an

illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease or condition (Basu, Friedman, & Burstin, 2002; Billings et al., 1993).

Chronic medical conditions, such as asthma, diabetes, and hypertension, are conditions that can often be managed with timely and effective treatment in an outpatient setting, thereby preventing hospitalization. Furthermore, the use of inpatient services rather than ambulatory care for managing chronic medical conditions may be more costly (Bindman et al., 1995; Billings et al., 1993). According to Bindman et al. (1995), preventable hospitalization rates might provide local, state, and federal policy-makers, as well as healthcare providers responsible for a defined population of patients, a method for measuring the effectiveness of outpatient care delivery. Billings et al. (1993) reported hospitalization rates were higher in low-income areas in New York City due to socioeconomic status and barriers to access to care. Their findings also suggested access to ambulatory care and the performance of the outpatient care delivery system may have a substantial effect on admission rates for a broad range of medical and surgical conditions. They recommended the need for further study to determine the relative impact of various economic, structural, and cultural factors that affect access to care, which applies to both civilian and correctional environments.

Ensuring public safety is of paramount importance to the criminal justice system. In order to protect communities, considerable costs are generated from transporting inmates and guarding them, day and night, at local hospitals. Based upon the security level of each inmate—minimum-, medium-, or maximum-security, one or more correctional officers are required. High profile inmates or those who are deemed an escape risk require additional security resources. When considering the use of one

or more vehicles, security equipment, and custody staff just for one inmate's hospital stay, the costs can add up quickly. For example, if 10 or more inmates are hospitalized on a daily basis, each inmate trip would require the use of a correctional vehicle, an ambulance if the patient is critically ill, and at least two officers to provide security during the trip. Complicating the issue is the unpredictability of hospital admissions, which requires institutions to pull from already stretched resources and pay overtime to bring in off-duty officers to cover posts vacated by officers needed for inmate transport and in-hospital security.

Previous Studies Comparing Inmate Cohorts

Few studies have been published with the intent of comparing hospital admissions, outcomes, or mortality for inmate and non-inmate cohorts; and only one study was found comparing inmates to non-inmates utilizing HCUP data. Winter (2011) used HCUP data attempting to determine if inmates: 1) receive a different quality of care than non-inmates using the measures "number and type of procedures" and "time from admission to first procedure;" and 2) have different levels of acuity than non-inmates using the measures of length of stay, risk of mortality, severity of illness, and number of diagnoses. Although Winter's focus was on patients with a diagnosis of either heart disease or chest pain, her method for determining the level of acuity (i.e., using measures for risk of mortality, severity of illness, and number of diagnoses) to assess morbidity is useful in this study.

A study by Patterson (2010) compared mortality rates between a "cloistered sample" of working-age prisoners and non-prisoners by age, sex, race, and socioeconomic status for the years 1985 thru 1998. The high percentage of minorities,

poorer people, people with lower levels of education, and people with higher levels of morbidity suggests levels of mortality in prison would be higher than the mortality levels of the non-incarcerated population. However, according to Patterson (2010), several prison mortality studies illustrate findings that contrast with the expectation of higher mortality in prison (Mumola, 2007; Novick & Remmlinger, 1978; Ruback & Innes, 1988). It is important to note many study design limitations made it difficult to make causal claims, prompting recommendations for further research (Patterson, 2010).

An additional study on prisoner mortality in the North Carolina Department of Correction was conducted by Rosen, Wohl, and Schoenbach (2011), looking at data from 1995 through 2005. Their results found the mortality of black prisoners was lower than that of black state residents for both traumatic and chronic causes of death. They also found the mortality of white prisoners was lower than that of white state residents for accidents, but greater for several chronic causes of death. They recommended future studies be designed to disentangle the effects of morbidity and prison healthcare on chronic disease mortality to further elucidate the healthcare needs of prisoners during their incarceration and after their release (Rosen, Wohl, & Schoenbach, 2011).

Propensity-score matching, discussed in the previous chapter, was used in several studies (Bjertnaes, 2014; Hanna et al., 2012; Nosyk et al., 2006; Whittenbecher, Scheller-Kreinsen, Röttger, & Busse, 2013) to create comparable cohorts. Ratio matching varied amongst the studies, including 1:1 matching (Bjertnaes, 2014; Nosyk, 2006; Whittenbecher, 2013), and 1:4 matching (Hanna et al., 2012). The types of control variables used for matching included patient demographics (e.g., age, race,

gender, and income), expected payer, hospital, Charlson Comorbidity Index, and total charges. Most studies grouped age by 10 year increments. They also categorized income by low, medium, and high. Statistical analyses were conducted by unpaired *t* test with 2-tail distribution for quantitative values and Chi-square (χ^2) test for categorical values. *P* values less than .05 for associations were considered to confer significance.

Literature Search

To be able to synthesize current evidence, identify key perspectives, and incorporate recommendations into this study, a wide cross-section of literature was examined by performing a multi-field search of the Ovid/MEDLINE library database, the AHRQ HCUP database, and the Bureau of Justice Statistics publication search feature for articles published between 1996 to the second week of September, 2016. The search terms were divided into the following categories using the Boolean and positional operators AND and OR to focus search results: 1) "retrospective analysis," including searches for "hospital admission," "Massachusetts," and "HCUP" databases; 2) "propensity-score matching," which included "hospital admission," and outcomes for "morbidity," "patient acuity," "mortality," "cost," "length of stay," and "ambulatory care sensitive conditions;" and 3) "criminal justice," including key words for "prisoner," "inmate," "incarcerated," "prison," and "jail."

Inclusion and exclusion criteria

Literature articles were included if they matched topics including retrospective analyses, propensity scores, hospital admissions, and outcomes, and contained any

viewpoint on criminal justice (prison or jail) healthcare. Full text evaluation of each result was completed and all irrelevant articles were removed.

Search results

The cumulative search results provided 579 peer reviewed publications, 424 from Ovid/MEDLINE, 134 from the AHRQ Research Studies database, and 21 from the Bureau of Justice Statistics Publications and Products search engine. After removal of duplicates (22) and a thorough review of titles and abstracts, articles were judged against the inclusion criteria to derive the final set of 56 publications (37 from Ovid/MEDLINE, including 17 related to inmates; 11 from AHRQ, including only 1 related to inmates; and 8 from the Bureau of Justice Statistics of which all were related to inmates) for full-text literature review.

3. METHODOLOGY

Study Design and Hypotheses

Design

A retrospective analysis of archival inpatient data from hospitals in the Commonwealth of Massachusetts for calendar years 2011-2013 was conducted, comparing a cohort of patients admitted from court or law enforcement sources with a matched sample of patients from other sources. Data were obtained from the State Inpatient Databases (SID), which are part of the Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP). The individual discharge is the unit of analysis.

To ensure a comparable matching between incarcerated and non-incarcerated groups and to balance baseline characteristics between the two groups, propensity-score matching was conducted. A 1:1 matching ratio was used, which according to Hanna et al. (2012) maximizes the power while maintaining a balance between covariates between the two groups. The power of a research study is that study's probability of correctly rejecting the null hypothesis in favor of the alternative hypothesis (Shi, 2008).

Shi (2008) suggests sample size is determined by a number of factors including the characteristics and size of the population, the nature of the analysis to be conducted, and the number of variables to be analyzed at one time. A rule of thumb is to include at

least 30 to 50 cases for each variable subcategory to ensure sufficient cases are represented (Shi, 2008). SAS version 9.4 (SAS Institute, 2011) was used to conduct the propensity-score matching. Shi's (2008, p. 284) sample size selection chart shows a population of 100,000 would require a minimum sample size of 398 in order to meet a confidence level of 95% and a relative precision of 5%. A sample of 3,000 or more incarcerated patients would be considered a large sample. When including non-incarcerated patients, the total sample was expected to be approximately 6,400.

Hypotheses

Research question

Are there any differences in morbidity (including level of patient acuity), mortality, costs, lengths of stay, and ambulatory care sensitive conditions for hospitalized patients admitted from court or law enforcement sources as compared to patients from other sources?

Null hypothesis

There are no differences in morbidity (including level of patient acuity), mortality, costs, lengths of stay, and ambulatory care sensitive conditions between incarcerated and non-incarcerated patients.

Alternative hypothesis

Incarcerated patients have higher morbidity (including level of patient acuity), mortality, costs, lengths of stay, and ambulatory care sensitive conditions compared to non-incarcerated patients.

Population and Sample

The population for this study includes all adult patients, ages 18 and above, with documented hospital admissions in the HCUP SID for Massachusetts from 2011-2013. Out-of-state residents (identified in the variable PSTATE) were excluded from the data set to limit confounding caused by patient lifestyles and levels of care provided in different states. The variable ASOURCE (Admission source—uniform coding) was used to identify admissions from court/law enforcement versus other sources. Values include "1" for Emergency Department; "2" for Another Hospital; "3" for Another Health Facility including long term care; "4" for Court/Law Enforcement; "5" for Routine, Birth, and Other; "." for Missing; and ".A" for Invalid. Maternity-related cases were also excluded.

Data Set Description

The data set consists of variables divided into 3 categories: covariates for propensity-score matching of cohorts, outcome variables, and file linkage variables. All records with missing or invalid data element values (e.g., age, gender, race, length of stay (LOS), etc.) were removed from the final data set since those variables are of primary interest in this study. Cases with a length of stay coded as "0" or "1" in the LOS data element were excluded from analysis, since they may have reflected elective procedure or observation types of visits.

HCUP data management and quality assurance

The HCUP SID dataset is subject to standards and protections established by the Health Insurance Portability and Accountability Act of 1996 (HIPAA, 1996) and implementing regulations. The principal investigator completed the HCUP Data Use

Agreement Training on 9 September 2016, and submitted a copy of the completion certificate along with a signed Data Use Agreement for State Databases form to the Medical University of South Carolina College of Health Professions, per guidance from the Doctoral Project Committee chairperson. The procedures used to protect data in this study such as secured storage, protected data access, and privacy protection of hospital or patient identifiable information are compliant with the Data Use Agreement.

Annual data quality assessments of the HCUP data are performed by independent contractors, which guarantee internal validity of the databases. Since 1998, quality control procedures utilize multiple edit checks to assess validity of values, internal consistency of data elements, and consistency of values with established norms (HCUP Quality Control Procedures, 2016).

Operational Definitions of Variables

Definitions and values for each variable used in this study were obtained from the HCUP webpage titled "Central Distributor SID: Availability of Data Elements by Year" (ARHQ HCUP Website, 2016, July 15). Definitions from other sources are referenced separately.

Covariates

Covariates used to match cohorts include age, Charlson Comorbidity Index score, sex, primary expected payer, and race. Since many of the prisoner admissions were for psychological issues, additional covariates for psychological conditions, suicide, and injuries were also used to ensure a comparable proportion of controls were being admitted for similar broad categories. The covariates are represented by the data

elements AGE, CHARLSSCORE, FEMALE, INJURY, PAY1, PSYCH, RACE, and SUICIDE. Definitions and values for the covariates are as follows:

- AGE (Age in years at admission): Age in years is calculated from the birth date and the admission date in the HCUP State databases. Values include "0-124" for Age in Years, "." for Missing, ".A" for Invalid, and ".C" for Inconsistent.

- CHARLSSCORE (Charlson Comorbidity Index Score): The Charlson Comorbidity Index takes into account the number and seriousness of comorbid disease and is used to predict the risk of death within 1 year. Values in the SID for Massachusetts are the updated index scores and can range from "0" for no comorbid disease, up to a maximum of "28" based upon the number and severity of comorbid disease.

- FEMALE (Indicator of sex): The sex of the patient is provided by the data source. Values include "0" for Male, "1" for Female, "." for Missing, ".A" for Invalid, and ".C" for Inconsistent.

- INJURY (Injury ICD-9-CM diagnosis reported on record): Records with injuries are identified by Clinical Classifications Software (CCS) ICD-9-CM diagnosis classification (E_CCS1$\geq$2600). Values for INJURY include "0" for no injury diagnosis reported on discharge record, and "1" for injury diagnosis reported on discharge record.

- PAY1 (Primary expected payer—uniform): PAY1 indicates the expected primary payer. Values include "1" for Medicare, "2" for Medicaid, "3" for

Private Insurance, “4” for Self-pay, “5” for No Charge, “6” for Other, “.” for Missing, and “.A” for Invalid. For analysis purposes, Self-pay and No Charge were merged with Other, resulting in only four categories for primary expected payer.

- PSYCH: Records with psychological conditions are identified by Clinical Classifications Software (CCS) ICD-9-CM diagnosis classification (DXCCS1>649). Values for PSYCH include “0” for no psychological diagnosis reported on discharge record, and “1” for psychological diagnosis reported on discharge record.

- RACE (Race—uniform): HCUP coding includes race and ethnicity in one data element (RACE). If the source supplied race and ethnicity in separate data elements, ethnicity takes precedence over race in setting the HCUP value for race. Values include “1” for White, “2” for Black, “3” for Hispanic, “4” for Asian or Pacific Islander, “5” for Native American, “6” for Other, “.” for Missing, and “.A” for Invalid. For analysis purposes, Asian or Pacific Islander and Native American were merged with Other, resulting in only four categories for race.

- SUICIDE: Records with conditions related to suicide are identified by Clinical Classifications Software (CCS) ICD-9-CM diagnosis classification (E_CCS1=662). Values for SUICIDE include “0” for no suicide diagnosis reported on discharge record, and “1” for suicide diagnosis reported on discharge record.

Outcome variables

The outcomes of interest are morbidity (including level of patient acuity), mortality, cost, length of stay, and ambulatory care sensitive conditions. They were determined by the data elements ADRGSEV, ADRGRISKMORTALITY, NCHRONIC, and NDX for morbidity; DIED for mortality; TOTCHG and cost obtained from cost-to-charge ratio conversion for estimated cost (TOTCOST); LOS for length of stay; and DXn (ICD-9-CM) and PQIn for ambulatory care sensitive conditions (ACSC). Definitions and values for the outcome variables are as follows:

Morbidity

The Centers for Disease Control and Prevention (CDC) defines morbidity as illness or lack of health caused by disease, disability, or injury (CDC, 2016). Similarly, Jacobson (2014) defines morbidity as the presence of illness or disease, whether that disease is relatively mild, like the common cold, or quite severe. For this study, morbidity includes the level of patient acuity and was identified by analyzing measures for the number of diagnoses, number of chronic conditions, risk of mortality, and severity of illness. The National Library of Medicine (2013) defines patient acuity as the assessment of a patient's illness, its chronicity, severity, and other qualitative aspects. Data elements for morbidity and patient acuity are as follows:

- NDX (Number of diagnoses on this record): NDX indicates the total number of diagnoses (valid and invalid) coded on the discharge record. In assigning NDX, the first listed diagnosis is included in the count, even if it is blank, so long as there is a secondary diagnosis present. The values range from "0 to 30" diagnoses.

- NCHRONIC (Number of chronic conditions): The data element NCHRONIC contains the count of unique chronic diagnoses reported on the discharge. A chronic condition is defined as a condition that lasts 12 months or longer and meets one or both of the following tests: (a) it places limitations on self-care, independent living, and social interactions; and/or (b) it results in the need for ongoing intervention with medical products, services, and special equipment. The values range from "0 to 30" chronic conditions.

- ADRGRISKMORTALITY (All Patient Refined DRG mortality risk): The All Patient Refined Risk of Mortality Class reports the likelihood of dying as determined by the All Patient Refined system. Values include "1" for Minor likelihood of dying, "2" for Moderate likelihood of dying, "3" for Major likelihood of dying, "4" for Extreme likelihood of dying, "." for Missing; and ".A" for Invalid.

- ADRGSEV (All Patient Refined DRG severity level): The All Patient Refined DRG Complexity Subclass reports the complexity subclass for the All Patient Refined DRGs. This is an indicator of the extent of physiologic decompensation or organ system loss of function. With the exception of newborn patients, each APR-DRG is subdivided into four complexity subclasses. Assignment to a complexity subclass is based, in part, on the complexity of a patient's secondary diagnoses, interactions among secondary diagnoses, age, principal diagnosis, and the presence of certain non-operating room procedures. Values include "0" for Newborn DRGs, "1" for Minor loss of

function, “2” for Moderate loss of function, “3” for Major loss of function, “4” for Extreme loss of function, “.” for Missing; and “.A” for Invalid.

Mortality

Mortality is a measure of the incidence of deaths in a population (CDC, 2016). The data element “DIED” indicates died during hospitalization and is coded from the discharge disposition of the patient. Values include “0” for Did not Die, “1” for Died, “.” for Missing, and “.A” for Invalid.

Cost

Estimated hospital costs were calculated for each patient by multiplying the total charges and hospital-specific cost-to-charge ratios provided with the SID and Central Distributor cost-to-charge data files.

- TOTCHG (Total charges—cleaned): TOTCHG contains the edited total charges. TOTCHG is a continuous variable with value representing rounded charges in United States dollars. Bills with missing charges were excluded from the analysis (“.” for Missing, “.A” for Invalid, and “.C” for Inconsistent).
- TOTCOST (Total Estimated Cost): TOTCOST is a continuous variable with value representing rounded charges in United States dollars. TOTCOST is calculated by multiplying TOTCHG by the hospital-specific cost-to-charge ratios.

Length of stay

Length of stay can also be used to determine patient acuity. However, it was analyzed separately in this study.

- LOS (Length of Stay—cleaned) is a continuous variable with the value represented in days. It is calculated by subtracting the admission date from the discharge date. Values include "0-365" for Days, "." for Missing, ".A" for Invalid, and ".C" for Inconsistent.

Prevention quality indicators and ambulatory care sensitive conditions

Prevention Quality Indicators (PQIs) and ambulatory care sensitive conditions (ACSCs) are identified through ICD-9-CM codes found in the diagnosis variable (DXn) and through the use of the PQIn variables found in variables PQI1, 2, 3, 5, 7, 8, 10, 11, 12, 14, 15, and 16) which are defined in Figure 2.

- DXn (Diagnosis – ICD9-CM): In the HCUP database the first listed diagnosis (DX1) is the principal diagnosis defined as the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care. Values include "ann" or "annnn" for 3- or 5-digit ICD-9-CM codes respectively, "blank" for Missing, "invl" for Invalid, and "incn" for Inconsistent. For Massachusetts, there can be up to 15 diagnoses recorded.

- PQIn (Prevention Quality Indicator): Values for PQIn include "0" for No designated ICD-9 codes are linked to the indicator, and "1" for Yes, at least one designated ICD-9 code is linked to the indicator. Descriptions of each PQI and designated ICD-9 codes are listed in Appendix C.

- ACSC (Ambulatory Care Sensitive Condition): Values for ACSC include "0" for No PQIs are linked to the indicator, and "1" for Yes, at least one PQI is linked to the indicator.

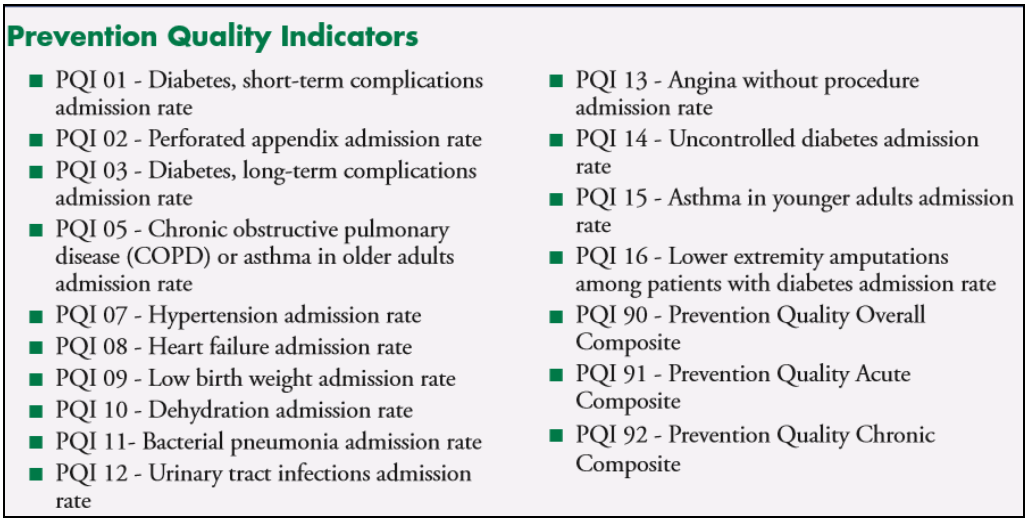

Figure 2. Prevention Quality Indicators (AHRQ Brochure, 2015).

Linkage variables

The data elements DSHOSPID, KEY, and YEAR were used to link the SID with the cost-to-charge ratios file.

- DSHOSPID (Data source hospital number) is the data source's own number scheme for identifying hospitals and facilities. Massachusetts uses from 1 to 5 numerical characters. The DSHOSPID variable was used to match records and link files for cost-to-charge ratio calculations.

- KEY (Unique record identifier) contains a unique record identifier, not a patient identifier. Beginning in the 1998 data, all HCUP databases are sorted by KEY. KEY was used to link records in the Core and Charges files in the SID with the Central Distributor Cost-to-Charge Ratios File to better identify costs.

- YEAR (Calendar year): The discharge year (YEAR) is always coded. Only records with the 4-digit calendar years 2011-2013 were used.

Data Analysis

The analytical approaches most used by researchers when comparing two or more groups and when utilizing propensity-score matching is the Chi-square (χ^2) analysis for categorical variables, *t* test for continuous variables, multiple linear regression for continuous dependent variables (e.g., length of stay, number of diagnoses, number of chronic conditions, and cost of hospitalization), and logistic regression models for categorical dependent variables (e.g., risk of mortality and severity level), adjusting for the propensity score (Kulkarni et al., 2010; Nosyk et al., 2006; Webster, Zhang, & Rosenthal, 2006; Winter, 2011). These tests were used to investigate relationships between outcome variables and whether or not the patient was an inmate, controlling for age, Charlson Comorbidity Index score, indicator of sex, primary expected payer, race, psychological conditions, suicide, and injuries.

Statistical analyses were performed using SAS version 9.4 (SAS Institute, 2011) and IBM Corporation SPSS Statistics for Windows (version 24.0) (IBM Corporation, 2016).

Limitations

The HCUP SID is an administrative data set available to the public. Limitations to the databases include data collection and entry errors, lack of clinical detail (e.g., stage of disease, vital statistics), state-dependent ability to track patients over time or setting, and restriction of analysis to variables that are found in the data set (Steiner, Elixhauser, & Schnaier, 2002). Information on the healthcare inmates receive within prisons and jails is not available, so it is not possible to examine potential disparities in healthcare utilization that occurs within facilities prior to hospitalization. Inmates have

no control over the hospitals to which they are sent, which could result in sample selection bias, as there may be unobserved correlations between inmates from particular prisons (Winter, 2011).

The PQI and ACSC data have at least four limitations (AHRQ, 2001). The first limitation is the complexity of the relationship between socioeconomic status and PQI rates makes it difficult to delineate how much of the observed relationships are due to true access to care difficulties in potentially underserved populations, or due to other patient characteristics, unrelated to quality of care, that vary systematically by socioeconomic status. The second limitation is environmental conditions that are not under the direct control of the healthcare system can substantially influence some of the PQIs (e.g., COPD and asthma admission rates are likely to be higher in areas with poorer air quality). The third is the evidence related to potentially avoidable hospital admissions is limited for each indicator, because many of the indicators have been developed as parts of sets. Lastly, the fourth limitation is relatively little is known about which components represent the strongest measures of access and quality.

Limitations in secondary databases include predetermined variables and fixed methods of data collection and input (Best, 1999). Data from the HCUP SID have limitations which affect their usefulness and accuracy for some analyses. Schoenman, Sutton, Elixhauser, and Love (2007) described the limitations as falling into three categories: quality of data elements, missing data elements, and excluded populations (e.g., Federal hospitals, such as Veteran's Administration and Indian Health Service). Some states may not utilize all of the available data elements in the SID, as was found with the 2011-2013 SIDs where very few states (eight in 2011, five in 2012, and two in

2013) used the admission source data element which allowed for determining patient admissions from court or law enforcement (AHRQ HCUP, 2016, July 15). If this coding were extended to other states, it would enable more extensive data analysis and increase the generalizability of findings. Data quality suffers in multi-state analyses when states collect data elements differently, such as collecting different categories for expected payer categories or for race/ethnicity (Andrews, 2015). Considering these and other limitations, researchers need to be thoughtful in designing studies with HCUP data and interpreting the results (Mutter & Stocks, 2014).

Protection of Human Subjects

According to the HCUP Data Use Agreement (2016, September 9), HCUP databases conform to the definition of a limited data set. A limited data set is healthcare data in which 16 direct identifiers, specified in the Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, have been removed. Under the HIPAA Privacy Rule, review by an Institutional Review Board is not required for use of limited data sets (HIPPA Privacy Rule, Government Printing Office, 2016a, 2016b). Also, this study is considered "non-human subject" research; therefore, Institutional Review Board approval was not required.

4. RESULTS

Descriptions of Sample Population and Matched Cohort

Overall, 123,205 patients were included (Table 2), which consists of 3,212 patients admitted from court or law enforcement sources and the remaining 119,993 patients (30% random sample of the non-inmate population) admitted from other sources. Propensity-score matching with a 1:1 matching ratio resulted in 6,424 patients (3,212 inmates—"treated"; and 3,212 non-inmates—"control") identified for analysis.

Before matching, several demographic differences were evident (Table 2) between the inmate and non-inmate populations. The inmate population was younger, having a mean age of 44 years vs. 60 years for the non-inmate population (44.22 vs. 59.82, $p = <.0001$). The proportion of males to females was higher for inmates compared to non-inmates (55.5% male, 44.5% female vs. 49.2% male, 50.8% female; $p = <.0001$). The proportions of Hispanic and Black inmates were higher compared to non-inmates (58% White, 30% Hispanic, 10% Black vs. 82% White, 7% Hispanic, 7% Black; $p = <.0001$). Inmates had fewer diagnoses for injuries (7.2% vs. 21.4%, $p = <.0001$) and significantly more diagnoses for psychological issues (93.9% vs. 12.0%; $p = <.0001$). The Charlson Comorbidity Index Score was lower among inmates as compared to non-inmates (0.57 vs. 1.45, $p = <.0001$). Lastly, primary insurance payer usage was more balanced for inmates (34% Medicare, 27% private insurance, and 26%

Medicaid vs. 52.5% Medicare, 27.7% private insurance, and 13.0% Medicaid; p = <.0001). All variables, with the exception of suicide, had statistically significant p values ($p < .0001$), indicating significant differences between the unmatched groups.

After matching, these differences no longer existed (Table 2), demonstrating the utility of propensity-score matching for selection bias reduction. For example, inmate versus non-inmate mean age was similar (44.2 vs. 44.5, $p = 0.428$); as was sex (55.5% vs. 56.7% male, 44.5% vs. 44.3% female; $p = 0.352$); and race was very similar (58.2% vs. 58.2% White, 30.0% vs. 30.1% Hispanic, and 9.7% vs. 9.7% Black; $p = .999$).

Table 2

Demographic Characteristics before and after Propensity-Score Matching

	Unmatched Groups (N = 123,205)			Matched Groups (n = 6,424)		
Variable	Non-inmate Patients (n = 119,993)	Inmate Patients (n = 3,212)	*p* Value 2-sided	Comparison Patients (n = 3,212)	Inmate Patients (n = 3,212)	*p* Value 2-sided
Age, yr.						
Mean (SD)	59.82 (17.061)	44.22 (17.134)	.000	44.49 (17.004)	44.22 (17.134)	.428
Median	62.00	43.00		43.00	43.00	
Range	18-85	18-85		18-85	18-85	
Age category, yr. (%)						
18-30	9,154 (7.6)	833 (25.9)	.000	792 (24.7)	833 (25.9)	.603
31-43	12,242 (10.2)	829 (25.8)		854 (26.6)	829 (25.8)	
44-55	23,244 (19.4)	774 (24.1)		765 (23.8)	774 (24.1)	
56-85	75,353 (62.8)	776 (24.2)		801 (24.9)	776 (24.2)	
Race (%)						
White	98,215 (81.9)	1,870 (58.2)	.000	1,868 (58.2)	1,870 (58.2)	.999
Black	8,292 (6.9)	311 (9.7)		311 (9.7)	311 (9.7)	
Hispanic	8,406 (7.0)	965 (30.0)		968 (30.1)	965 (30.0)	
Other	5,080 (4.2)	66 (2.1)		65 (2.0)	66 (2.1)	
Gender (%)						
Male	59,051 (49.2)	1,783 (55.5)	.000	1,820 (56.7)	1,783 (55.5)	.352
Female	60,942 (50.8)	1,429 (44.5)		1,392 (43.3)	1,429 (44.5)	
Insurance Type (%)						
Medicare	63,034 (52.6)	1,079 (33.6)	.000	1,115 (34.7)	1,079 (33.6)	.048
Medicaid	15,638 (13.0)	849 (26.4)		856 (26.7)	849 (26.4)	
Private	33,269 (27.7)	924 (28.8)		835 (26.0)	924 (28.8)	
Other	8,041 (6.7)	360 (11.2)		406 (12.6)	360 (11.2)	
Injury (%)	25,731 (21.4)	231 (7.2)	.000	211 (6.6)	231 (7.2)	.324
Suicide (%)	964 (0.8)	26 (0.8)	.969	30 (0.9)	26 (0.8)	.591
Psych (%)	14,420 (12.0)	3,015 (93.9)	.000	3,015 (93.9)	3,015 (93.9)	1.0
Charlson Score						
Mean (SD)	1.45 (2.029)	0.57 (1.003)	.000	0.57 (1.129)	0.57 (1.003)	.010
Median	1.0	0.00		0.00	0.00	
Range	0-16	0-10		0-10	0-10	

Propensity-score matching was performed in SAS utilizing the Greedy Matching method available in PROC PSMATCH. In propensity-score matching, prison (inmate or non-inmate) was treated as the dependent variable and the variables listed in Table 2 as predictor variables. A 1:1 matching ratio was used, whereby a single treated participant is matched to a single untreated participant who has the most similar propensity score. Evidence of balance on covariates was checked and illustrated with a Love Plot of standardized mean or proportion differences for all covariates before and after matching (Figure 3). The after matching green open circles indicate all predictors met the high quality reduction in selection bias of less than 0.20 standardized differences as shown by the vertical broken lines in Figure 3. Statistical

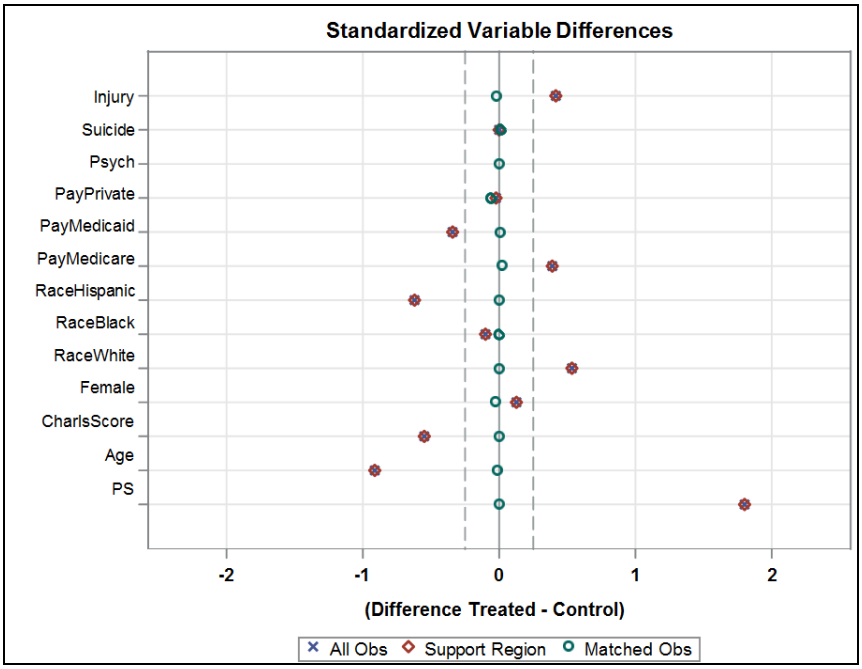

Figure 3. Standardized Variable Differences Graph. Illustrates strong balance of variable differences within the matched cohort.

significance of differences in means and proportions before and after the match was confirmed by using the *t* test for continuous variables and the Chi-square (χ^2) test for categorical variables (Table 2).

Outcomes Analysis

Descriptive statistics for unadjusted outcomes (Table 3) reveal there are statistically-significant differences between the inmate and non-inmate cohorts for several variables, including the number of diagnoses, number of chronic conditions, DRG risk of mortality, DRG severity level, estimated total cost, and length of stay.

On average, inmate patients had less diagnoses recorded in their discharge records than did non-inmates (7.67 vs. 7.99, $p = < .0001$). However, inmate patients had more chronic conditions (4.78 vs. 4.63, $p = .011$) compared to non-inmates. Inmates also had higher total costs ($9,890 vs. $8,243, $p = < .0001$) than non-inmates and, they had longer lengths of stay (10.25 vs. 7.67, $p = < .0001$).

Data for DRG Risk of Mortality and DRG Severity Level variables showed larger proportions of inmate patients were less likely to die (85.7% vs. 76.0% minor likelihood; 11.2% vs. 17.8% moderate likelihood, $p = < .0001$) and had less loss of function (28.0% vs. 24.2% minor loss; 60.9% vs. 54.8% moderate loss, $p = < .0001$) as compared to their non-inmate counterparts.

Since data were so sparse for Prevention Quality Indicators and Ambulatory Care Sensitive Conditions, the results for these variables were not very informative in this population.

In-hospital mortality was not statistically different (0.2% vs. 0.2%, $p = 1.0$) for the matched cohorts.

Table 3

Descriptive Statistics for Unadjusted Outcomes

Variable	Matched Groups (n = 6,424)		
	Comparison Patients (n = 3,212)	Inmate Patients (n = 3,212)	*p* Value 2-sided
Number of Diagnoses			
Mean (SD)	7.99 (3.880)	7.67 (3.078)	.000
Median	8.0	7.0	
Range	1-15	1-15	
Number of Chronic Conditions			
Mean (SD)	4.63 (2.319)	4.78 (2.162)	.011
Median	4.0	4.0	
Range	0-14	0-14	
DRG Risk of Mortality (%)			
Minor Likelihood of Dying	2,441 (76.0)	2,754 (85.7)	.000
Moderate Likelihood of Dying	572 (17.8)	361 (11.2)	
Major Likelihood of Dying	154 (4.8)	84 (2.6)	
Extreme Likelihood of Dying	45 (1.4)	13 (0.4)	
DRG Severity Level			
Minor Loss of Function	778 (24.2)	901 (28.0)	.000
Moderate Loss of Function	1,759 (54.8)	1,955 (60.9)	
Major Loss of Function	565 (17.6)	331 (10.3)	
Extreme Loss of Function	110 (3.4)	25 (0.8)	
Mortality—Died (%)	6 (0.2)	5 (0.2)	1.0
Estimated Total Cost ($)			
Mean (SD)	8,243 (11,061.633)	9,890 (11,859.072)	.000
Median	5,116	6,322	
Range	686-192,980	1,381-160,069	
Length of Stay (day)			
Mean (SD)	7.67 (8.647)	10.25 (12.057)	.000
Median	5.0	7.0	
Range	2-173	2-161	
Prevention Quality Indicators (%)			
PQI 1 Diabetes Short-term Complications	5 (0.2)	1 (0.0)	.219
PQI 2 Perforated Appendix	1 (0.0)	0 (0.0)	1.0
PQI 3 Diabetes Long-term Complications	50 (1.6)	64 (2.0)	.219
PQI 5 COPD or Asthma in Older Adults	4 (0.1)	2 (0.1)	.687
PQI 7 Hypertension	1 (0.0)	7 (0.2)	.070
PQI 8 Heart Failure	5 (0.2)	4 (0.1)	1.0
PQI 10 Dehydration	2 (0.1)	1 (0.0)	1.0
PQI 11 Bacterial Pneumonia	2 (0.1)	3 (0.1)	1.0
PQI 12 Urinary Tract Infection	2 (0.1)	2 (0.1)	1.0
PQI 14 Uncontrolled Diabetes	0 (0.0)	1 (0.0)	1.0
PQI 15 Asthma in Younger Adults	3 (0.1)	0 (0.0)	.250
PQI 16 Lower-Extremity Amputation among Patients with Diabetes	0 (0.0)	0 (0.0)	N/A
Ambulatory Care Sensitive Conditions (%)	70 (2.2)	83 (2.6)	.326

Several regression analyses were conducted to investigate associations between inmate status and outcome variables. Multiple generalized linear regression was used to assess association between comparison groups for continuous dependent variables, to include number of chronic conditions, number of diagnoses, total cost, and length of stay. Multiple logistic regression models for categorical dependent variables were used to examine group association with DRG mortality risk, DRG severity level, in-hospital mortality, and admission for an ambulatory care sensitive condition. Statistically-significant differences (Adjusted *p* Values) between the matched groups were confirmed for variables listed in Table 4.

Table 4

Results for Unadjusted and Adjusted Outcomes

Variable	Matched Groups (n = 6,424)				
	Unadjusted Comparison Patients (n = 3,212)	Unadjusted Inmate Patients (n = 3,212)	Adjusted Comparison Patients (n = 3,212)	Adjusted Inmate Patients (n = 3,212)	*Adjusted p* Value 2-sided
Number of Diagnoses					
Mean	7.99	7.67	7.52	7.25	.000
Number of Chronic Conditions					
Mean	4.63	4.78	4.31	4.46	.002
DRG Risk of Mortality (%)					
Minor Likelihood of Dying	2,441 (76.0)	2,754 (85.7)	2,441 (76.0)	2,754 (85.7)	.000
Moderate Likelihood of Dying	572 (17.8)	361 (11.2)	572 (17.8)	361 (11.2)	
Major Likelihood of Dying	154 (4.8)	84 (2.6)	154 (4.8)	84 (2.6)	
Extreme Likelihood of Dying	45 (1.4)	13 (0.4)	45 (1.4)	13 (0.4)	
DRG Severity Level					
Minor Loss of Function	778 (24.2)	901 (28.0)	778 (24.2)	901 (28.0)	.000
Moderate Loss of Function	1,759 (54.8)	1,955 (60.9)	1,759 (54.8)	1,955 (60.9)	
Major Loss of Function	565 (17.6)	331 (10.3)	565 (17.6)	331 (10.3)	
Extreme Loss of Function	110 (3.4)	25 (0.8)	110 (3.4)	25 (0.8)	
Estimated Total Cost ($)					
Mean	8,243	9,890	8,535	10,226	.000
Length of Stay (day)					
Mean	7.67	10.25	7.92	10.40	.000

In our adjusted outcomes findings (Table 4), inmates stayed almost 2.5 days longer in the hospital (10.40 vs. 7.92; $p = < .0001$) and cost nearly $1,700 ($10,226 vs. $8,535, $p = < .0001$) or 19.8% more per admission than their non-inmate counterparts

while controlling for age, race, primary payer, gender, Charlson score, injuries, suicide, and psychological issues. On average, inmate patients had less diagnoses recorded in their discharge records than non-inmates (7.25 vs. 7.52; p = .0002). However, inmate patients had more chronic conditions (4.46 vs. 4.31; p = .0019).

Among individuals with the lowest level DRG risk of mortality (1 = minor likelihood of dying), inmates had nearly 7.75 times higher odds of having a minor likelihood of dying over the highest risk level (4 = extreme likelihood of dying), when compared to equally matched non-inmate counterparts (Odds Ratio [OR] = 7.746; 95% Confidence Interval [CI] = 3.949-15.194, p = < .0001) (Table 5; Figure 4).

Among individuals with the lowest DRG severity levels (1 = minor loss of function; 2 = moderate loss of function), inmates had 6.95 (Level 1 OR 6.951, CI: 4.359-11.085; p = < .0001) and 6.28 (Level 2 OR 6.282, CI: 3.971-9.939; p = < .0001) times higher odds of being in the lower DRG severity categories than the highest level (4 = extreme loss of function), when compared to equally matched non-prisoner counterparts (Table 5; Figure 5).

Table 5

DRG Risk of Mortality and DRG Severity Risk Odds Ratio Estimates

DRG Risk of Mortality and DRG Risk of Severity (Incarcerated) Odds Ratio Estimates and Wald Confidence Intervals			
Odds Ratio	**Estimate**	**95% Confidence Interval**	
Mortality Risk 1 = Minor likelihood of dying	7.746	3.949	15.194
Mortality Risk 2 = Moderate likelihood of dying	2.844	1.452	5.570
Mortality Risk 3 = Major likelihood of dying	2.214	1.096	4.472

DRG Risk of Mortality and DRG Risk of Severity (Incarcerated) Odds Ratio Estimates and Wald Confidence Intervals			
Odds Ratio	**Estimate**	**95% Confidence Interval**	
Severity Risk 1 = Minor loss of function	6.951	4.359	11.085
Severity Risk 2 = Moderate loss of function	6.282	3.971	9.939
Severity Risk 3 = Major loss of function	2.947	1.848	4.699

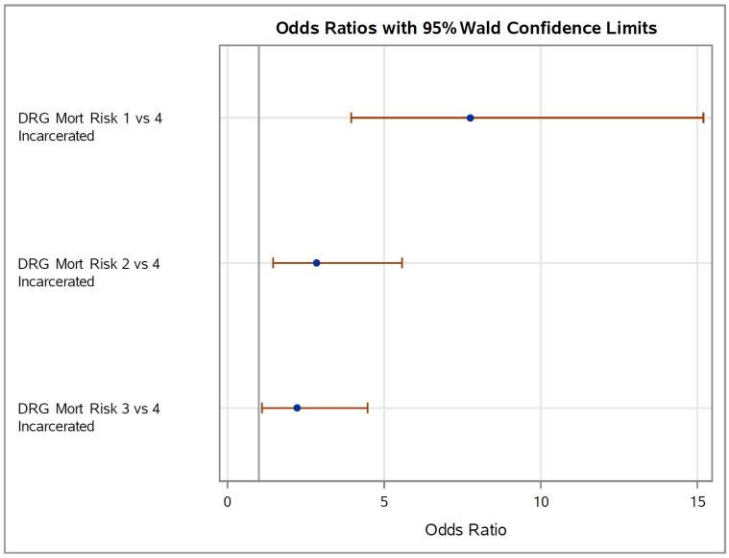

Figure 4. DRG Risk of Mortality Odds Ratios with 95% Confidence Intervals

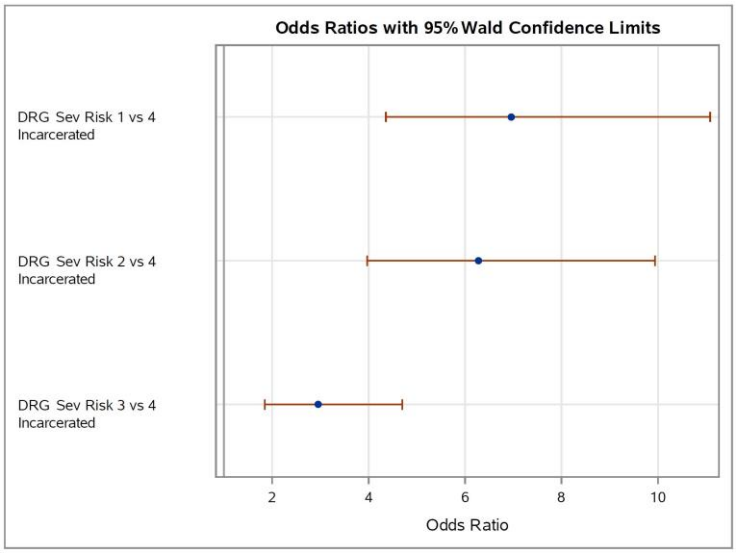

Figure 5. DRG Risk of Severity Odds Ratios with 95% Confidence Intervals

5. DISCUSSION

Discussion of Results

In this study, we compared the Commonwealth of Massachusetts' discharge data from the Healthcare Cost and Utilization Project State Inpatient Databases for two very closely matched cohorts of patients (inmates versus non-inmates), examining whether there were any differences between the groups for morbidity, mortality, cost, length of stay, and ambulatory care sensitive conditions. We found that although inmates were less sick (lower morbidity), they had more chronic conditions, longer hospital admission lengths of stay, and higher costs than their non-inmate counterparts. Therefore, the findings support our hypothesis that differences exist in morbidity, cost, and length of stay.

A total of 3,212 inmates were hospitalized in Massachusetts between the years 2011-2013, and it cost almost $5.5 million more to treat them compared to a similar group of non-inmates. Hospital admission lengths of stay for inmates were nearly 2.5 days longer than non-inmates. This 31% increase in length of stay creates significant additional costs to taxpayers, beyond simply the healthcare costs presented in this study, in order to cover equipment as well as salaries and overtime pay for correctional officers needed to guard prisoners around the clock in outside hospitals. Therefore, it is important for correctional institution leaders to identify what factors exist within their

control, which may negatively impact patient care and result in hospital admissions. Also, if an admission is necessary, then what can be done differently to decrease lengths of stay and overall costs without impacting patient quality or outcomes?

There are a number of possible explanations for the findings that inmates have more chronic diseases, longer lengths of stay, and higher costs. Historically, the availability and scope of medical and mental health services provided within correctional institutions has been inadequate (World Health Organization, 2007). Funding has always been difficult because of legislative pressures to reduce spending and voter reluctance to pay for prisons (Friedman, 1992). Lack of funds and shortfalls in specialty providers who manage chronic diseases and mental health issues make it very challenging to recruit and retain quality healthcare staff. A 2015 report for the Association of American Medical Colleges projected shortfalls in non-primary care specialties to range between 37,400 and 60,300 by 2025 (Dall, West, Chakrabarti, & Iacobucci, 2016). Hiring of providers is especially difficult for correctional institutions due to the restrictive, not well-equipped work environments, low salaries, demanding patient population, and desolate locations.

There are a growing number of inmates entering the criminal justice system with medical and psychiatric issues (Grohs, 2013). Additionally, older individuals who have high rates of comorbidities are the fastest growing group of prisoners in most countries (Davoren et al., 2015). According to Grohs (2013), patients with multiple comorbidities are a challenge and require communication and coordination between healthcare providers called *an integrated care approach*. This approach ensures healthcare is not delivered in silos, but rather is provided using a team approach.

However, most jails and prisons manage their own healthcare or contract it out. Lack of integrated care or coordination between correctional facilities and local hospitals exacerbates existing problems and calls into question the adequacy of prisoners' healthcare.

The morbidity measures used in this analysis indicate inmates tend to be less sick than the non-incarcerated population, so an increase in the length of stay could possibly be the result of "gaming" of the system by inmates who wish to stay out of prison or jail for as long as possible. It is also possible hospital providers may not want to return inmates to prisons or jails if they are concerned about the level of care inmates will receive at those facilities. Each morbidity measure has its weaknesses; therefore, results are limited to proxy measures.

Overcrowding in prisons and jails continues to be a significant problem across the United States. According to the most current Bureau of Justice Statistics report on prison populations (Carson & Anderson, 2016), at the end of 2015, the number of prisoners in the Commonwealth of Massachusetts still continued to exceed housing design capacity (122.8%), which was down from 137% of capacity in 2014 (Carson, 2015). This housing capacity issue may be preventing hospitalized patients from being discharged and transported in a timely manner because there is no space to house them, which would increase lengths of stay and overall costs.

Upon notification of discharge, the ability of correctional facilities to pick up patients may be delayed due to the need to secure appropriate transportation vehicles or to identify and equip the required number of correctional officers to safely escort inmates, especially those who are deemed dangerous or high profile.

Conclusion and Recommendations

The provision of healthcare to inmates is required by law, paid for by taxpayers, and managed differently by each correctional institution. This study found that although inmates tended to be less sick when admitted to the hospital, they still had more chronic conditions, longer lengths of stay, and cost more than an equally matched cohort of non-inmates.

Hospital admissions, lengths of stay, and total costs are impacted by many factors, such as patient comorbidity, number of chronic diseases, availability of specialty providers and other medical staff, quality of care, timeliness of care, funding, transportation, and correctional officer staffing. The management of medical and mental healthcare in prisons and jails requires an integrated care and team approach to improve patient outcomes and reduce costs.

The following seven recommendations are provided to help improve the provision and management of inmate care at correctional institutions:

First, it is crucial to conduct a rapid assessment at intake. Understanding an inmate's health upon entry into the correctional system allows for early intervention and better planning for medical and mental health concerns. Providers can begin providing or continue providing medications (or other treatment modalities) in order to stabilize a condition and prevent the expense of an emergency room visit or hospitalization.

Second, communication, case management, and discharge planning between hospitals and correctional facilities need improvement. Discharge planning should begin immediately when a patient is admitted. Beginning discharge planning at

admission is the recommendation across the healthcare industry. Dialogue between case managers and prison housing managers must be timely to ensure prison housing is secured as quickly as possible once a discharge date is known.

Third, correctional institutions should create incentives to increase staffing levels of specialty providers, custody officers, and other healthcare personnel at their facilities. Consideration should be given to obtaining federal funding for educational loan repayment or monetary bonuses to recruit and retain quality healthcare providers. Consider offering pay increases for correctional officers who attend specialized training (e.g., Crisis Intervention Team training) and maintain certification to handle stressors caused by working with vulnerable inmates who are very sick, mentally ill, or elderly.

Fourth, hospitals in very few states document the admission source, which identifies whether patients are admitted from court or law enforcement facilities. This lack of documentation greatly reduces the ability to conduct comparison research for inmate populations. Correctional institutions in collaboration with state hospital associations should discuss the utility of collecting admission source data and start requiring hospitals to document this important information.

Fifth, correctional institution leadership (both custody and health services) should collaborate with each other and with public health officials and local hospitals to develop integrated care teams to better manage patients with chronic diseases who are prone to recidivism. Similarly to how the sheriff of Hampden County, Massachusetts, manages care at his jail, they should consider bringing providers from the community into the prisons or jails (Ashe, 2014). This would give inmates the opportunity to receive comprehensive treatment from dedicated public health professionals who are

truly interested in their welfare. After release, the patient would continue treatment in the community with the same provider.

Sixth, state lawmakers should require, at a minimum, the implementation of National Commission on Correctional Health Care standards (including care pathways for medical issues like diabetes and congestive heart failure) and require on a regular basis a formal evaluation of the delivery of medical and mental health services (including patient outcomes) from agencies outside of the criminal justice system, such as the state's Department of Health and Human Services or state Public Health Department. This level of oversight will help to ensure standards of care are implemented and improve accountability and patient outcomes.

Seventh, correctional institutions should consider implementing an electronic medical record (EMR) and telehealth services or expand upon existing technologies to improve continuity of care and reduce the need for staffing, transportation, and other resources required to take inmates to off-site healthcare facilities. When considering purchasing an EMR, ensuring interoperability with local community hospital EMR systems should be of paramount importance.

Areas for Further Study

Future studies should be designed to determine the medical and mental health needs of inmates, focusing on quality and delivery of care within correctional institutions. They should determine Case Mix Index values to better allocate resources for treating specific groups of patients and they should study outcomes for the ever-increasing "graying" population. Correctional institutions should delve into operational mechanisms and processes such as housing, transportation, medical and custody

staffing, discharge planning, and the use of an electronic medical record and telehealth services to improve continuity of care and efficiencies.

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Appendix A

Partner Participation in HCUP

State	State Inpatient Databases	State Ambulatory Surgery Databases	State Emergency Department Databases	National (Nationwide) Inpatient Sample	Kids' Inpatient Databases	Nationwide Emergency Department Sample	Nationwide Readmissions Database
	Central Distributor*	Central Distributor*	Central Distributor *	NIS	KID	NEDS	NRD
Alaska				2010-2012	'12		
Arizona	1990-2014		2005-2014	1989-2001, 2003-2013	'97, '00, '03, '06, '09, '12	2006-2013	
Arkansas	2004-2013			2004-2013	'06, '09, '12		2013
California	2003-2011**	2005-2011	2005-2011	1988-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Colorado	1990-2014	1997-2014		1988-2013	'97, '00, '03, '06,'09, '12		
Connecticut				1993-2013	'97, '00, '03, '06, '09, '12	2006-2013	
District of Columbia	2013-2014			2013			
Florida	1990-2014	1997-2014	2005-2014	1988-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Georgia	2010-2014†	2010-2014†	2010-2014†	1997-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Hawaii	1996-2014		2003-2014	1997-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Illinois				1988-2013	'97, '03, '06, '09, '12	2009-2013	
Indiana				2003-2013	'03, '06, '09, '12	2006-2013	
Iowa	1990-2014	2004-2014	2004-2014	1988-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Kansas				1993-2013	'97, '00, '03, '06, '09, '12	2006-2013	
Kentucky	2000-2014	2000-2014	2008-2014	2000-2013	'00, '03, '06,'09, '12	2008-2013	
Louisiana				2008-2013	'09, '12		2013
Maine	1999-2003, 2006-2012	1999-2003, 2006-2012	1999-2003, 2006-2012	1999-2002, 2007-2011	'00, '09	2006-2009, 2011-2012	
Maryland	1990-2013	1997-2013	1999-2013	1993-2013	'97, '00, '03, '06,'09, '12	2006-2013	
Massachusetts	1990-2013		2002-2013	1988-2013	'97, '00, '03, '06, '09, '12	2006-2013	2013
Michigan	1999-2014	2004-2014		2001-2013	'03, '06,'09, '12		
Minnesota				2001-2013	'03, '06,'09, '12	2006-2013	
Mississippi	2010-2011			2010-2011			
Missouri				1995-2013	'97, '00, '03, '06,'09, '12	2006-2013	2013
Montana				2009-2013	'09, '12		
Nebraska	2001-2014	2001-2014	2001-2014	2001-2013	'03, '06,'09, '12	2006-2013	2013
Nevada	2002-2013	2011-2013	2010-2013	2002-2013	'03, '06,'09, '12	2010-2013	2013
New Hampshire				2003-2009	'03, '06,'09	2006-2009	
New Jersey	1990-2014	1997-2014	2004-2014	1988-2013	'97, '00, '03, '06,'09, '12	2006-2013	
New Mexico	2008-2014			2009-2013	'09, '12		2013
New York	1990-2014	1997-2013	2006-2013	1993-2013	'97, '00, '03, '06,'09, '12	2007-2013	2013
North Carolina	2000-2014	2000-2014	2007-2014	2000-2013	'00, '03, '06,'09, '12	2007-2013	
North Dakota				2011-2013	'12	2011-2013	
Ohio				2002-2013	'03, '06,'09, '12	2006-2013	
Oklahoma				2005-2013	'06,'09, '12		
Oregon	1993-2014	2010-2014		1993-2013	'97, '00, '03, '06,'09, '12		
Pennsylvania				1989-2003, 2008-2013	'97, '00, '09, '12		
Rhode Island	2002-2014		2007-2014	2001-2012	'03, '06,'09, '12	2007-2013	
South Carolina	1995-2013	2000-2013	2000-2013	1993-2013	'97, '00, '03, '06,'09, '12	2006-2013	2013
South Dakota	2007-2014			2002-2013	'03, '06,'09, '12	2006-2013	2013
Tennessee				1995-2013	'97, '00, '03, '06,'09, '12	2006-2013	2013
Texas				2000-2013	'00, '03, '06,'09, '12		
Utah	1997-2013	1997-2013	2000-2013	1997-2013	'97, '00, '03, '06,'09, '12	2006-2013	2013
Vermont	2001-2014	2001-2014	2002-2014	2001-2013	'03, '06,'09, '12	2006-2013	2013
Virginia				1999-2004, 2006-2013	'00, '03, '06,'09, '12		2013
Washington	1990-2014			1988-2013	'97, '00, '03, '06,'09, '12		2013
West Virginia	2000-2014			2000-2013	'00, '03, '06,'09, '12		
Wisconsin	1990-2014	1998-2014	2004-2014	1989-2013	'97, '00, '03, '06,'09, '12	2006-2013	2013
Wyoming				2007-2013	'09, '12		
Currently participating	30	19	20	48	46	31	21

* Efforts to gain 2013 and 2014 Central Distributor participation is currently underway.
** Beginning December 2007, California no longer releases their 1995-2001 HCUP Central Distributor SID.
† - Georgia data is not available to for-profit entities or to students. The Georgia Hospital Association must approve any data release.

(AHRQ HCUP Website, 2016, August 10)

Appendix B

United Nations Health Rights of Prisoners

- The enjoyment of the highest attainable standard of physical and mental health is a human right.

- It is a basic requirement that all prisoners should be given a medical examination as soon as they have been admitted to a prison or place of detention.

- Any necessary medical treatment should then be provided free of charge.

- Prisoners should generally have the right to request a second medical opinion.

- Prisoners and all detained persons have the right to the highest attainable standard of physical and mental health.

- Prisoners should have free access to the health services available in the country.

- Decisions about a prisoner's health should be taken only on medical grounds by medically qualified people.

- The medical officer has an important responsibility to ensure that proper health standards are met. He or she can do this by regularly inspecting and advising the director of the prison on the suitability of food, water, hygiene, cleanliness, sanitation, heating, lighting, ventilation, clothing, bedding and opportunities for exercise.

- Every prison should have proper health facilities and medical staff to provide for a range of health needs, including dental and psychiatric care. Sick prisoners who cannot be treated in the prison, such as prisoners with mental illness, should be transferred to a civilian hospital or to a specialized prison hospital.

- All prisoners shall have access to a qualified dental practitioner.

- Services for psychiatric diagnosis and, if appropriate, treatment shall be available at every prison.

- Prisoners who are insane shall not be detained in prisons, but transferred as soon as possible to mental institutions.

- Prisoners suffering from other mental diseases shall be treated in specialized institutions under medical management.

- During their stay in a prison, insane and mentally ill prisoners shall be supervised by a medical officer.

- It is important that healthcare for prisoners be provided by at least one qualified medical officer.

- Medical personnel have a duty to provide prisoners and detainees with healthcare equal to that which is afforded to those who are not imprisoned or detained.

- The primary responsibility of healthcare personnel is to protect the health of all prisoners.

- Healthcare personnel shall not commit or give their permission for any acts which may adversely affect the health of prisoners.

- All prisoners shall be provided with facilities to meet the needs of nature in a clean and decent manner and to maintain adequately their own cleanliness and good appearance.

- All prisoners shall have at least one hour’s daily exercise in the open air if the weather permits.

Appendix C

Prevention Quality Indicators

(AHRQ Quality Indicators, October 2016)

PQI 01: Diabetes Short-Term Complications Admission Rate

Description: Admissions for a principal diagnosis of diabetes with short-term complications (ketoacidosis, hyperosmolarity, or coma) per 100,000 population, ages 18 years and older. Excludes obstetric admissions and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for diabetes short-term complications (ketoacidosis, hyperosmolarity, or coma). Diabetes short-term complications diagnosis codes:

25010 DM KETO T2, DM CONT	25022 DM W/ HYPROSM T2, DM UNCNT
25011 DM KETO T1, DM CONT	25023 DM W/ HYPROSM T1, DM UNCNT
25012 DM KETO T2, DM UNCONT	25030 DM COMA NEC TYP II, DM CNT
25013 DM KETO T1, DM UNCONT	25031 DM COMA NEC T1, DM CONT
25020 DM W/ HYPROSM T2, DM CONT	25032 DM COMA NEC T2, DM UNCONT
25021 DM W/ HYPROSM T1, DM CONT	25033 DM COMA NEC T1, DM UNCONT

Denominator: Population ages 18 years and older in the metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred. May be combined with uncontrolled diabetes as a single indicator as a simple sum of the rates to form the Healthy People 2010 indicator (note that the AHRQ QI excludes transfers to avoid double-counting cases).

PQI 02: Perforated Appendix Admission Rate

Description: Admissions for any-listed diagnosis of perforations or abscesses of the appendix per 1,000 admissions with any-listed appendicitis, ages 18 years and older. Excludes obstetric admissions and transfers from other institutions.

Numerator: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any-listed ICD-9-CM diagnosis codes for perforations or abscesses of appendix. Perforations or abscesses of appendix diagnosis codes:

5400 AC APPEND W PERITONITIS	5401 ABSCESS OF APPENDIX

Denominator: Discharges, for patients ages 18 years and older, with any-listed ICD-9-CM diagnosis codes for appendicitis. Discharges are assigned to the denominator based on the metropolitan area† or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred. Appendicitis diagnosis codes:

5400 AC APPEND W PERITONITIS	5409 ACUTE APPENDICITIS NOS
5401 ABSCESS OF APPENDIX	541 APPENDICITIS NOS

PQI 03: Diabetes Long-Term Complications Admission Rate

Description: Admissions for a principal diagnosis of diabetes with long-term complications (renal, eye, neurological, circulatory, or complications not otherwise specified) per 100,000 population, ages 18 years and older. Excludes obstetric admissions and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for diabetes with long-term complications (renal, eye, neurological, circulatory, or complications not otherwise specified). Diabetes with long-term complications diagnosis codes:

25040 DM RENAL COMP T2 CONT	25070 DM CIRCU DIS T2 CONT
25041 DM RENAL COMP T1 CONT	25071 DM CIRCU DIS T1 CONT
25042 DM RENAL COMP T2 UNCNT	25072 DM CIRCU DIS T2 UNCNT
25043 DM RENAL COMP T1 UNCNT	25073 DM CIRCU DIS T1 UNCNT
25050 DM EYE COMP T2 CONT	25080 DM W COMP NEC T2 CONT
25051 DM EYE COMP T1 CONT	25081 DM W COMP NEC T1 CONT
25052 DM EYE COMP T2 UNCNT	25082 DM W COMP NEC T2 UNCNT
25053 DM EYE COMP T1 UNCNT	25083 DM W COMP NEC T1 UNCNT
25060 DM NEURO COMP T2 CONT	25090 DM W COMPL NOS T2 CONT
25061 DM NEURO COMP T1 CONT	25091 DM W COMPL NOS T1 CONT
25062 DM NEURO COMP T2 UNCNT	25092 DM W COMPL NOS T2 UNCNT
25063 DM NEURO COMP T1 UNCNT	25093 DM W COMPL NOS T1 UNCNT

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county where the hospital discharge occurred.

PQI 05: Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate

Description: Admissions with a principal diagnosis of chronic obstructive pulmonary disease (COPD) or asthma per 100,000 population, ages 40 years and older. Excludes cystic fibrosis, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 40 years and older, with either a principal ICD-9-CM diagnosis code for COPD; or a principal ICD-9-CM diagnosis code for asthma. COPD (excluding acute bronchitis) diagnosis codes:

4910 SIMPLE CHR BRONCHITIS	4920 EMPHYSEMATOUS BLEB
4911 MUCOPURUL CHR BRONCHITIS	4928 EMPHYSEMA NEC
49120 OBS CHR BRNC W/O ACT EXA	494 BRONCHIECTASIS
49121 OBS CHR BRNC W ACT EXA	4940 BRONCHIECTAS W/O AC EXAC
49122 OBS CHR BRONC W AC BRONC	4941 BRONCHIECTASIS W AC EXAC
4918 CHRONIC BRONCHITIS NEC	496 CHR AIRWAY OBSTRUCT NEC
4919 CHRONIC BRONCHITIS NOS	

Asthma diagnosis codes:

49300 EXT ASTHMA W/O STAT ASTH
49301 EXT ASTHMA W STATUS ASTH
49302 EXT ASTHMA W ACUTE EXAC
49310 INT ASTHMA W/O STAT ASTH
49311 INT ASTHMA W STATUS ASTH
49312 INT ASTHMA W ACUTE EXAC
49320 CH OB ASTH W/O STAT ASTH
49321 CH OB ASTHMA W STAT ASTH
49322 CH OBS ASTH W ACUTE EXAC
49381 EXERCSE IND BRONCHOSPASM
49382 COUGH VARIANT ASTHMA
49390 ASTHMA W/O STATUS ASTHM
49391 ASTHMA W STATUS ASTHMAT
49392 ASTHMA W ACUTE EXACERBTN

Denominator: Population ages 40 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 07: Hypertension Admission Rate

Description: Admissions with a principal diagnosis of hypertension per 100,000 population, ages 18 years and older. Excludes kidney disease combined with dialysis access procedure admissions, cardiac procedure admissions, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for hypertension. Hypertension diagnosis codes:

4010 MALIGNANT HYPERTENSION
4019 HYPERTENSION NOS
40200 MAL HYPERTEN HRT DIS NOS
40210 BEN HYPERTEN HRT DIS NOS
40290 HYPERTENSIVE HRT DIS NOS
40300 MAL HYP REN W/O REN FAIL
40310 BEN HYP REN W/O REN FAIL
40390 HYP REN NOS W/O REN FAIL
40400 MAL HY HT/REN W/O CHF/RF
40410 BEN HY HT/REN W/O CHF/RF
40490 HY HT/REN NOS W/O CHF/RF

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 08: Heart Failure Admission Rate

Description: Admissions with a principal diagnosis of heart failure per 100,000 population, ages 18 years and older. Excludes cardiac procedure admissions, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for heart failure. Heart failure diagnosis codes:

39891 RHEUMATIC HEART FAILURE
40201 MAL HYPERT HRT DIS W CHF
40211 BENIGN HYP HRT DIS W CHF
42821 AC SYSTOLIC HRT FAILURE
42822 CHR SYSTOLIC HRT FAILURE
42823 AC ON CHR SYST HRT FAIL

40291 HYPERTEN HEART DIS W CHF
40401 MAL HYPER HRT/REN W CHF
40403 MAL HYP HRT/REN W CHF&RF
40411 BEN HYPER HRT/REN W CHF
40413 BEN HYP HRT/REN W CHF&RF
40491 HYPER HRT/REN NOS W CHF
40493 HYP HT/REN NOS W CHF&RF
4280 CONGESTIVE HEART FAILURE
4281 LEFT HEART FAILURE
42820 SYSTOLIC HRT FAILURE NOS
42830 DIASTOLC HRT FAILURE NOS
42831 AC DIASTOLIC HRT FAILURE
42832 CHR DIASTOLIC HRT FAIL
42833 AC ON CHR DIAST HRT FAIL
42840 SYST/DIAST HRT FAIL NOS
42841 AC SYST/DIASTOL HRT FAIL
42842 CHR SYST/DIASTL HRT FAIL
42843 AC/CHR SYST/DIA HRT FAIL
4289 HEART FAILURE NOS

Denominator: Population ages 18 years and older in metropolitan area† or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 10: Dehydration Admission Rate

Description: Admissions with a principal diagnosis of dehydration per 100,000 population, ages 18 years and older. Excludes obstetric admissions and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with either a principal ICD-9-CM diagnosis code for dehydration; or any secondary ICD-9-CM diagnosis codes for dehydration and a principal ICD-9-CM diagnosis code for hyperosmolality and/or hypernatremia, gastroenteritis, or acute kidney injury.

Dehydration diagnosis codes:

2765 HYPOVOLEMIA
27650 VOLUME DEPLETION
27651 DEHYDRATION
27652 HYPOVOLEMIA

Hyperosmolality and/or hypernatremia diagnosis codes:

2760 HYPEROSMOLALITY

Gastroenteritis diagnosis codes:

00861 INTES INFEC ROTAVIRUS
00862 INTES INFEC ADENOVIRUS
00863 INT INF NORWALK VIRUS
00864 INT INF OTH SML RND VRUS
00865 INTES INFEC CALCIVIRUS
00866 INTES INFEC ASTROVIRUS
00867 INT INF ENTEROVIRUS NEC
00869 ENTERITIS NOS
0088 VIRAL ENTERITIS NOS
0090 INFECTIOUS ENTERITIS NOS
0091 ENTERITIS OF INFECT ORIG
0092 INFECTIOUS DIARRHEA NOS
0093 DIARRHEA OF INFECT ORIG
5589 NONINF GASTROENTERIT NEC

Acute kidney failure diagnosis codes:

5845 AC KIDNY FAIL, TUBR NECR	5849 ACUTE KIDNEY FAILURE NOS
5846 AC KIDNY FAIL, CORT NECR	586 RENAL FAILURE NOS
5847 AC KIDNY FAIL, MEDU NECR	9975 SURG COMPL-URINARY TRACT
5848 ACUTE KIDNEY FAILURE NEC	

Denominator: Population ages 18 years and older in metropolitan area† or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 11: Bacterial Pneumonia Admission Rate

Description: Admissions with a principal diagnosis of bacterial pneumonia per 100,000 population, ages 18 years and older. Excludes sickle cell or hemoglobin-S admissions, other indications of immunocompromised state admissions, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for bacterial pneumonia. Bacterial pneumonia diagnosis codes:

481 PNEUMOCOCCAL PNEUMONIA	48242 METH RES PNEU D/T STAPH
4822 H.INFLUENZAE PNEUMONIA	48249 STAPH PNEUMONIA NEC
48230 STREP PNEUMONIA UNSPEC	4829 BACTERIAL PNEUMONIA NOS
48231 GRP A STREP PNEUMONIA	4830 MYCOPLASMA PNEUMONIA
48232 GRP B STREP PNEUMONIA	4831 CHLAMYDIA PNEUMONIA
48239 OTH STREP PNEUMONIA	4838 OTH SPEC ORG PNEUMONIA
48240 STAPH PNEU NOS	485 BRONCOPNEUMONIA ORG NOS
48241 METH SUS PNEUM D/T STAPH	486 PNEUMONIA, ORGANISM NOS

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 12: Urinary Tract Infection Admission Rate

Description: Admissions with a principal diagnosis of urinary tract infection per 100,000 population, ages 18 years and older. Excludes kidney or urinary tract disorder admissions, other indications of immunocompromised state admissions, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-09-CM diagnosis code for urinary tract infection. Urinary tract infection diagnosis codes:

59010 AC PYELONEPHRITIS NOS	59081 PYELONEPHRIT IN OTH DIS
59011 AC PYELONEPHR W MED NECR	5909 INFECTION OF KIDNEY NOS
5902 RENAL/PERIRENAL ABSCESS	5950 ACUTE CYSTITIS

5903 PYELOURETERITIS CYSTICA	5959 CYSTITIS NOS
59080 PYELONEPHRITIS NOS	5990 URIN TRACT INFECTION NOS

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 14: Uncontrolled Diabetes Admission Rate

Description: Admissions for a principal diagnosis of diabetes without mention of short-term (ketoacidosis, hyperosmolarity, or coma) or long-term (renal, eye, neurological, circulatory, or other unspecified) complications per 100,000 population, ages 18 years and older. Excludes obstetric admissions and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for uncontrolled diabetes without mention of a short-term or long-term complication. Uncontrolled diabetes without mention of a short-term or long-term complication diagnosis codes:

25002 DMII WO CMP UNCNTRLD	25003 DMI WO CMP UNCNTRLD

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred. May be combined with diabetes short-term complications as a single indicator as a simple sum of the rates to form the Healthy People 2010 indicator (note that the AHRQ QI excludes transfers to avoid double counting cases).

PQI 15: Asthma in Younger Adults Admission Rate

Description: Admissions for a principal diagnosis of asthma per 100,000 population, ages 18 to 39 years. Excludes admissions with an indication of cystic fibrosis or anomalies of the respiratory system, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 through 39 years, with a principal ICD-09-CM diagnosis code for asthma. Asthma diagnosis codes:

49300 EXT ASTHMA W/O STAT ASTH	49321 CH OB ASTHMA W STAT ASTH
49301 EXT ASTHMA W STATUS ASTH	49322 CH OBS ASTH W ACUTE EXAC
49302 EXT ASTHMA W ACUTE EXAC	49381 EXERCSE IND BRONCHOSPASM
49310 INT ASTHMA W/O STAT ASTH	49382 COUGH VARIANT ASTHMA
49311 INT ASTHMA W STATUS ASTH	49390 ASTHMA W/O STATUS ASTHM
49312 INT ASTHMA W ACUTE EXAC	49391 ASTHMA W STATUS ASTHMAT
49320 CH OB ASTH W/O STAT ASTH	49392 ASTHMA W ACUTE EXACERBTN

Denominator: Population ages 18 through 39 years in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.

PQI 16: Lower-Extremity Amputation Among Patients with Diabetes Rate

Description: Admissions for any-listed diagnosis of diabetes and any-listed procedure of lower-extremity amputation (except toe amputations) per 100,000 population, ages 18 years and older. Excludes any-listed diagnosis of traumatic lower-extremity amputation admissions, obstetric admissions, and transfers from other institutions.

Numerator: Discharges, for patients ages 18 years and older, with any-listed ICD-09-CM procedure codes for lower-extremity amputation and any-listed ICD-09-CM diagnosis codes for diabetes.

Lower-extremity amputation procedure codes:

8410 LOWER LIMB AMPUTAT NOS
8412 AMPUTATION THROUGH FOOT
8413 DISARTICULATION OF ANKLE
8414 AMPUTAT THROUGH MALLEOLI
8415 BELOW KNEE AMPUTAT NEC
8416 DISARTICULATION OF KNEE
8417 ABOVE KNEE AMPUTATION
8418 DISARTICULATION OF HIP
8419 HINDQUARTER AMPUTATION

Diabetes diagnosis codes: (ACSLEAD)

25000 DMII WO CMP NT ST UNCNTR
25001 DMI WO CMP NT ST UNCNTRL
25002 DMII WO CMP UNCNTRLD
25003 DMI WO CMP UNCNTRLD
25010 DMII KETO NT ST UNCNTRLD
25011 DMI KETO NT ST UNCNTRLD
25012 DMII KETOACD UNCONTROLD
25013 DMI KETOACD UNCONTROLD
25020 DMII HPRSM NT ST UNCNTRL
25021 DMI HPRSM NT ST UNCNTRLD
25022 DMII HPROSMLR UNCONTROLD
25023 DMI HPROSMLR UNCONTROLD
25030 DMII O CM NT ST UNCNTRLD
25031 DMI O CM NT ST UNCNTRLD
25032 DMII OTH COMA UNCONTROLD
25033 DMI OTH COMA UNCONTROLD
25040 DMII RENL NT ST UNCNTRLD
25041 DMI RENL NT ST UNCNTRLD
25042 DMII RENAL UNCNTRLD
25043 DMI RENAL UNCNTRLD
25050 DMII OPHTH NT ST UNCNTRL
25051 DMI OPHTH NT ST UNCNTRLD
25052 DMII OPHTH UNCNTRLD
25053 DMI OPHTH UNCNTRLD
25060 DMII NEURO NT ST UNCNTRL
25061 DMI NEURO NT ST UNCNTRLD
25062 DMII NEURO UNCNTRLD
25063 DMI NEURO UNCNTRLD
25070 DMII CIRC NT ST UNCNTRLD
25071 DMI CIRC NT ST UNCNTRLD
25072 DMII CIRC UNCNTRLD
25073 DMI CIRC UNCNTRLD
25080 DMII OTH NT ST UNCNTRLD
25081 DMI OTH NT ST UNCNTRLD
25082 DMII OTH UNCNTRLD
25083 DMI OTH UNCNTRLD
25090 DMII UNSPF NT ST UNCNTRL
25091 DMI UNSPF NT ST UNCNTRLD
25092 DMII UNSPF UNCNTRLD
25093 DMI UNSPF UNCNTRLD

Denominator: Population ages 18 years and older in metropolitan area or county. Discharges in the numerator are assigned to the denominator based on the metropolitan area or county of the patient residence, not the metropolitan area or county of the hospital where the discharge occurred.