INPATIENT POST-ACUTE CARE UTILIZATION PATTERNS AND OUTCOMES IN PENNSYLVANIA MEDICAID

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ABSTRACT

The Medicaid expansion, one of the key provisions under the Affordable Care Act (ACA), has turned Medicaid into a larger player in the US healthcare system. The intent of the expansion was to increase access to essential healthcare services such as post-acute care (PAC) for low-income individuals. Studies have shown that variation in Medicare spending is attributed to the variation in post-acute care (PAC) utilization which includes care in home health, skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and long-term acute care hospitals (LTACH). However, very little is known about PAC utilization in the Medicaid population. For instance, Pennsylvania expanded Medicaid in January 2015, initially under a 1115 waiver and then under the original terms of the ACA. Many more individuals and families of low socioeconomic status were able to enroll in the Medicaid program as a result of the expansion. With studies pointing to PAC utilization and spending as the driver of variation in Medicare healthcare costs, the same may pertain to the Medicaid population.

Chapter 1 provides the purpose, findings, and implications of the dissertation.

Chapter 2 is a retrospective cohort study that determines the association between insurance type, either enrolled in Medicaid or commercial insurance, and the likelihood of being admitted to an inpatient PAC facility. The study found that hospitalized Medicaid beneficiaries were as likely

as similar patients with commercial insurance to be admitted to any PAC facility but less likely to be admitted to an inpatient PAC facility (SNF, IRF, LTACH). This would inform policymakers that new Medicaid enrollees, which tend to be low-income and nondisabled adults, will certainly increase the cost of the Medicaid program.

Chapter 3 is a retrospective cohort study that determines whether Medicaid managed care utilizes inpatient PAC differently than its FFS counterpart. The study found that Medicaid managed care beneficiaries were more likely to be admitted to an inpatient PAC than their FFS counterparts. This has significant cost implications since the majority of all Medicaid beneficiaries in the United States were enrolled in an MCO.

Chapter 4 is a retrospective cohort study that determines the degree to which patient outcomes observed among Medicaid beneficiaries was mediated by variation in the intensity of PAC utilization. The study found that PAC utilization patterns for hospitalized Medicaid beneficiaries impacted readmissions and mortality to a degree. While we could not determine whether more PAC utilization would result in better quality of care, the effect of these patterns on outcomes should encourage states to standardize their approach to PAC and take necessary steps to improve patient management and care coordination among providers.

Public Health Significance

This dissertation addressed the three tenets of the healthcare iron triangle: access, cost, and quality. It will inform policymakers on how new Medicaid enrollees due to the expansion can potentially affect future cost to the program and impact the outcomes of Medicaid beneficiaries.

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It has been exactly seven years and one month since my trip to South Beach, Miami. The trip happened during the peak of the Southwest “Wanna Get Away” ad campaign. After my appeal to stay in osteopathic medical school was denied by the administrators, I felt like I had to get away. Everything I built to that point in my life was crumbling down. During one of the nights at South Beach, while my friends were away clubbing and enjoying life not thinking about medicine, I stayed in to reflect on why I had screwed up. I remember staring into the Atlantic on the rooftop of our hotel and realized that I never took myself seriously. Why am I not back at home? Why am I not trying to put my life back together? I was banking too much into “everything will work out in the end” and not working hard towards fulfilling my ambitions. That was how I lived life, and it had to change. At that point, I finally started to grow up.

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1.0 INTRODUCTION

The Medicaid expansion, one of the key provisions under the Affordable Care Act (ACA), has turned Medicaid into a larger player in the US healthcare system. The intent of the expansion was to increase access to essential healthcare services such as post-acute care (PAC) for low-income individuals. Studies have shown that variation in Medicare spending is attributed to the variation in post-acute care (PAC) utilization which includes care in home health, skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and long-term acute care hospitals (LTACH). However, very little is known about PAC utilization in the Medicaid population. For instance, Pennsylvania expanded Medicaid in January 2015, initially under a 1115 waiver and then under the original terms of the ACA. Many more individuals and families of low socioeconomic status were able to enroll in the Medicaid program as a result of the expansion. With studies pointing to PAC utilization and spending as the driver of variation in Medicare healthcare costs, the same may pertain to the Medicaid population.

The purpose of this dissertation was to determine how Medicaid coverage affected placement in PAC and how those patterns impacted patient outcomes. Determining PAC utilization in Medicaid would provide insight on the potential increased cost and demand of health services due to the expansion. In the first study, we found that hospitalized Medicaid beneficiaries were as likely as similar patients with commercial insurance to be admitted to any PAC facility but less likely to be admitted to an inpatient PAC facility (SNF, IRF, LTACH). This would inform policymakers that new Medicaid enrollees, which tend to be low-income and nondisabled adults, will certainly increase the cost of the Medicaid program. For the second paper, we discovered that Medicaid managed care beneficiaries were more likely to be admitted to an inpatient PAC than

their FFS counterparts. This has significant cost implications since the majority of all Medicaid beneficiaries in the United States were enrolled in an MCO. Lastly, the third paper revealed that PAC utilization patterns for hospitalized Medicaid beneficiaries impacted readmissions and mortality to a degree. While we could not determine whether more PAC utilization would result in better quality of care, the effect of these patterns on outcomes should encourage states to standardize their approach to PAC and take necessary steps to improve patient management and care coordination among providers. Ultimately, these three analyses will inform policymakers on how new Medicaid enrollees due to the expansion can potentially affect future cost to the program and impact the outcomes of Medicaid beneficiaries.

2.0 THE EFFECT OF MEDICAID INSURANCE COVERAGE ON DISCHARGE TO AN INPATIENT POST-ACUTE CARE FACILITY

2.1 ABSTRACT

Introduction

Post-acute care (PAC) utilization is a major driver of health care spending in the United States. At the same time, the recent Medicaid expansion carried out under the Affordable Care Act (ACA) will extend health insurance to the previously uninsured, individuals that historically have low rates of PAC use. This policy created a tension by which newly insured individuals may contribute to the growth in health care spending through PAC utilization. In this context, it is important to understand how Medicaid insurance influences current PAC use as a preface to understanding the impact of insurance expansion on PAC.

Objective

To determine the association between insurance type, either enrolled in Medicaid or commercial insurance, and the likelihood of being admitted to an inpatient PAC facility.

Methods

We performed a retrospective cohort study using the Pennsylvania Healthcare Cost Containment Council inpatient discharge dataset from 2008 to 2010 Q1. Eligible patients were between the ages of 18 – 64, insured through either Medicaid or commercial insurance, and diagnosed in the top 20 diagnosis related group that were discharged to an inpatient PAC facility. Multivariate logistic

regression models were used to estimate the association between insurance type and discharge to an inpatient PAC facility.

Results

A total of 133,996 records were in the final analytic cohort, of whom 14,397 (10.7%) were discharged to an inpatient PAC facility. Conditional on discharge to PAC, commercially insured patients were more likely to be discharged to a high intensive inpatient PAC facility such as an inpatient rehabilitation facility (IRF) or long-term acute care hospital (LTACH) (60.1% vs. 38.1%; $p < 0.001$). These relationships were not reflected in the multivariate analysis. Medicaid patients were considerably more likely to be admitted to a high intensive inpatient PAC facility (IRF, LTACH) than individuals with commercial insurance (OR: 1.60; 95% CI: 1.51 – 1.70; $p < 0.001$). Subsequently, Medicaid patients were less likely to be admitted to an inpatient PAC facility (SNF, IRF, LTACH) than commercially insured individuals (OR: 0.87; 95% CI: 0.84 – 0.91; $p < 0.001$).

Conclusions

Hospitalized Medicaid beneficiaries were as likely as similar patients with commercial insurance to be admitted to a PAC facility but less likely to be admitted to an inpatient PAC facility. Nevertheless, the data suggests that Medicaid expansion may lead to an increase in overall PAC use due to the demand of services from new Medicaid enrollees. At the same time, Medicaid beneficiaries tend to be admitted to more intensive forms of PAC due to increased access in urban areas. To the degree that appropriate PAC can produce health and financial benefits, the data highlights opportunities for states to standardize their approach to PAC, thereby offsetting increases in PAC spending associated with Medicaid expansion.

2.2 INTRODUCTION

Healthcare reformers in the past and present have endured the difficulty of balancing access, cost and quality; the tenets of the healthcare iron triangle. Over the past fifty years, these tenets have been continuously deliberated within Medicaid, the public health insurance program primarily for low-income families and individuals. The Medicaid expansion, recently carried out under the Affordable Care Act (ACA), has turned Medicaid into a larger player in the US healthcare system. As a result of the Expansion, Medicaid enrollment in April 2015 has increased by 21% to over 71 million Americans since the enactment of the ACA in 2010 (Kaiser Family Foundation, 2015c). This number is projected to further increase significantly if the 19 states that have thus far not expanded choose to do so, and the uninsured or individuals in the coverage gap (i.e. above the income requirement for Medicaid but below the lower limit to qualify for subsidies for the insurance marketplace) are enrolled through the insurance marketplace as required by the individual mandate.

As a result of the ACA, the uninsurance rate has dropped considerably from a peak of 18.2% in 2010 to 10.7% in the first quarter of 2015 (Kaiser Family Foundation, 2015a). While it is remarkable to see a large portion of uninsured individuals obtain health insurance in a short period of time, it is expected that such increases would lead to a significant rise in healthcare utilization and expenditures. This is because the new enrollees as a result of the Medicaid expansion are likely to be low-income and nondisabled adults which is different than current Medicaid enrollees who tend to be disabled adults, adults with children, or extremely poor especially in states with very low income requirements. In addition, for states that decided to expand Medicaid well after the implementation of the ACA, individuals previously in the coverage gap now qualify for Medicaid. These individuals are expected to utilize health services more so

than when they were previously uninsured. One bellwether example of this may be post-acute care, which we define here as non-acute inpatient health care services that occur immediately following an acute care hospitalization. For instance, among stroke survivors, uninsured patients were approximately half as likely to be discharged to an inpatient post-acute care (PAC) facility than privately insured patients (L. Skolarus, Meurer, Burke, Bettger, & Lisabeth, 2012).

PAC utilization, which includes care in home health, skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and long-term acute care hospitals (LTACH) could mean the difference in terms of quality of life for patients that need to rehabilitate towards living a normal life. These PAC settings vary in costs and intensity of care. The least costly and intensive setting is home health which provides skilled nursing and other therapy at the patient's home. Home health does not require a preceding hospital stay and home health care services are provided whenever it is deemed medically necessary for the patient. SNFs provide skilled nursing care and therapy that cannot be done at the home due to more complex medical conditions and surgeries. Consequently, SNFs are more costly than home health care. IRFs provide care to medically complex patients who require intensive rehabilitation from a multidisciplinary team of healthcare providers. Care at an IRF is significantly more expensive than care at a SNF. Finally, the most expensive PAC setting is an LTACH since they treat patients with chronic critical illness who require care for an extended period of time. Generally, LTACH patients are transferred from the intensive care unit of a hospital which means individuals are often mechanically ventilated or severely debilitated due to their complex medical condition.

According to a report by the Medicare Payment Advisory Commission (MedPAC), PAC is a major driver of both overall healthcare spending and variation across regions (Medicare Payment Advisory Commission, 2011). While it is unknown whether this trend is similar in

Medicaid or commercial insurance, it is expected that stakeholders will focus on cost control by improving PAC utilization. With the Medicaid expansion, previously uninsured individuals are now more likely to utilize services such as PAC. This creates an opportunity to expand PAC in ways that may lead to better outcomes such as improved health status, fewer readmissions, and shorter hospital length of stay. On the other hand, the expansion of PAC use may significantly increase cost while not necessarily lead to better outcomes.

Currently, there is little literature on how the Medicaid expansion impacts PAC use. However, we do know that Medicaid tends to have lower reimbursement rates than Medicare and private insurance, which could affect utilization of PAC. In 2012, Medicaid programs paid on average 66% of the amount Medicare reimburses for the same services and only six states have comparable or higher reimbursement rates for Medicaid than Medicare (Zuckerman, 2012). These lower rates may limit access to PAC, especially the more intensive and expensive settings. Incidentally, a few studies have suggested that regions with higher Medicaid fee rates are associated with higher physician acceptance rates for new Medicaid patients (Decker, 2007, 2012). Nevertheless, other studies have shown that higher Medicaid fees alone do not necessarily increase access and quality of care significantly (Cunningham & O'Malley, 2009; Shen & Zuckerman, 2005). The ACA mandated increases in Medicaid fees to Medicare levels to encourage provider participation for the expansion; however, the rate increase expired at the end of 2014 with only 15 states continuing to participate (Kaiser Family Foundation, 2012; Smith, Gifford, & Ellis, 2014). In the end, it is unclear what role Medicaid has in the current PAC marketplace.

In anticipation of increased cost in Medicaid, states are looking to implement cost control measures such as transitioning to or expanding managed care, tightening drug formularies, and implementing stricter utilization management controls on PAC. As a result, there is concern

whether Medicaid patients would be able to receive the appropriate level of rehabilitation intensity after an inpatient visit. Inappropriate discharge could lead to poorer outcomes such as higher mortality and hospital readmissions (Mor, Intrator, Feng, & Grabowski, 2010). Since hospitals have taken cuts in reimbursement because of the ACA (Gruber, 2010), providers have looked for ways to improve margins such as insuring the uninsured through Medicaid and making sure these patients are appropriately discharged to the correct setting in a timely matter. One study that looked at PAC for joint replacements reported that Medicaid patients were significantly less likely to receive more intensive PAC than individuals with commercial insurance or Medicare with similar severity of illness (Freburger et al., 2011). Ultimately, hospitals are looking to avoid hospital readmissions and incur extra costs. However, it is not known whether these patients would substantially benefit from a more intensive PAC setting. PAC options such as SNFs and IRFs do improve health outcomes in certain conditions (Buntin, Colla, Deb, Sood, & Escarce, 2010; Kramer et al., 1997), but likely at a cost that Medicaid would not cover for their lower-risk patients.

While the Medicaid expansion has improved the healthcare safety net for the country, many individuals have the perception that Medicaid insurance meant receiving lower quality of care than private insurance. In addition, the stigma associated with public insurance programs and poverty permeates throughout the low-income population (H. Allen, Wright, Harding, & Broffman, 2014). As a result, we sought to determine whether having Medicaid as opposed to commercial insurance had an effect on the course of treatment through a patient's episode of care (Figure 1). In theory, sicker patients such as individuals with high number of comorbidities are likely to be discharged to high intensive PAC settings which have the ability to provide the required rehabilitation and care necessary for recovery. However, we believe that insurance type has an important impact on discharge to an inpatient PAC facility. A significant discrepancy in PAC utilization between

Medicaid and commercial insurance would open up the discussion on whether Medicaid provides sufficient and good quality of care especially for the sickest of patients. On the other hand, administering care more efficiently and effectively could explain the differences in PAC utilization between insurance types.

This study has important implications. This study would inform policymakers on what is expected for PAC utilization when a state decides to expand Medicaid. Specifically, we focused on the utilization of new Medicaid enrollees as a results of the expansion which tend to be nondisabled adults. In this paper, we are determining whether there is an association between insurance type, either enrolled in Medicaid or commercial insurance, and the likelihood of being admitted to an inpatient PAC facility such as a SNF, IRF, or LTACH. Given previous literature, we hypothesize that individuals with commercial insurance are likely to go to an inpatient PAC facility than Medicaid recipients. In this study, we used an administrative dataset provided by the state of Pennsylvania to compare individuals that were either covered by commercial insurance or Medicaid.

2.3 STUDY DATA AND METHODS

2.3.1 Study Design and Population

This was a retrospective cohort study using hospital discharge data from the Pennsylvania Health Care Cost Containment Council (PHC4) inpatient administrative dataset. This dataset contains detailed demographic and utilization variables for all inpatient discharges statewide (Pennsylvania Health Care Cost Containment Council). The study population consists of Pennsylvania patients

aged 18 – 64 who were either enrolled in Medicaid (fee-for-service or managed care) or commercial insurance from January 1, 2008 to March 31, 2010. The reason for this age limitation was to exclude individuals who were dually-eligible for Medicare and Medicaid, since Medicare cost-sharing rules would bias the results. In addition, the cohort was limited to the top 20 diagnosis related groups (DRG) that were discharged to an inpatient PAC facility. Patients in the top 20 DRGs represented about 36% of all patients discharged to an inpatient PAC facility. While we lost a significant number of patients, limiting the analysis to the top 20 DRGs created a more homogeneous cohort for robust comparison.

2.3.2 Study Variables

We acquired patient demographics from the discharge records in the PHC4 dataset, and we created comorbidity indicators using an algorithm developed by Elixhauser which relies on ICD-9-CM diagnoses and procedure codes (Agency for Health Care Research and Quality; Elixhauser, Steiner, Harris, & Coffey, 1998). Intensive care unit (ICU) admission and length of stay were determined using revenue codes (revenue code 200 – 202, 207 – 213, 219) provided by the PHC4 revenue code dataset (Quan, Parsons, & Ghali, 2004). Mechanical ventilation was identified using ICD-9-CM procedure codes (Quan et al., 2004). We believe admission to the ICU and mechanical ventilation are good indicators of patient severity of illness. The PHC4 dataset also contains the MediQual Atlas Severity of Illness System which is derived from clinical variables collected at the facility and generated to obtain a predicted probability of death (Pennsylvania Health Care Cost Containment Council, 2010).

The primary outcome variable was whether the hospitalization ended with a discharge to an inpatient PAC facility. This includes a SNF, IRF, or LTACH. Medicaid generally does not pay

for care at an LTACH, but allows it under strict exceptions. We kept patients who were discharged to an LTACH in the analysis because excluding this group would introduce selection bias and leaves out a significant portion of patients who need PAC. PAC utilization was identified using the discharge codes in the PHC4 inpatient records. The primary exposure was whether the patient was covered by commercial insurance or Medicaid, and this was identified using the primary payer code in the PHC4 discharge records. We decided to compare only commercial insurance to Medicaid because these insurers must maintain healthy profit margins while allowing great flexibility to patients in terms of the provider choice and type of care. To stay viable, both commercial insurance and Medicaid require cost optimization, which gives us a more balanced comparison of inpatient PAC utilization.

2.3.3 Analysis

We examined patient and clinical characteristics of the Medicaid and commercial groups using summary statistics. Differences between the comparison groups were tested using t-tests and chi-square tests for continuous and categorical variables, respectively. To determine the relationship between discharge to an inpatient PAC facility and insurance status, we used a multivariate logistic regression model. The model was risk-adjusted for all demographic variables, mechanical ventilation, ICU admission, hospital and ICU length of stay, Elixhauser comorbidities, and PHC4 region. We adjusted for geographic region since rural areas of Pennsylvania had more limited access to inpatient PAC facilities than urban areas. To account for differences in provider characteristics and clustering, we also performed a hierarchical linear model with random hospital effects. While we included geographic region as a fixed effect, the random effects model considers the hospital-to-hospital variability of patient treatment depending on access to an inpatient PAC

facility. The MediQual predicted probability of death was not used as a predictor due to a high proportion of missing values (18.8%) in the discharge records. All continuous variables such as age were converted to quadratic splines to provide a better model fit (Howe et al., 2011). Data management and statistical analyses were performed using SAS 9.4 (SAS Institute Inc.) and Stata SE 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station). A p-value of 0.05 or below was classified as significant.

2.4 STUDY RESULTS

Over the study period (2008 – 2010 Q1), there were 3,575,127 inpatient records in Pennsylvania. After applying the exclusion criteria, 133,996 records were in the final analytic cohort (Figure 2). Patients with commercial insurance were discharged to a PAC facility more often than Medicaid patients (29.8% vs. 22.4%); however, this difference is primarily due to the differences in home health (Table 2). Overall, 14,373 or 10.7% of patients with Medicaid or commercial insurance were discharged to an inpatient PAC facility. The patient characteristics of the two study samples stratified by insurance status are shown in Table 3. Medicaid recipients that were discharged to an inpatient PAC were younger and had a significantly higher proportion of nonwhites (42.6% vs. 20.4%; $p < 0.001$) than individuals insured commercially. In addition, the majority of Medicaid patients were admitted through the emergency department and were more likely to be presented with multiple and more severe comorbidities. During the hospital stay, Medicaid patients were more likely to be admitted to the ICU and mechanically ventilated with a significantly higher predicted probability of death and longer hospital and ICU length of stay than commercially insured patients. However, a greater proportion of commercially insured patients were discharged

to higher intensive PAC facilities (IRF, LTACH) than their Medicaid counterparts (60.1% vs. 38.1%; $p < 0.001$).

The multivariate logistic regression analysis examined three outcomes of varying intensities (Table 4). The analysis suggested that Medicaid patients were more likely to be admitted to an inpatient PAC facility (SNF, IRF, LTACH) than commercially insured individuals (OR: 1.08; 95% CI: 1.04 – 1.13; $p < 0.001$; AUC = 0.807). In contrast, for high intensive PAC which only includes more expensive IRFs and LTACHs, Medicaid patients were considerably less likely to be admitted to a higher intensive inpatient PAC facility (IRF, LTACH) than individuals with commercial insurance (OR: 0.57; 95% CI: 0.54 – 0.60; $p < 0.001$; AUC = 0.767). Interestingly, if all PAC settings were incorporated in the analysis which includes the less intensive and less costly home health care, then Medicaid patients were less likely admitted to any PAC facility was than the commercially insured (OR: 0.94; 95% CI: 0.92 – 0.97; $p < 0.001$; AUC = 0.803). Overall, black patients and patients who were admitted to the ICU were significantly more likely to be discharged to an inpatient PAC facility regardless of insurance status.

In the hierarchical regression analysis (Table 5), the results were significantly different when accounting for hospital random effects. Medicaid patients were less likely to be admitted to an inpatient PAC facility than commercially insured individuals (OR: 0.87; 95% CI: 0.84 – 0.91; $p < 0.001$). On the other hand, Medicaid patients were significantly more likely to be admitted to a higher intensive inpatient PAC facility than individuals with commercial insurance (OR: 1.60; 95% CI: 1.51 – 1.70; $p < 0.001$). Individuals with Medicaid and commercial insurance were equally as likely to be admitted to any PAC facility (OR: 1.03; 95% CI: 1.00 – 1.07; $p = 0.06$).

2.5 DISCUSSION

This study sought to determine whether Medicaid patients were as likely as commercially insured patients to receive similar levels of care during recovery after an acute hospitalization. Specifically, we wanted to provider potential estimates for what is expected for PAC utilization as a result of the Medicaid expansion. We concluded that the hierarchical regression models, which accounted for hospital random effects, were more credible than the multivariable logistic models since access to an inpatient PAC facility was highly variable among providers. The analysis of the primary outcome confirmed the hypothesis that Medicaid recipients were less likely to be sent to an inpatient PAC facility in the random hospital effects model. This result confirms and extends the findings of a joint replacement study that Medicaid patients are more likely to receive less intensive PAC than commercial and Medicare patients with similar severity of illness (Freburger et al., 2011). On the other hand, the hierarchical model indicated that Medicaid patients were significantly more likely to receive more expensive and high intensive PAC. Furthermore, we observed that Medicaid expansion is likely to impact PAC utilization since the discharge pattern for Medicaid patients are significantly different than commercially insured patients. This finding has cost implications that states must consider since the major driver of healthcare spending and variation stems from PAC utilization (Medicare Payment Advisory Commission, 2011). How individual states will react to the Medicaid expansion remains to be seen. However, if there is a significant increase in PAC utilization in the upcoming years, then it could pave way for cost control measures that may impact hospital revenue and patient quality of care.

We performed a sensitivity analysis to see the effect of insurance type on all PAC settings. Interestingly, for all PAC settings, including the low intensive home health care, Medicaid and commercially insured patients were equally as less likely to be discharged to any PAC facility.

This may suggest that Medicaid is compelled to use home health care over more intensive PAC setting such as SNFs due to its significantly lower cost. However, this may also indicate that commercial insurers underutilize home health care. In either case, these results show that there is an insurance-based difference in PAC utilization, and it could draw attention towards standardizing PAC planning. Policymakers could label this as a cost control measure or a quality improvement program that would overuse and underuse of PAC.

The differences in PAC utilization patterns between insurance types were substantially distinct. Although Medicaid patients were sicker than commercially insured patients in the cohort, they had a significantly lower proportion sent to inpatient PAC facilities. In contrast, Medicaid patients were significantly more likely to be admitted to a high intensive inpatient PAC facility. While discharge to an inpatient PAC facility does not necessarily mean better care, the discrepancy is still noteworthy. There are several possible reasons for this disparity. First, Medicaid may lack a uniform assessment to determine what level of care is medically necessary for each patient to recover after a hospitalization. Commercial insurers may have better algorithms in their plans to determine the appropriate level of care. The Pennsylvania Long Term Care Commission has recommended an adoption of a uniform assessment to determine levels of care which would streamline the process for hospitals and patients (Pennsylvania Long Term Care Commission, 2014). However, this may be difficult for rural patients since access to more intensive forms of PAC care such as IRFs and LTCHs is greater in urban areas. In the end, this insurance-based difference tells us that we need to “right-size” PAC utilization by optimizing the decision-making process.

Second, determinants for post-acute care under Pennsylvania Medicaid is managed through a waiver system with eligibility requirements including prior authorization from a physician. These

extra levels of bureaucracy create an inefficient system that could delay or prevent Medicaid patients from receiving appropriate levels of care. Although over 80% of Medicaid recipients in Pennsylvania are under managed care, long term care services are not covered under capitation payments (Centers for Medicare and Medicaid Services, 2014). A solution to this problem would be to shift long term care responsibilities to managed care for a more coordinated system. Managed care would be able to use their own assessment tools to determine appropriate levels of care for each patient. Still, it is unknown whether this would improve outcomes or encourage placement to a high intensive PAC facility without extra reimbursement incentives.

Lastly, Pennsylvania Medicaid generally does not pay for care at an LTACH, which are the most expensive PAC setting. LTACHs provide highly intensive rehabilitation for critically ill patients. While commercially insured patients were less sick than Medicaid patients, a higher proportion were transferred to an LTACH (7.0% vs. 1.7%). Few states such as Washington do pay for LTACHs in their Medicaid programs, but it is not clear whether this is beneficial to the Medicaid population. Some Pennsylvania Medicaid managed care organizations allow exceptions for patients to be admitted to an LTACH. Nonetheless, Medicaid patients may benefit from more intensive PAC setting if deemed medically necessary.

There were several limitations in this study. First, the study population was limited to inpatient discharge records in Pennsylvania. Although the dataset used gives a rare insight on comparing individuals insured commercially to Medicaid recipients, the population may not be representative of patients in other states. In addition, Medicaid rules vary greatly across states which reduces the generalizability of the results. Second, as with all administrative datasets, coding errors are not uncommon, which may have some effect on the accuracy of the models. Although the PHC4 dataset did contain the MediQual probability of death which is determined using clinical

and laboratory data, the variable was not used in the logistic models due to a high rate of missingness. As a result, the dataset lacks clinical data that may have significantly improve the models. Third, although we excluded individuals over the age of 65 to eliminate most dual-eligibles, it did not exclude individuals who were poor and disabled and qualified for both Medicare and Medicaid. This may have affected our results since Medicare usually pays first for PAC claims. Fourth, we were not able to adjust for socioeconomic status such as income. While Medicaid status may give some indication of socioeconomic status, adjusting for income accounts for individuals that may be in the coverage gap or borderline qualifies for Medicaid or subsidies for the insurance marketplace. Lastly, the dataset limited our ability to follow patients through their episode of care, which could have provided better insight on the outcome of each PAC location and the accuracy of the discharge disposition codes.

2.6 CONCLUSION

Hospitalized Medicaid beneficiaries were as likely as similar patients with commercial insurance to be admitted to a PAC facility, but less likely to be admitted to an inpatient PAC facility. Nevertheless, the data suggests that Medicaid expansion may lead to an increase in PAC use due to the demand of services from new Medicaid enrollees, and that PAC use will be a major burden on states after the expansion. At the same time, Medicaid beneficiaries tend to be admitted to more intensive forms of PAC due to increased access in urban areas. To the degree that appropriate PAC can produce health and financial benefits, the data highlights opportunities for states to standardize their approach to PAC. This study has opened up avenues for further study on whether Medicaid recipients would have better outcomes as a result of receiving comparable levels of care as

individuals with other insurance types. Given the fact that Medicaid has reimbursement rates considerably lower than Medicare and private insurance, improving patient care for the low-income community, especially after a hospital stay, will be a difficult challenge.

3.0 COMPARING INPATIENT POST-ACUTE CARE UTILIZATION PATTERNS BETWEEN FEE-FOR-SERVICE AND MANAGED CARE IN PENNSYLVANIA MEDICAID

3.1 ABSTRACT

Introduction

In the past decade, there has been a rise in managed care organizations (MCO) directing health services utilization and cost for state Medicaid programs. With many states implementing or considering the recent Medicaid expansion, cost concerns have steered state policymakers towards MCOs to deliver healthcare to the majority of their respective Medicaid recipients. According to a Medicare Payment Advisory Commission report, post-acute care (PAC) utilization is a major driver of healthcare spending in the United States. As a result, it is important to determine if the shift towards MCOs and away from the old fee-for-service (FFS) delivery system will improve care coordination through the optimization of PAC utilization. In prior work we demonstrated: (a) that Medicaid beneficiaries use PAC at a rate similar to the commercially insured, yet also use less intense forms of PAC; and (b) that these differences may explain some of the differences in post-acute mortality and readmission rates between Medicaid beneficiaries and the commercial insured. Here, we explore whether some of these differences may be moderated by MCOs. These results can be used to inform policymakers on whether to contract MCOs for future Medicaid expansions.

Objective

The purpose of this study is to determine whether Medicaid managed care utilizes inpatient PAC differently than its FFS counterpart.

Methods

We performed a retrospective cohort study using Pennsylvania Medicaid claims data from 2007 to 2011. Eligible patients were between the ages of 18 – 64 and diagnosed in the top 20 diagnosis related group that were discharged to an inpatient PAC. Multivariable logistic regression models were used to estimate the association between Medicaid delivery type and probability of discharge to an inpatient PAC.

Results

115,107 Medicaid unique claims were in the final analytic cohort, and 2,399 (2.1%) of these claims ended in a discharge to an inpatient PAC facility. FFS Medicaid patients had a significantly greater hospital length of stay (15.0 vs. 10.2) and admitted to the ICU more often (48.5% vs. 29.8%) than patients with managed care. Conditional on discharge to an inpatient PAC, Medicaid managed care patients were significantly more likely to be discharged to an IRF (59.5% vs. 34.9%) while the reverse holds true for SNF where FFS patients predominated (54.5% vs. 38.0%). In the multivariate analysis, Medicaid patients under managed care were more likely to be admitted to an inpatient PAC facility (SNF, IRF, LTACH) than FFS Medicaid patients (OR: 3.19; 95% CI: 2.87 – 3.54; $p < 0.001$). Medicaid managed care patients were considerably more likely to be admitted to a high intensive inpatient PAC facility (IRF, LTACH) than FFS Medicaid patients (OR: 5.48; 95% CI: 4.73 – 6.34; $p < 0.001$).

Conclusions

Medicaid managed care beneficiaries were more likely to be admitted to an inpatient PAC than their FFS counterparts. The impact of managed care in Pennsylvania appeared to be positive for Medicaid beneficiaries because of the shorter length of stay and admittance to more intensive rehabilitation settings under MCOs. Assuming MCOs are utilizing their capitated payments from the state efficiently, this study suggests opportunities for states to contract MCOs to manage their Medicaid programs with the expansion underway.

3.2 INTRODUCTION

As of March 2016, 32 states including D.C. have expanded Medicaid with some non-expansion states proposing alternative expansion plans for state legislature and federal approval (National Academy for State Health Policy). The impact of the Medicaid expansion is significant in part that individuals who were uninsured previously and now insured by Medicaid are more likely to utilize healthcare services such as post-acute care (PAC) than when they were uninsured. Many states are concerned that an increase in healthcare utilization means a rise in healthcare costs thus more Medicaid spending. However, the Kaiser Family Foundation looked at the effects of the Medicaid expansion on state budgets and found that states have so far incurred only limited additional costs related to the considerable increase in enrollment and experienced savings in their Medicaid programs (Dorn, Francis, Rudowitz, & Snyder, 2015). To further control cost and utilization, states have used managed care organizations (MCO) to manage healthcare for Medicaid recipients. This includes improvements in care coordination, increased access through provider networks, and competition among MCOs that may lead to quality improvements and

lower costs. As a result, the proportion of Medicaid managed care beneficiaries have significantly increased from 58% in 2002 (Medicare, Services, Health, & Services, 2013) to 72% in 2013 (Medicare, Services, Health, & Services, 2015). With Medicaid enrollment rising at a substantial rate due to the expansion, it is important to understand how managed care affects Medicaid recipients in terms of where they receive treatment to fully recover from acute illness and the quality of care compared to the rest of the population.

Many previously uninsured Americans are now insured and have easier access to healthcare services as a result of the Affordable Care Act, which relaxed Medicaid income requirements, removed categorical eligibility requirements, and streamlined enrollment to reduce barriers in obtaining insurance. However, there is concern as to whether Medicaid recipients are receiving comparable quality of care as individuals insured through other means such as private insurance. One study demonstrated that managed care plans that served predominately Medicaid recipients had lower scores on most quality of care indicators than plans with commercially insured individuals only (Landon et al., 2007). In addition, the same study determined that plans which serve both Medicaid and commercial enrollees had no significant differences in quality of care scores over plans with just Medicaid beneficiaries (Landon et al., 2007). These lower quality scores among the Medicaid population could be attributed to smaller reimbursement rates in Medicaid fee-for-service (FFS) and managed care where states typically pay a fixed per member per month rate to an MCO. In 2012, Medicaid paid on average nationwide 66% of the amount Medicare reimburses for the same services and only six states have comparable or higher reimbursement rates for Medicaid than Medicare (Zuckerman, 2012). These lower rates may limit participation of primary care practices and PAC facilities in Medicaid provider networks which would affect access to care for low-income communities. In addition, studies have suggested that regions with

higher Medicaid fee rates is associated with higher physician acceptance rates for new Medicaid patients (Decker, 2007, 2012) and longer physician visit durations which could lead to higher quality of care (Decker, 2007). Nevertheless, other studies have shown that higher Medicaid fees alone do not necessarily increase access and quality of care significantly (Cunningham & O'Malley, 2009; Shen & Zuckerman, 2005). The ACA did mandate increases in Medicaid fees to Medicare levels to encourage provider participation in the expansion; however, the rate increase expired in 2014 and only 15 states continued to participate (Kaiser Family Foundation, 2012; Smith et al., 2014). The effects of the ACA mandated fee increase on access and quality of care have not yet been assessed. In any case, there are gaps in access and quality that needs to be addressed in the Medicaid population.

Many states, especially those that have expanded Medicaid or plan to expand, have moved many of their Medicaid recipients from the traditional FFS delivery system to managed care plans in order to reduce expenditures. Despite having their own prior authorization and clinical guidelines to manage Medicaid patients, states believe that MCOs have the better tools and innovative system to administer care more efficiently and effectively. For instance, reports from the Medicare Payment Advisory Commission found that there is significant variation in spending on PAC, which includes skilled nursing facilities (SNF), inpatient rehabilitation facilities (IRF), and long-term acute care hospitals (LTACH) (Medicare Payment Advisory Commission, 2011). Although no reports point to significant variation in PAC Medicaid spending, MCOs are expected to focus on PAC utilization in Medicaid to control costs. However, this could lead to underuse of more intensive PAC settings such as IRFs to achieve cost savings. One study reported that Medicaid patients that underwent joint replacements were significantly less likely to receive care from more intensive and expensive PAC settings than individuals with commercial insurance or

Medicare with similar severity of illness (Freburger et al., 2011). Similarly in stroke survivors, Medicaid beneficiaries were nearly 75% less likely to receive care in an IRF than the less intensive and expensive SNF compared with commercially insured patients (L. Skolarus et al., 2012). Our previous work also showed that patients with commercial insurance were significantly more likely to receive care in a high intensive inpatient PAC facility such as an IRF and LTACH. Nevertheless, it is unknown if there is a difference in PAC use between Medicaid FFS and managed care (Figure 3). Pennsylvania was one of the early adopters of Medicaid managed care, and the significant shift towards MCOs in Pennsylvania Medicaid over FFS in the past decade opens up the discussion on whether this would have a significant effect on the course of treatment through a patient's episode of care. The general assumption is that sicker patients such as individuals admitted to the intensive care unit or mechanically ventilated are likely to be discharged to higher intensive PAC facilities which have the ability to provide the required rehabilitation and care necessary for recovery. If MCOs are not able to provide more efficient and effective care than Medicaid under FFS, then we can argue that the current shift to MCOs may not necessarily be beneficial for Medicaid patients. Nevertheless, states believe that MCOs have the ability to be more efficient and effective in coordinating care than the FFS system.

The objective of this study is to determine whether Medicaid managed care utilizes inpatient PAC differently than Medicaid FFS. This study would inform policymakers on what is expected for PAC utilization in Medicaid FFS versus managed care. Whether this information can be used to show how efficiently managed care uses state Medicaid dollars or how this would impact patient quality of care depends on these differences. Furthermore, these results can impact policy decisions to contract MCOs to manage patients in the future. We hypothesize that there is a difference in PAC utilization between Medicaid FFS and managed care based on the fact that

both delivery types have very distinct methods to coordinate care. In this study, we will be focusing on Pennsylvania's Medicaid program which has recently expanded Medicaid and a significant proportion of Medicaid patients in managed care plans.

3.3 STUDY DATA AND METHODS

3.3.1 Study Design and Population

This was a retrospective cohort study using Pennsylvania Medicaid claims data from 2007 to 2011 provided by the Pennsylvania Department of Human Services. The Medicaid claims record used in this study comprised the inpatient, enrollment, and provider files. These files contain information on demographics, diagnoses, revenue codes, Medicaid enrollment eligibility and dates, and provider type and specialty.

The study population consists of Pennsylvania patients aged 18 – 64 who were enrolled in a HealthChoices managed care plan or placed in the traditional FFS delivery system from 2007 to 2011. Medicaid recipients 65 and over were excluded due to their eligibility for Medicare and thus these individuals would be dually-eligible. Consequently, the Medicare cost-sharing rules for dually-eligibles would bias the results. The population was limited to the top 20 diagnosis related groups (DRG) that were discharged to an inpatient PAC facility. This would reduce confounding and create a more homogeneous population for robust comparison.

3.3.2 Study Variables

We obtained patient demographics which includes age, gender, and race from the inpatient Medicaid claim records. Comorbidities were determined using an algorithm developed by Elixhauser, which uses ICD-9-CM codes in the inpatient claims (Agency for Health Care Research and Quality; Elixhauser et al., 1998). Intensive care unit (ICU) admission was determined using revenue codes (revenue code 200 – 202, 207 – 213, 219) provided by the inpatient Medicaid claim records (Quan et al., 2004). Mechanical ventilation was identified using ICD-9-CM procedure codes (Quan et al., 2004). Medicaid eligibility, which includes Supplemental Security Income (SSI), General Assistance (GA), and Temporary Assistance for Needy Families (TANF), was obtained from the enrollment files.

The primary outcome variable was whether the hospitalization ended with a discharge to an inpatient PAC facility. The provider file was used to identify inpatient PAC facilities, which were defined as a SNF, IRF, or LTACH. Subsequently, we observed transfers within one day of discharge from an inpatient hospital to an inpatient PAC facility in the claims. This approach allows for a more accurate determination of discharge destinations instead of relying on discharge status codes, which has been shown to be only moderately accurate (Kahn & Iwashyna, 2010). The primary exposure was the Medicaid delivery type defined as enrolling in FFS or managed care. This information was obtained from the enrollment file which contains the delivery type and its associated enrollment dates. To determine the delivery type, the discharge date in the inpatient claims were matched up with the corresponding enrollment dates to confirm whether the patient was enrolled in a managed care plan or FFS at the time. For patients that were enrolled in Medicaid during the hospital stay, we used the same procedure to determine delivery type since the

proportion of managed care and FFS for these previously uninsured individuals reflected Pennsylvania rates.

3.3.3 Analysis

We examined patient and clinical characteristics of each Medicaid cohort using summary statistics. Differences between the comparison groups were tested using t-tests and chi-square tests for continuous and categorical variables, respectively. To determine the relationship between discharge to an inpatient PAC facility and Medicaid delivery type, a multivariate logistic regression model was used. The model was risk-adjusted for all demographic variables, mechanical ventilation, ICU admission, hospital length of stay, Elixhauser comorbidities, and PHC4 region (Figure 4). We adjusted for geographic region since some areas of Pennsylvania had limited access to Medicaid managed care during the study period. The proportion of FFS Medicaid recipients was higher in rural regions than more urban areas (Table 6). Medicaid eligibility was also adjusted in our model since patients eligible for Medicaid through the TANF program were more likely to enroll in managed care (Table 8). Lastly, we included diagnosis related groups in the models due to the significant differences in diagnoses (Table 8). All continuous variables such as age were converted to quadratic splines to provide a better model fit (Howe et al., 2011). In addition, we included only hospital survivors not discharged to a hospice in our regression models to account for death as a competing risk in discharge to an inpatient PAC facility. To account for differences in provider characteristics and clustering, we also performed a hierarchical linear model with random hospital effects. While we included geographic region as a fixed effect, the random effects model considers the hospital-to-hospital variability of patient treatment depending on access to an inpatient PAC facility. Data management and statistical analyses were performed

using SAS 9.4 (SAS Institute Inc.) and Stata SE 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station). A p-value of 0.05 or below was classified as statistically significant.

3.4 STUDY RESULTS

There were 2,715,537 inpatient claims in Pennsylvania Medicaid during the study period. After applying the exclusion criteria, 115,107 unique claims were in the final analytic cohort with 44,392 (38.6%) and 70,715 (61.4%) classified as FFS and managed care, respectively (Figure 5). Of those in the final cohort, 2,399 (2.1%) of these claims ended in a discharge to an inpatient PAC facility. For hospitalizations ending with discharge to an inpatient PAC facility, the proportion of Medicaid patients with FFS rose steadily from 2007 to 2011 while inpatient PAC utilization patterns remained relatively stable during this period (Table 7). However, parsing out these patterns by Medicaid delivery type reveals a different picture (Table 8). For FFS recipients, the number of discharges to SNFs increased significantly (58.2% to 75.2%) while discharges to IRFs decreased (35.9% to 18.6%) during the study period. In contrast, Medicaid beneficiaries served by managed care experienced the reverse patterns with discharges to IRFs notably increasing (50.8% to 65.4%) while discharges to SNFs decreasing (43.2% to 30.0%) throughout the study. These trends demonstrate a distinction in discharge patterns between the delivery types with these differences widening as time moved forward.

The patient characteristics of the two Medicaid cohorts displayed some interesting differences and similarities (Table 9). Medicaid FFS beneficiaries had a significantly higher proportion of white beneficiaries than the managed care group. This is likely due to the fact that some rural areas in Pennsylvania did not have any HealthChoices plans available. While both

Medicaid cohorts have similar severity of illness in terms of comorbidity count and the presence of severe comorbid conditions, FFS recipients were considerably more likely to be admitted to the ICU (48.5% vs. 29.8%) and mechanically ventilated (10.6% vs. 6.5%) than patients with managed care. Furthermore, hospital length of stay for FFS Medicaid patients were substantially longer than their managed care counterparts (15.0 vs. 10.2 days). Yet, Medicaid managed care patients were significantly more likely to be discharged to an IRF (59.5% vs. 34.9%) while the reverse holds true for SNF where FFS patients predominated (54.5% vs. 38.0%).

The multivariate logistic regression analysis examined two outcomes of varying intensities (Table 10). The analysis suggested that Medicaid patients with managed care were more likely to be discharged to an inpatient PAC than FFS recipients (OR: 3.29; 95% CI: 2.97 – 3.64; $p < 0.001$; AUC = 0.881). We also performed a sensitivity analysis and tested the likelihood of discharge to a high intensive inpatient PAC facility which includes only IRFs and LTACHs. For this outcome, Medicaid patients with managed care were considerably more likely to be discharged to a high intensive inpatient PAC than FFS recipients (OR: 5.24; 95% CI: 4.54 – 6.06; $p < 0.001$; AUC = 0.910). Interestingly, mechanically ventilated patients were as likely to be discharged to an inpatient PAC facility than patients who were not ventilated (OR: 1.07; 95% CI: 0.84 – 1.36; $p = 0.601$) even when the cohort was limited to hospital survivors not discharged to a hospice. The odds were smaller for discharges to a high intensive inpatient PAC facility (OR: 1.07; 95% CI: 0.78 – 1.47; $p = 0.666$). In the hierarchical regression analysis (Table 11), the effects of Medicaid delivery type on discharge to an inpatient PAC were similar when accounting for hospital random effects. Medicaid patients with managed care were more likely to be discharged to an inpatient PAC than FFS recipients (OR: 3.19; 95% CI: 2.87 – 3.54; $p < 0.001$). In addition, Medicaid patients with managed care were considerably more likely to be discharged to a high intensive inpatient

PAC than FFS recipients (OR: 5.48; 95% CI: 4.73 – 6.34; $p < 0.001$). There were no notable differences in the effects of patient demographics and frailty on the primary outcome.

Lastly, we stratified our cohort by urbanicity to determine whether this relationship persisted throughout regions of Pennsylvania (Table 12). In urban regions, which included the Pittsburgh and Philadelphia metropolitan area, the odds were stronger for Medicaid managed care patients discharged to either an inpatient PAC (OR: 4.20; 95% CI: 3.68 – 4.80; $p < 0.001$; ROC = 0.885) and a high intensive inpatient PAC facility than FFS beneficiaries (OR: 5.42; 95% CI: 4.50 – 6.51; $p < 0.001$; ROC = 0.905). However, in rural areas, which consisted of all other regions, the relationship was weaker for either discharge to an inpatient PAC facility (OR: 2.16; 95% CI: 1.85 – 2.53; $p < 0.001$; ROC = 0.880) and a high intensive inpatient PAC facility (OR: 4.64; 95% CI: 3.73 – 5.78; $p < 0.001$; ROC = 0.905). When accounting for hospital random effects (Table 13), the odds for discharge to an inpatient PAC were similar for both urban (OR: 4.08; 95% CI: 3.56 – 4.68; $p < 0.001$) and rural (OR: 2.14; 95% CI: 1.82 – 2.51; $p < 0.001$). Similarly, the odds for discharge to a high intensive inpatient PAC remained steady for urban (OR: 5.38; 95% CI: 4.46 – 6.48; $p < 0.001$) and rural (OR: 4.66; 95% CI: 3.73 – 5.81; $p < 0.001$) areas.

3.5 DISCUSSION

In Pennsylvania Medicaid, patients in managed care plans receive care in higher intensive and more expensive PAC facilities than recipients in the traditional FFS system. Moreover, the PAC utilization patterns in Medicaid managed care plans reflected that of commercial insurance from our previous study. The increase in IRF utilization throughout the study period especially during its sudden rise in 2010 suggests a shift in payment policy. In fact, the Pennsylvania Department of

Public Welfare established supplemental payments to IRFs participating in the Medicaid program starting in July 2010 (Alexander, 2012; Dichter, 2010). This policy change likely affected the utilization of IRFs in two ways. First, the propensity of IRFs accepting Medicaid patients increased with the incentive of an additional payment. Second, the increased reimbursements opened up an opportunity to discharge patients in need of a higher intensive PAC setting to an IRF instead of either prolonging the hospital stay or discharging to a SNF or home health setting which may not have been adequate enough for full rehabilitation. On the other hand, the incentives may encourage hospitals to discharge patients to a high intensive PAC setting earlier to avoid incurring additional cost due to prolonged hospital stays. This would result in possible overuse of high intensive PAC facilities. Ultimately, these results supported our hypothesis that traditional FFS had distinct PAC utilization patterns as managed care plans in Medicaid.

While IRF utilization increased in managed care during the study period, we observed a significant decrease in the proportion of discharges to an IRF in Medicaid FFS. There are a few reasons why there is a large discrepancy in PAC utilization patterns between Medicaid managed care and FFS. The state Medicaid FFS system may have stricter prior authorization requirements for high intensive PAC settings due to costs. On the other hand, MCOs have the resources, established care coordination, and high negotiation clout to afford high intensive PAC settings when medically necessary. It is also likely that the state of Pennsylvania has paid MCOs at a high enough fixed per member per month rate to continue participating in the Medicaid program and allow for enough resources to utilize high intensive PAC facilities. Another possibility is that Medicaid FFS overuses SNFs due to its lower cost and more relaxed requirements. However, it can be argued that there are more available SNFs that accept Medicaid patients than IRFs and LTACHs. Incidentally, Pennsylvania Medicaid does not pay for LTACH stay because of its

extremely high costs; however, an administrative waiver request may be filled out by the provider if it is deemed medically necessary (Pennsylvania Department of Human Services, 2012). According to our results, the amount of discharges to an LTACH is rare compared to SNFs and IRFs in both delivery systems.

The differences in patient characteristics between delivery system were considerably different especially during the hospital stay. One significant demographic difference is that the proportion of nonwhites were significantly less in Medicaid FFS than managed care. This is likely due to the minimal availability of HealthChoices managed care plans in rural areas during the study period. Consequently, Medicaid beneficiaries that live in rural areas may have limited access to acute care hospitals and other essential health services such as PAC facilities. This constrained supply may explain why Medicaid FFS beneficiaries have on average 4.8 days longer hospital length of stay and significantly more likely to be admitted to the ICU than patients in managed care plans. According to a study, nearly half of trauma patients with hospital length of stay of 10 days or longer experienced discharge delays due to difficulty in PAC placement (Hwabejire et al., 2013). Not only does the availability of high intensive PAC facilities affect inpatient care and utilization PAC patterns, but also the use of case managers to coordinate care for Medicaid patients. MCOs have more established networks and innovative care coordination than the state FFS system, which likely leads to fewer delays during transitions of care.

An alternative to FFS and managed care, which was used primarily for rural areas, is the Primary Care Case Management (PCCM) program. PCCMs have been used in other states which acts as a hybrid between FFS and managed care. In this plan, the state pays a fixed rate to a primary care provider or case manager to coordinate care and health services are reimbursed under the FFS model. During the study period, Pennsylvania had a PCCM program called ACCESS Plus that was

available for Medicaid beneficiaries in rural counties who did not voluntarily participate in the HealthChoices managed care plan. According to our sensitivity analysis, the PCCM program did not seem to have as much effect on PAC utilization. We believe that availability of PAC facilities likely had a significant effect on PAC utilization patterns in rural areas than delivery type. In 2013, the ACCESS Plus program was phased out and mandatory enrollment in an MCO was required for all Medicaid beneficiaries with some exceptions.

There were several limitations in this study. First, the study population was limited to Medicaid claims in Pennsylvania. While the population may not be representative of patients in other states, the dataset we analyzed contained 100% of Medicaid claims that were submitted in the state. Furthermore, state Medicaid policy varies widely among states and can change with time. The Pennsylvania Medicaid policy has changed significantly from our study period to the current times. However, many states still either do not have or have a limited proportion of Medicaid beneficiaries enrolled in managed care plans. Our study would inform policymakers in those states to consider contracting MCOs over maintaining the traditional FFS system. Second, administrative datasets contains some coding errors that may have some effect on the accuracy of our models. Nevertheless, our claims dataset gave us the ability to avoid relying on inaccurate discharge status codes (Kahn & Iwashyna, 2010). Third, we were not able to adjust for socioeconomic status such as income. While Medicaid status may give some indication of socioeconomic status, adjusting for income accounts for individuals that may be in the coverage gap or borderline qualifies for Medicaid or subsidies for the insurance marketplace. Lastly, even though we excluded beneficiaries over the age of 65 to restrict dual-eligibles, it did not exclude recipients who were poor and disabled. This may have affected some of our results since Medicare funds are initially exhausted before using Medicaid dollars for PAC claims.

3.6 CONCLUSION

Medicaid managed care beneficiaries were more likely to be admitted to an inpatient PAC than recipients in the traditional FFS system. These PAC utilization patterns reflect that of commercial insurance from our previous study. The impact of managed care in Pennsylvania appeared to be positive for Medicaid beneficiaries because of the shorter length of stay and admittance to more intensive rehabilitation under MCOs. This may be due to better care coordination. While Pennsylvania currently mandates Medicaid recipients to enroll in a HealthChoices managed care plan with few exceptions, this study can inform other states that still have a vested Medicaid FFS system. Assuming MCOs are utilizing their capitated payments from the state efficiently, this study suggests opportunities for states to contract MCOs to manage their Medicaid programs with the expansion underway. Pennsylvania is one of 32 states to expand Medicaid, and they are doing so using their managed care system which should be a model for other states to replicate. This would ensure that new and current Medicaid recipients receive the highest quality of care possible through proper patient management and care coordination.

4.0 THE IMPACT OF POST-ACUTE CARE UTILIZATION IN MEDICAID AND COMMERCIAL INSURANCE ON PATIENT OUTCOMES

4.1 ABSTRACT

Introduction

Medicaid expansion under the Affordable Care Act has insured numerous individuals who were without insurance which allowed them to take better advantage of essential health services such as post-acute care (PAC). Our previous research suggested that while Medicaid recipients were as likely as individuals with commercial insurance to be admitted to an inpatient PAC, they are considerably less likely to be discharged to a high intensive inpatient PAC such as an inpatient rehabilitation facility (IRF) and long-term acute care hospital (LTACH). Reduced utilization of certain inpatient PAC settings may translate into quality gaps between Medicaid and private insurance that could be reinforced under the Medicaid expansion. With the rapid expansion of Medicaid over the next several years, it is important to understand how PAC utilization patterns impact patient outcomes.

Objective

The purpose of this study is to determine the degree to which patient outcomes observed among Medicaid beneficiaries was mediated by variation in the intensity of PAC utilization.

Methods

We performed a retrospective cohort study using Pennsylvania administrative inpatient discharge records. Eligible patients were between the ages of 18 – 64 and discharged to an inpatient PAC. We used a two-stage causal pathway modeling approach to determine the influence of PAC utilization on the relationship between insurance type and patient outcomes. Multivariable logistic regression models were fitted to estimate odds ratio for the relationship between insurance status and patient outcomes. These models adjust for only patient characteristics. Subsequently, another identical set of multivariate logistic models were fitted except with the addition of type of inpatient PAC facility. Marginal effects between these sets of models were calculated to estimate the mediating effect of PAC type on the relationship between insurance status and patient outcomes.

Results

40,603 records were in the final analytic cohort. The majority of patients that were discharged to an inpatient PAC facility were Medicaid beneficiaries (59.4 % vs. 40.6%; $p < 0.001$). However, commercially insured patients were more likely to be discharged to a high intensive inpatient PAC facility (IRF, LTACH) than individuals covered under Medicaid (54.7% vs. 26.2%; $p < 0.001$). In our models testing the association between insurance type and patient outcomes, controlling for PAC utilization rates increased the odds ratio of Medicaid beneficiaries being readmitted to a hospital (30-day marginal effect: 1.26; 90-day marginal effect: 1.14; 180-day marginal effect: 1.11). Conversely, controlling for PAC utilization rates had a significant, positive effect on mortality rates (30-day marginal effect: 0.78; 90-day marginal effect: 0.84; 180-day marginal effect: 0.86).

Conclusions

PAC utilization patterns for hospitalized Medicaid beneficiaries impacted readmissions and mortality to a degree. These results should push states to standardize their approach to PAC and take necessary steps to improve patient management and care coordination among providers.

4.2 INTRODUCTION

The Medicaid program has been a healthcare safety net for millions of low-income and disabled Americans for over fifty years. Under the Medicaid expansion through the Affordable Care Act (ACA), enrollment in the program has increased since minimum income eligibility levels were raised for states that participated in the expansion. Recent numbers indicate that Medicaid enrollment has increased by 21% to more than 71 million Americans from the passage of the ACA, and this number is expected to rise as more states decide to participate (Kaiser Family Foundation, 2015c) As a result, this safety net is becoming more vital under the current expansion.

One of the main limitations of the Medicaid program is the historically low reimbursement rates compared to Medicare and commercial insurance. Only six states have Medicaid reimbursement rates comparable or higher than Medicare, and for the remaining states, Medicaid paid on average 66% of the amount Medicare reimburses for the same services (Zuckerman, 2012). These lower rates discourage many providers from accepting Medicaid patients which reduces access to primary care for individuals in low socioeconomic areas. Furthermore, this has created barriers to essential services such as post-acute care (PAC), which provides key benefits during recovery from acute illness. These barriers may eventually lead to gaps in quality of care between Medicaid beneficiaries and other insurance types. Nevertheless, studies have been mixed on

whether increasing Medicaid reimbursements would significantly narrow this access gap. It has been suggested that regions with higher Medicaid reimbursement rates were associated with higher physician acceptance rates for new Medicaid patients which means greater access to care and longer physician visit durations which may lead to better quality of care (Decker, 2007, 2012). On the other hand, other studies have shown that higher Medicaid fee rates alone do not significantly increase access and quality of care (Cunningham & O'Malley, 2009; Shen & Zuckerman, 2005). These inconsistent results suggest that there may be a deeper underlying issue beyond provider reimbursements.

As previously shown in many studies, health care associated with Medicaid has been comparatively worse than with commercial insurance. All-cause hospital readmission rates were observed to be higher across all levels of severity of illness (Jiang & Wier, 2010), and the likelihood to be readmitted for heart failure and all-cause was 68% and 32% greater in Medicaid patients than the commercially insured, respectively (L. A. Allen, Tomic, Smith, Wilson, & Agodoa, 2012). These poorer patient outcomes could be attributed to anywhere from the lack of preventive care to the recovery and rehabilitation from a hospital stay. We know from a few studies that Medicaid beneficiaries had significantly lower scores on most quality of care measures such as screenings, immunizations, and chronic disease management than individuals with commercial insurance within the same plan or across all plans (Landon et al., 2007; Thompson, Ryan, Pinidiya, & Bost, 2003). However, the recent focus is now on PAC, and the concept that better coordination of care to ensure effective transitions between hospitals stays and PAC leads to fewer readmissions (Mechanic, 2014).

Since a Medicare Payment Advisory Commission report found that there is significant variation in spending on PAC, considerable attention has been devoted to improving utilization of

these services such as skilled nursing facilities (SNF), long-term acute care hospitals (LTACH), and inpatient rehabilitation facilities (IRF) in order to lower healthcare costs (Medicare Payment Advisory Commission, 2011). This could mean developing better care coordination between the acute care provider and PAC facility. At the same time, it could mean limiting the use of PAC which could exclude patients that may need those services to recover from an illness. In previous work, we demonstrated that although Medicaid recipients tend to be discharged to PAC at comparable rates compared to patients with commercial insurance, Medicaid recipients have substantially decreased utilization to high intensity inpatient PAC such as IRFs and LTACHs (Le, 2016). While lower utilization of these services does not necessarily equate to poorer quality of care, the significant differences in utilization between Medicaid beneficiaries and commercially insured individuals may explain at least part of the variations in patient outcomes.

From our review of the literature, we observed the relationship between insurance type and patient outcomes. To build on these observations, we sought to determine the extent to which the increased mortality and readmissions observed among Medicaid beneficiaries was, in part, mediated by variation in the intensity of PAC utilization. While sicker patients such as individuals admitted to the intensive care unit or that developed high number of comorbidities likely translates to worse outcomes, we hypothesize that PAC utilization patterns have a significant effect on that relationship. Our previous work showed that there were discrepancies in PAC utilization between Medicaid and commercial insurance, especially in regards to high intensive PAC settings.13 The degree to which these PAC utilization patterns of either insurance type had an effect on patient outcomes is unknown (Figure 6). A large effect on the relationship between insurance type and patient outcomes could mean that PAC utilization needs to be “right-sized” in order to deliver more efficient and effective care.

The purpose of this study is to determine the degree to which patient outcomes observed among Medicaid beneficiaries was mediated by variation in the intensity of PAC utilization. We sought to identify Medicaid recipients and commercially insured patients who were discharged to an inpatient PAC facility. Subsequently, we wanted to determine the impact of these PAC utilization patterns in Medicaid and commercial insurance on readmission and mortality. We hypothesized based on previous literature that PAC utilization patterns for Medicaid recipients would have a negative effect on readmissions and mortality. This study is important since it will inform how the Medicaid expansion will influence patient outcomes, and consequently, potential added costs to the healthcare system.

4.3 STUDY DATA AND METHODS

4.3.1 Study Design and Population

This was a retrospective cohort study using hospital discharge data from the Pennsylvania Health Care Cost Containment Council (PHC4) inpatient administrative dataset. This hospitalization level dataset contains detailed demographic, clinical, and utilization variables for all inpatient discharges statewide (Pennsylvania Health Care Cost Containment Council). The study population consists of Pennsylvania patients aged 18 – 64 who were either enrolled in Medicaid (fee-for-service or managed care) or commercial insurance from January 1, 2008 to March 31, 2010. The reason for this age limitation was to exclude individuals that are dually-eligible and for whom Medicare cost-

sharing rules may bias the results. The cohort was limited to patients that were discharged to an inpatient PAC facility.

4.3.2 Study Variables

We acquired patient demographics from the discharge records in the PHC4 dataset and we obtained information on comorbidities using an algorithm developed by Elixhauser, which uses ICD-9-CM codes on individual patient records (Agency for Health Care Research and Quality; Elixhauser et al., 1998). Intensive care unit (ICU) admission was determined using revenue codes (revenue code 200 – 202, 207 – 213, 219) provided by the PHC4 revenue code dataset (Quan et al., 2004). Mechanical ventilation was identified using ICD-9-CM procedure codes (Quan et al., 2004). Inpatient PAC facility was defined as a SNF, LTACH, or IRF. Hospitalizations that ended with a discharge to an inpatient PAC facility was identified using the discharge codes in the PHC4 inpatient records.

In this study, readmissions and mortality were used to assess patient outcomes. Readmissions in both cohorts were defined as a readmission to any short-stay hospital within 30, 90, and 180 days of being discharged from the index hospital stay. Only the initial readmission was counted to maintain independence of observations. Mortality was defined by the time of death (30, 90, and 180 days) occurring after admission to the index short-stay hospital. The observed number of days to death and date of death was included in the PHC4 inpatient record if the mortality had occurred. The primary predictor was insurance type which is either Medicaid coverage or commercial insurance.

4.3.3 Analysis

We examined patient characteristics of the final analytic cohort using summary statistics. Differences between the two insurance types were tested using t-tests and chi-square tests for continuous and categorical variables, respectively. To determine the influence of PAC utilization on the relationship between insurance type and patient outcomes, we used a two-stage causal pathway modeling approach. First, we fit multivariable logistic regression models to estimate odds ratio for the relationship between insurance status and our two outcomes (readmission and mortality). These models adjust for only patient characteristics. Next, we fit a multivariate logistic models identical to the first but with the addition of type of inpatient PAC facility (SNF, IRF, LTACH). Subsequently, we calculated the marginal effect by dividing the pairwise odds ratios. This marginal effect can be interpreted as the mediating impact of PAC type on the relationship between insurance status and patient outcomes. The patient characteristics in the model consisted of demographic variables, mechanical ventilation, ICU admission, hospital length of stay, and Elixhauser comorbidities. All continuous variables such as age were converted to quadratic splines to provide a better model fit (Howe et al., 2011). Data management and statistical analyses were performed using SAS 9.4 (SAS Institute Inc.) and Stata SE 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station). A p-value of 0.05 or below was classified as significant.

4.4 STUDY RESULTS

Over the study period, there were 3,575,127 inpatient records in Pennsylvania. After applying the exclusion criteria, 40,603 records were in the final analytic cohort (Figure 7). Patient

characteristics in the cohort were stratified by insurance type (Table 11). Medicaid beneficiaries were more likely than commercially insured patients to be discharged to an inpatient PAC facility (59.4% vs. 40.6%). Medicaid recipients were younger and had a significantly higher proportion of nonwhite beneficiaries (43.3% versus 19.6%) than commercially insured individuals. Despite presenting with multiple and more severe comorbidities, Medicaid patients had a shorter length of stay, less likely to be admitted to the ICU, and equally as likely to be mechanically ventilated. At the same time, Medicaid patients were significantly less likely to be discharged to a high intensive inpatient PAC facility (IRF, LTACH) than individuals with commercial insurance (26.2% vs. 54.7%; $p < 0.001$). Hospital readmission from PAC facility was higher in Medicaid patients for all three time points (30 day: 5.6% vs. 4.9%, $p = 0.002$; 90-day: 9.4% vs. 7.3%, $p < 0.001$; 180-day: 10.8% vs. 8.1%, $p < 0.001$). In addition, unadjusted patient outcomes were higher in Medicaid patients (30 day: 2.8% vs. 1.6%, $p < 0.001$; 90-day: 9.1% vs. 5.3%, $p < 0.001$; 180-day: 14.4% vs. 8.0%, $p < 0.001$).

In the multivariate logistic regression analysis (Table 12), Medicaid patients were more likely to be readmitted to a hospital from the PAC facility and more likely to die than commercially insured patients after adjusting for only patient characteristics. These associations persisted in our second model for both readmissions and mortality after adjusting for inpatient PAC type. Nevertheless, the variation in the intensity of PAC utilization had distinct mediating effects on readmissions and mortality. In our models testing the association between insurance type and patient outcomes, controlling for PAC utilization rates increased the odds ratio of Medicaid beneficiaries being readmitted to a hospital (30-day marginal effect: 1.26; 90-day marginal effect: 1.14; 180-day marginal effect: 1.11). Conversely, controlling for PAC utilization rates had a

significant, positive effect on mortality rates (30-day marginal effect: 0.78; 90-day marginal effect: 0.84; 180-day marginal effect: 0.86).

4.5 DISCUSSION

This study sought to determine the degree to which mortality and readmissions observed among Medicaid beneficiaries was mediated by variation in the intensity of PAC utilization. The degree to which this impacts patient outcomes is dependent on the PAC utilization rates for both insurance types. There were many reasons for the major discrepancies in PAC utilization between these two insurance types. First, Pennsylvania Medicaid does not pay for an LTACH stay likely due to its substantial price tag and unconvincing cost-effectiveness over other PAC settings such as an IRF or SNF. LTACHs provide highly intensive rehabilitation for critically ill patients which Medicaid patients may need to fully recover from acute illness. On the other hand, the issue could be that commercial insurers may be over-utilizing more intensive PAC facilities. In the end, it is difficult to determine the "correct" amount of PAC for these patients. Second, Medicaid has a waiver system that is expected to have stricter qualifications and cost limits for PAC determination than commercial insurance. The Pennsylvania Long Term Care Commission has acknowledged that there needs to be an adoption of a uniform assessment in Medicaid to determine appropriate levels of care that would streamline the process for providers and patients (Pennsylvania Long Term Care Commission, 2014). Third, low Medicaid reimbursement rates limits patients' access to PAC facilities. This has been an ongoing issue since the inception of Medicaid. Fourth, we observed that the proportion of Medicaid patients with mental and behavioral illness is significantly higher than commercial insurance which may affect placement in a PAC facility. Lastly, Medicaid

patients are more likely to receive poorer coordination of care which may affect their discharge location. These patients are more likely to be in major teaching hospitals where there are more likely to receive penalties under the hospital readmissions reduction program (Joynt & Jha, 2013). As shown in this study, the Medicaid cohort were significantly more likely to be readmitted to a hospital. Furthermore, since a significant proportion of the Medicaid population has a mental or behavioral diagnoses, additional support and coordination among providers is necessary to prevent poor patient outcomes.

Using the knowledge of these PAC utilization patterns, it is clearer to see how this effects the relationship between insurance type and readmissions and mortality. Our results supported the hypothesis that Medicaid recipients would experience worse readmissions than commercially insured patients. These results were consistent with previous literature (L. A. Allen et al., 2012; Jiang & Wier, 2010) that compared readmission rates between Medicaid beneficiaries and individuals with commercial insurance. Our results had a higher effect than previous studies. This could be due to several reasons. First, the commercial insurance cohort were all discharged to an inpatient PAC facility while only a fraction of the Medicaid cohort were treated similarly. In addition, the effects may have been greater since commercially insured patients were more likely to be discharged to a high intensive PAC facility such as an IRF and an LTACH. This is further supported by another study in patients with joint replacement procedures which found that Medicaid patients were more likely to receive less intensive PAC than commercially insured patients with similar severity of illness (Freburger et al., 2011). On the other hand, the stronger effects could be attributed to the significantly higher proportion of individuals with mental or behavioral disorders in the Medicaid population than in the commercial cohort. Trudnak, et al. examined readmission rates in the Medicaid population and found that individuals with mental or

behavioral disorders contribute to the highest proportion of readmissions with nearly 20% of all readmissions (Trudnak et al., 2014). This highlights the need to reevaluate care for individuals with mental or behavioral disorders or to revise qualifications for PAC determination.

Conversely, adjusting for PAC utilization patterns decreased the odds of mortality in Medicaid patients which rejected the other part of our hypothesis. However, individuals with Medicaid coverage were still more likely to die than commercially insured patients. Other studies have observed higher likelihood of in-hospital mortality and complications in Medicaid patients undergoing major surgical operations (Kelz et al., 2004; LaPar et al., 2010). Combining these two findings, there are some reasons that Medicaid patients appear to still have a higher probability of mortality. First, Medicaid patients may be more likely to receive care from poor performing hospitals. This is supported by a study showing that Medicaid beneficiaries make up the largest proportion of patients in worst performing hospitals (Jha, Orav, & Epstein, 2011). Second, Medicaid patients may have experienced poor follow-up care or received unsatisfactory levels of PAC necessary for full rehabilitation. Consequently, this also has an effect on cost where 12.5% of Medicaid hospitalization payments in eighteen states were for hospital readmissions (Trudnak et al., 2014). While current PAC utilization patterns have increased the chance for survival, an increase in odds for readmission signals that the problem could be due to inefficient care. A solution to this problem is to change the way Medicaid reimburses for services. Currently, long term care services are not covered under capitation payments even under managed care. Medicaid should include PAC services under episode-based payments and then paid to managed care organizations to assess, care coordinate, and manage patients efficiently. This is similar to what has been done with the Hospital Readmissions Reduction Program carried out by the ACA.

There were several limitations in this study. First, the study population was limited to inpatient discharge records in Pennsylvania. The population may not be representative of patients in other states. In addition, Medicaid rules vary greatly across states which reduces the generalizability of the results. Coding errors are not uncommon in the administrative datasets which may have some effect on the accuracy of the models. Furthermore, the dataset lack clinical variables that may have significantly improve the models. Our dataset did contain the MediQual probability of death which is calculating using clinical and laboratory information; however, we did not risk-adjust for this variable in our models since the rate of missing was too high. Another limitation of our study was excluding individuals over the age of 65 to eliminate most dual-eligibles. This excludes a significant proportion of our population that were discharged to an inpatient PAC facilities. In addition, this exclusion did not remove individuals who were poor and disabled and qualified for both Medicaid and Medicare in which the latter pays first for PAC claims. We were not able to adjust for socioeconomic status such as income. While Medicaid status may give some indication of socioeconomic status, adjusting for income accounts for individuals that may be in the coverage gap or borderline qualifies for Medicaid or subsidies for the insurance marketplace. Lastly, administrative datasets limited our ability to follow patients through their episode of care, which would have provided more accurate discharge information as opposed to relying on discharge disposition codes.

4.6 CONCLUSION

The PAC utilization patterns for hospitalized Medicaid beneficiaries impacted patient outcomes to a degree. We do not know whether more PAC utilization for Medicaid patients would improve

outcomes. However, the poor readmission rates and significant discrepancies in PAC utilization patterns between these insurance types suggest that Medicaid underutilizes high intensive inpatient PAC in a way that may be deleterious for patient outcomes. Future research would investigate how payment reform such as implementing episode based payments would encourage better care coordination for Medicaid patients. These results should push states to standardize their approach to PAC and take necessary steps to improve patient management and care coordination among providers. With Pennsylvania participating in the Medicaid expansion, steps need to be taken to ensure that new and current beneficiaries receive high quality of care.

APPENDIX A – RELEVANT TABLES

Table 1. Top 20 diagnosis related groups (DRG) discharged to an inpatient PAC facility (2008 – 2010 Q1)

DRG (n=# of patients)	**PHC4 Cohort (n=40,603)**
Major joint replacement of lower extremity (470)	2960 (7.3)
Tracheostomy with prolonged vent with major operation (003)	1555 (3.8)
Psychoses (885)	1096 (2.7)
Septicemia without prolonged vent (871)	949 (2.3)
Intracranial hemorrhage or cerebral infarction with CC (065)	886 (2.2)
Bilateral/multiple major joint proc of lower extremity (462)	880 (2.2)
Tracheostomy with prolonged vent without major operation (004)	782 (1.9)
Infectious and parasitic diseases with operation (853)	513 (1.3)
Intracranial hemorrhage or cerebral infarction with MCC (064)	487 (1.2)
Alcohol/drug abuse or dependence without rehab (897)	452 (1.1)
Hip and femur procedure except major joint (481)	420 (1.0)
Respiratory system diagnosis with 96+ hours ventilator support (207)	406 (1.0)
Lower extremity and humerus procedure except hip, foot, femur without CC/MCC (494)	406 (1.0)
Lower extremity and humerus procedure except hip, foot, femur with CC (493)	405 (1.0)
Cellulitis without MCC (603)	390 (1.0)
Rehabilitation with CC/MCC (945)	378 (0.9)
Respiratory system diagnosis with less than 96 hours ventilator support (208)	373 (0.9)
Limb reattachment, hip and femur procedure for multiple significant trauma (956)	372 (0.9)
Intracranial hemorrhage or cerebral infarction without CC/MCC (066)	363 (0.9)
Spinal fusion except cervical without MCC (460)	324 (0.8)
Total (Top 20 DRGs)	**14397 (35.5)**
All other DRGs	26206 (65.5)

Values are frequency (percent)

CC = Complication; MCC = Major complication

Table 2. Discharge location by insurance type for all patients (2008 – 2010 Q1)

Characteristic (n=# of patients)	**Medicaid (n=61901)**	**Commercial (n=72095)**
Home	40280 (65.1)	46127 (64.0)
Other acute care hospital	1415 (2.3)	1355 (1.9)
Dead	1567 (2.5)	977 (1.4)
Post-acute care		
SNF	4339 (7.0)	2951 (4.1)
IRF	2549 (4.1)	3870 (5.4)
LTACH	119 (0.2)	569 (0.8)
Home health	7030 (11.4)	13026 (18.1)
Hospice	243 (0.4)	151 (0.2)
Other	4359 (7.0)	3069 (4.3)

Values are frequency (percent)

SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital

Table 3. Patient characteristics – Discharged to an inpatient PAC facility (2008 – 2010 Q1)

Characteristic (n=# of patients)	**Medicaid (n=7007)**	**Commercial (n=7390)**	**p-value**
Age	50.2 ± 10.8	52.0 ± 10.6	< 0.001
Female	3586 (51.2)	3764 (50.9)	0.776
Race			
White	4022 (57.4)	5882 (79.6)	
Black	2282 (32.6)	1024 (13.9)	< 0.001
Other	703 (10.0)	484 (6.5)	
Admission source			
Direct	2050 (31.6)	3491 (47.2)	
Emergency Department	3834 (54.7)	3002 (40.6)	< 0.001
Other Hospital	524 (7.5)	508 (6.9)	
Other	599 (8.5)	389 (5.3)	
Comorbidity count			
0	833 (11.9)	1598 (21.6)	
1	1759 (25.1)	2190 (29.6)	< 0.001
2	2042 (29.1)	1975 (26.7)	
3+	2373 (33.9)	1627 (22.0)	
Comorbidities			
CHF	547 (7.8)	191 (2.6)	< 0.001
COPD	1081 (15.4)	780 (10.6)	< 0.001
Diabetes mellitus	1074 (15.3)	905 (12.2)	< 0.001
Liver disease	278 (4.0)	146 (2.0)	< 0.001
Metastatic cancer	99 (1.4)	72 (1.0)	0.015
Other cancer	79 (1.1)	47 (0.6)	0.001
ICU Admission	2841 (40.5)	2178 (29.5)	< 0.001
Mechanical ventilation	2104 (30.0)	1419 (19.2)	< 0.001
MediQual predicted risk of death‡	0.080 ± 0.142	0.054 ± 0.132	< 0.001
Hospital length of stay	15.3 ± 20.9	11.2 ± 21.4	< 0.001
ICU length of stay*	14.8 ± 16.3	15.3 ± 19.4	0.258
Discharge location			
SNF	4339 (61.9)	2951 (39.9)	
IRF	2549 (36.4)	3870 (52.4)	< 0.001
LTACH	119 (1.7)	569 (7.7)	

Values are mean ± standard deviation or frequency (percent)
‡ - 19.2% missing
* - Condition on ICU admission

PAC = Post-Acute Care; CHF = Congestive Heart Failure; COPD = Chronic Obstructive Pulmonary Disease; ICU = Intensive Care Unit; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital; MV = Mechanical Ventilation

Table 4. Adjusted odds ratio of discharge to a PAC facility without hospital random effects*

Outcome	Odds Ratio	95% Confidence Interval	p-value
Inpatient PAC **			
Medicaid (vs. Commercial)	1.083	[1.039, 1.129]	< 0.001
Female	1.074	[1.032, 1.117]	< 0.001
Race (vs. White)			
Black	1.249	[1.184, 1.318]	< 0.001
Other	0.949	[0.881, 1.023]	0.170
ICU Admission	2.314	[1.803, 2.970]	< 0.001
Mechanical Ventilation	0.711	[0.649, 0.779]	< 0.001
High Intensive Inpatient PAC*			
Medicaid (vs. Commercial)	0.570	[0.539, 0.604]	< 0.001
Female	0.905	[0.859, 0.953]	< 0.001
Race (vs. White)			
Black	1.181	[1.100, 1.269]	< 0.001
Other	1.043	[0.949, 1.147]	0.384
ICU Admission	2.706	[1.959, 3.738]	< 0.001
Mechanical Ventilation	0.602	[0.534, 0.680]	< 0.001
All PAC**			
Medicaid (vs. Commercial)	0.943	[0.915, 0.973]	< 0.001
Female	1.058	[1.028, 1.089]	< 0.001
Race (vs. White)			
Black	1.051	[1.008, 1.095]	0.020
Other	0.934	[0.884, 0.986]	0.014
ICU Admission	1.185	[0.957, 1.469]	0.120
Mechanical Ventilation	0.654	[0.604, 0.709]	< 0.001

* Models adjusted for age, sex, race, admission source, Elixhauser comorbidities, comorbidity count, mechanical ventilation, ICU admission, hospital length of stay, ICU length of stay, and PHC4 region.
** Inpatient PAC = SNF, IRF, LTACH vs. No PAC, HHA
*** High Intensive Inpatient PAC = IRF, LTACH vs. No PAC, HHA, SNF
**** All PAC = HHA, SNF, IRF, LTACH vs. No PAC

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long Term Acute Care Hospital; HHA = Home Health Agency; ICU = Intensive Care Unit

Table 5. Adjusted odds ratio of discharge to a PAC facility with hospital random effects*

Outcome	Odds Ratio	95% Confidence Interval	p-value
Inpatient PAC **			
Medicaid (vs. Commercial)	0.873	[0.836, 0.912]	< 0.001
Female	1.104	[1.060, 1.149]	< 0.001
Race (vs. White)			
Black	1.155	[1.092, 1.519]	< 0.001
Other	0.980	[0.906, 1.059]	0.606
ICU Admission	2.263	[1.753, 2.921]	< 0.001
Mechanical Ventilation	0.680	[0.619, 0.746]	< 0.001
High Intensive Inpatient PAC*			
Medicaid (vs. Commercial)	1.600	[1.510, 1.696]	< 0.001
Female	0.929	[0.881, 0.980]	0.007
Race (vs. White)			
Black	1.128	[1.048, 1.214]	0.001
Other	1.060	[0.962, 1.169]	0.239
ICU Admission	2.646	[1.907, 3.673]	< 0.001
Mechanical Ventilation	0.589	[0.521, 0.667]	< 0.001
All PAC**			
Medicaid (vs. Commercial)	1.033	[0.999, 1.068]	0.056
Female	1.088	[1.055, 1.121]	< 0.001
Race (vs. White)			
Black	1.041	[0.996, 1.089]	0.077
Other	0.852	[0.803, 0.905]	< 0.001
ICU Admission	1.150	[0.922, 1.434]	0.214
Mechanical Ventilation	0.613	[0.565, 0.665]	< 0.001

* Models accounted for hospital random effects and adjusted for age, sex, race, admission source, Elixhauser comorbidities, comorbidity count, mechanical ventilation, ICU admission, hospital length of stay, ICU length of stay, and PHC4 region.
** Inpatient PAC = SNF, IRF, LTACH vs. No PAC, HHA
*** High Intensive Inpatient PAC = IRF, LTACH vs. No PAC, HHA, SNF
**** All PAC = HHA, SNF, IRF, LTACH vs. No PAC

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long Term Acute Care Hospital; HHA = Home Health Agency; ICU = Intensive Care Unit

Table 6. Medicaid delivery type by PHC4 region

PHC4 Region	Fee-For-Service	Managed Care
Region 1	10187 (37.4)	17048 (62.6)
Region 2	4292 (36.7)	7404 (63.3)
Region 3	1677 (39.7)	2545 (60.3)
Region 4	1419 (48.7)	1497 (51.3)
Region 5	4089 (50.6)	3995 (49.4)
Region 6	2925 (52.7)	2627 (47.3)
Region 7	3634 (40.9)	5252 (59.1)
Region 8	5430 (42.1)	7467 (57.9)
Region 9	9099 (32.5)	18896 (67.5)

Values are frequency (percent)

Table 7. Hospitalizations ending with discharge to an inpatient PAC facility by year (all DRGs)

Year	**2007**	**2008**	**2009**	**2010**	**2011**
Medicaid Delivery Type					
Fee-For-Service	373 (26.0)	397 (29.5)	421 (26.4)	494 (37.0)	484 (33.3)
Managed Care	1063 (74.0)	949 (70.5)	1173 (73.6)	843 (63.1)	971 (66.7)
Inpatient PAC					
SNF	676 (47.1)	632 (47.0)	760 (47.7)	589 (44.1)	655 (45.0)
IRF	674 (46.9)	632 (47.0)	747 (46.9)	657 (49.1)	725 (49.8)
LTACH	86 (6.0)	82 (6.1)	87 (5.5)	91 (6.8)	75 (5.2)

Values are frequency (percent)

Table 8. Hospitalizations ending with discharge to an inpatient PAC facility stratified by Medicaid delivery type (all DRGs)

Year	**2007**	**2008**	**2009**	**2010**	**2011**
Fee-For-Service					
Inpatient PAC					
SNF	217 (58.2)	230 (57.9)	275 (65.3)	350 (70.9)	364 (75.2)
IRF	134 (35.9)	137 (34.5)	108 (25.7)	114 (23.1)	90 (18.6)
LTACH	22 (5.9)	30 (7.6)	38 (9.0)	30 (6.1)	30 (6.2)
Managed Care					
Inpatient PAC					
SNF	459 (43.2)	402 (42.4)	485 (41.4)	239 (28.3)	291 (30.0)
IRF	540 (50.8)	495 (52.2)	639 (54.5)	543 (64.4)	635 (65.4)
LTACH	64 (6.0)	52 (5.5)	49 (4.2)	61 (7.2)	45 (4.6)

Values are frequency (percent)

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Hospital; LTACH = Long-Term Acute Care Hospital

Table 9. Patient characteristics – Discharged to an inpatient PAC facility (2007 – 2011)

Characteristic (n=# of patients)	**Fee-For-Service (n=639)**	**Managed Care (n=1760)**	**p-value**
Age	50.0 ± 11.6	49.8 ± 10.9	0.672
Female	291 (45.5)	1088 (61.8)	< 0.001
Race			
White	480 (75.1)	920 (52.3)	
Black	126 (19.7)	716 (40.7)	< 0.001
Other	33 (5.2)	124 (7.0)	
Medicaid Eligibility			
SSI	500 (78.2)	1377 (78.2)	
GA	116(18.2)	238 (13.5)	0.305
TANF	23 (3.6)	145 (8.2)	
Comorbidity count			
0	44 (6.9)	104 (5.9)	
1	114 (17.8)	21 (18.2)	0.929
2	152 (23.8)	463 (26.3)	
3+	329 (51.5)	872 (49.5)	
Comorbidities			
CHF	58 (9.1)	151 (8.6)	0.703
COPD	110 (17.2)	407 (23.1)	0.002
Diabetes mellitus	118 (18.5)	341 (19.4)	0.617
Liver disease	20 (3.1)	78 (4.4)	0.155
Metastatic cancer	8 (1.3)	15 (0.9)	0.375
Other cancer	10 (1.6)	17 (1.0)	0.219
ICU Admission	310 (48.5)	525 (29.8)	< 0.001
Mechanical ventilation	68 (10.6)	114 (6.5)	0.001
Hospital length of stay	15.0 ± 16.8	10.2 ± 13.7	< 0.001
Diagnosis related groups			
Major joint replacement of lower extremity	40 (6.3)	433 (24.6)	< 0.001
Intracranial hemorrhage or cerebral infarction	112 (17.5)	291 (16.5)	0.565
Tracheostomy	78 (12.2)	139 (7.9)	0.001
Respiratory system diagnosis	32 (5.0)	74 (4.2)	0.398
Poisoning & toxic effects of drugs	32 (5.0)	70 (4.0)	0.434
Multiple sclerosis & cerebellar ataxia	7 (1.1)	67 (3.8)	< 0.001
Hip and femur procedures	32 (5.0)	66 (3.8)	0.169
Lower extremity and humerus procedures	32 (5.0)	66 (3.8)	0.169
Bilateral/multiple major joint proc of lower extremity	6 (0.9)	62 (3.5)	< 0.001
Craniotomy and endovascular intracranial proc	24 (3.8)	59 (3.4)	0.633
Septicemia	62 (9.7)	54 (3.1)	< 0.001
Infectious and parasitic diseases with OR proc	42 (6.6)	48 (2.7)	< 0.001
Renal failure	28 (4.4)	47 (2.7)	0.033
Extensive OR proc unrelated to principal diagnosis	15 (2.3)	47 (2.7)	0.660

Table 9 Continued

Characteristic (n=# of patients)	Fee-For-Service (n=639)	Managed Care (n=1760)	p-value
Amputation for circ sys disorders exclude upper limb	16 (2.5)	46 (2.6)	0.881
COPD	10 (1.6)	46 (2.6)	0.133
Cellulitis	24 (3.8)	31 (2.3)	0.057
Heart failure and shock	26 (4.1)	38(2.2)	0.010
Other OR proc for multiple significant trauma	17 (2.7)	34 (1.9)	0.274
Psychoses	15 (2.3)	32 (1.8)	0.409
Discharge location			
SNF	348 (54.5)	615 (34.9)	
IRF	243 (38.0)	1048 (59.5)	< 0.001
LTACH	48 (7.5)	97 (5.5)	

Values are mean ± standard deviation or frequency (percent)

PAC = Post-Acute Care; CHF = Congestive Heart Failure; COPD = Chronic Obstructive Pulmonary Disease; ICU = Intensive Care Unit; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital

Table 10. Adjusted odds ratio of discharge to an inpatient PAC facility without hospital random effects*

Outcome	Odds Ratio	95% Confidence Interval	p-value
Inpatient PAC			
Managed Care (vs. Fee-For-Service)	3.289	[2.968, 3.644]	< 0.001
Female	1.113	[1.011, 1.224]	0.028
Race (vs. White)			
Black	1.023	[0.914, 1.144]	0.697
Other	0.657	[0.543, 0.794]	< 0.001
ICU Admission	1.502	[1.328, 1.699]	< 0.001
Mechanical Ventilation	1.067	[0.836, 1.362]	0.601
High Intensive Inpatient PAC*			
Managed Care (vs. Fee-For-Service)	5.242	[4.539, 6.055]	< 0.001
Female	1.021	[0.903, 1.154]	0.744
Race (vs. White)			
Black	1.042	[0.901, 1.206]	0.576
Other	0.808	[0.636, 1.026]	0.080
ICU Admission	1.649	[1.413, 1.923]	< 0.001
Mechanical Ventilation	1.072	[0.782, 1.468]	0.666

* Models accounted for hospital random effects and adjusted for age, sex, race, admission source, Elixhauser comorbidities, comorbidity count, mechanical ventilation, ICU admission, hospital length of stay, ICU length of stay, Medicaid eligibility, diagnosis related groups, and PHC4 region
** Inpatient PAC = SNF, IRF, LTACH
*** High Intensive Inpatient PAC = IRF, LTACH

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital; ICU = Intensive Care Unit

Table 11. Adjusted odds ratio of discharge to an inpatient PAC facility with hospital random effects*

Outcome	Odds Ratio	95% Confidence Interval	p-value
Inpatient PAC			
Managed Care (vs. Fee-For-Service)	3.189	[2.872, 3.540]	< 0.001
Female	1.104	[1.004, 1.216]	0.042
Race (vs. White)			
Black	0.985	[0.878, 1.104]	0.795
Other	0.680	[0.561, 0.825]	< 0.001
ICU Admission	1.574	[1.390, 1.784]	< 0.001
Mechanical Ventilation	1.077	[0.843, 1.376]	0.553
High Intensive Inpatient PAC*			
Managed Care (vs. Fee-For-Service)	5.476	[4.727, 6.344]	< 0.001
Female	1.016	[0.899, 1.149]	0.604
Race (vs. White)			
Black	1.028	[0.888, 1.190]	0.209
Other	0.844	[0.666, 1.070]	0.467
ICU Admission	1.779	[1.523, 2.080]	< 0.001
Mechanical Ventilation	1.096	[0.800, 1.502]	0.915

* Models accounted for hospital random effects and adjusted for age, sex, race, admission source, Elixhauser comorbidities, comorbidity count, mechanical ventilation, ICU admission, hospital length of stay, ICU length of stay, Medicaid eligibility, diagnosis related groups, and PHC4 region
** Inpatient PAC = SNF, IRF, LTACH
*** High Intensive Inpatient PAC = IRF, LTACH

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital; ICU = Intensive Care Unit

Table 12. Adjusted odds ratio of discharge to an inpatient PAC facility stratified by urbanicity without hospital random effects

	*Urban**		*Rural***	
Outcome	**Odds Ratio**	**95% Confidence Interval**	**Odds Ratio**	**95% Confidence Interval**
Inpatient PAC*				
Managed Care (vs. Fee-For-Service)	4.201	[3.678, 4.799]	2.162	[1.847, 2.531]
High Intensive Inpatient PAC**				
Managed Care (vs. Fee-For-Service)	5.416	[4.504, 6.512]	4.641	[3.728, 5.777]

* PHC4 Region 1, 8, 9
** PHC4 Region 2, 3, 4, 5, 6, 7
*** Inpatient PAC = SNF, IRF, LTACH
**** High Intensive Inpatient PAC = IRF, LTACH

‡ Not significant @ 0.05

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital; ICU = Intensive Care Unit

Table 13. Adjusted odds ratio of discharge to an inpatient PAC facility stratified by urbanicity with hospital random effects

	*Urban**		*Rural***	
Outcome	**Odds Ratio**	**95% Confidence Interval**	**Odds Ratio**	**95% Confidence Interval**
Inpatient PAC*				
Managed Care (vs. Fee-For-Service)	4.079	[3.559, 4.675]	2.138	[1.824, 2.506]
High Intensive Inpatient PAC**				
Managed Care (vs. Fee-For-Service)	5.380	[4.463, 6.484]	4.659	[3.733, 5.814]

* PHC4 Region 1, 8, 9
** PHC4 Region 2, 3, 4, 5, 6, 7
*** Inpatient PAC = SNF, IRF, LTACH
**** High Intensive Inpatient PAC = IRF, LTACH

‡ Not significant @ 0.05

PAC = Post-Acute Care; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital; ICU = Intensive Care Unit

Table 14. Patient characteristics – Admitted to an inpatient PAC facility

Characteristic (n=# of patients)	**Commercial (n=16490)**	**Medicaid (n=24113)**	**p-value**
Age	52.1 ± 10.6	50.9 ± 10.7	< 0.001
Female	7909 (48.0)	12076 (50.1)	< 0.001
Race			
White	13256 (80.4)	13655 (56.6)	
Black	2094 (12.7)	8400 (34.8)	< 0.001
Other	1140 (6.9)	2058 (8.5)	
Admission source			
Direct	6130 (37.2)	5345 (22.2)	
Emergency Department	7928 (48.1)	14419 (59.8)	< 0.001
Other Hospital	1229 (7.5)	1468 (6.1)	
Other	1203 (7.3)	2881 (11.9)	
Comorbidity count			
0	3398 (20.6)	2340 (9.7)	
1	4650 (28.2)	5260 (21.8)	< 0.001
2	4326 (26.2)	6963 (28.9)	
3+	4116 (25.0)	9550 (39.6)	
Comorbidities			
CHF	573 (3.5)	1896 (7.9)	< 0.001
COPD	1724 (10.5)	3828 (15.9)	< 0.001
Diabetes mellitus	2103 (12.8)	3943 (16.4)	< 0.001
Liver disease	365 (2.2)	1216 (5.0)	< 0.001
Metastatic cancer	378 (2.3)	524 (2.2)	0.423
Other cancer	198 (1.2)	392 (1.6)	< 0.001
ICU Admission	5774 (35.0)	7755 (32.3)	< 0.001
Mechanical ventilation	2244 (13.6)	3375 (14.0)	0.266
MediQual predicted risk of death‡	0.048 ± 0.116	0.051 ± 0.108	0.056
Hospital length of stay	10.9 ± 16.6	11.8 ± 15.3	< 0.001
ICU length of stay*	9.9 ± 14.0	9.2 ± 12.6	0.003
Discharge location			
SNF	7468 (45.3)	17800 (73.8)	
IRF	8104 (49.1)	6017 (25.0)	< 0.001
LTACH	918 (5.6)	296 (1.2)	
Outcomes			
Readmissions			
30-Day	802 (4.9)	1339 (5.6)	0.002
90-Day	1196 (7.3)	2260 (9.4)	< 0.001
180-Day	1339 (8.1)	2615 (10.8)	< 0.001
Mortality			
30-Day	269 (1.6)	678 (2.8)	< 0.001

Table 14 Continued

Characteristic (n=# of patients)	Commercial (n=16490)	Medicaid (n=24113)	p-value
90-Day	882 (5.3)	2186 (9.1)	< 0.001
180-Day	1325 (8.0)	3473 (14.4)	< 0.001

Values are mean ± standard deviation or frequency (percent)
‡ - 18.8% missing
* - Condition on ICU admission

CHF = Congestive Heart Failure; COPD = Chronic Obstructive Pulmonary Disease; ICU = Intensive Care Unit; SNF = Skilled Nursing Facility; IRF = Inpatient Rehabilitation Facility; LTACH = Long-Term Acute Care Hospital

Table 15. Adjusted odds ratios (OR) of patient outcomes

Outcome	Model 1 OR*	95% Confidence Interval	Model 2 OR**	95% Confidence Interval	Marginal Effect
Readmission – Medicaid (vs. Commercial)					
30-Day	1.101‡	[0.999, 1.214]	1.382	[1.249, 1.529]	1.255
90-Day	1.234	[1.140, 1.335]	1.405	[1.294, 1.526]	1.139
180-Day	1.278	[1.186, 1.377]	1.414	[1.308, 1.528]	1.106
Mortality – Medicaid (vs. Commercial)					
30-Day	1.751	[1.496, 2.048]	1.370	[1.164, 1.611]	0.782
90-Day	1.706	[1.558, 1.868]	1.429	[1.299, 1.572]	0.838
180-Day	1.847	[1.712, 1.993]	1.581	[1.459, 1.713]	0.856

* OR adjusted for age, sex, race, admission source, Elixhauser comorbidities, comorbidity count, mechanical ventilation, ICU admission, hospital length of stay, and ICU length of stay
** OR adjusted for patient characteristics and type of PAC facility (SNF, IRF, LTACH)

‡ Not significant @ 0.05

APPENDIX B – RELEVANT FIGURES

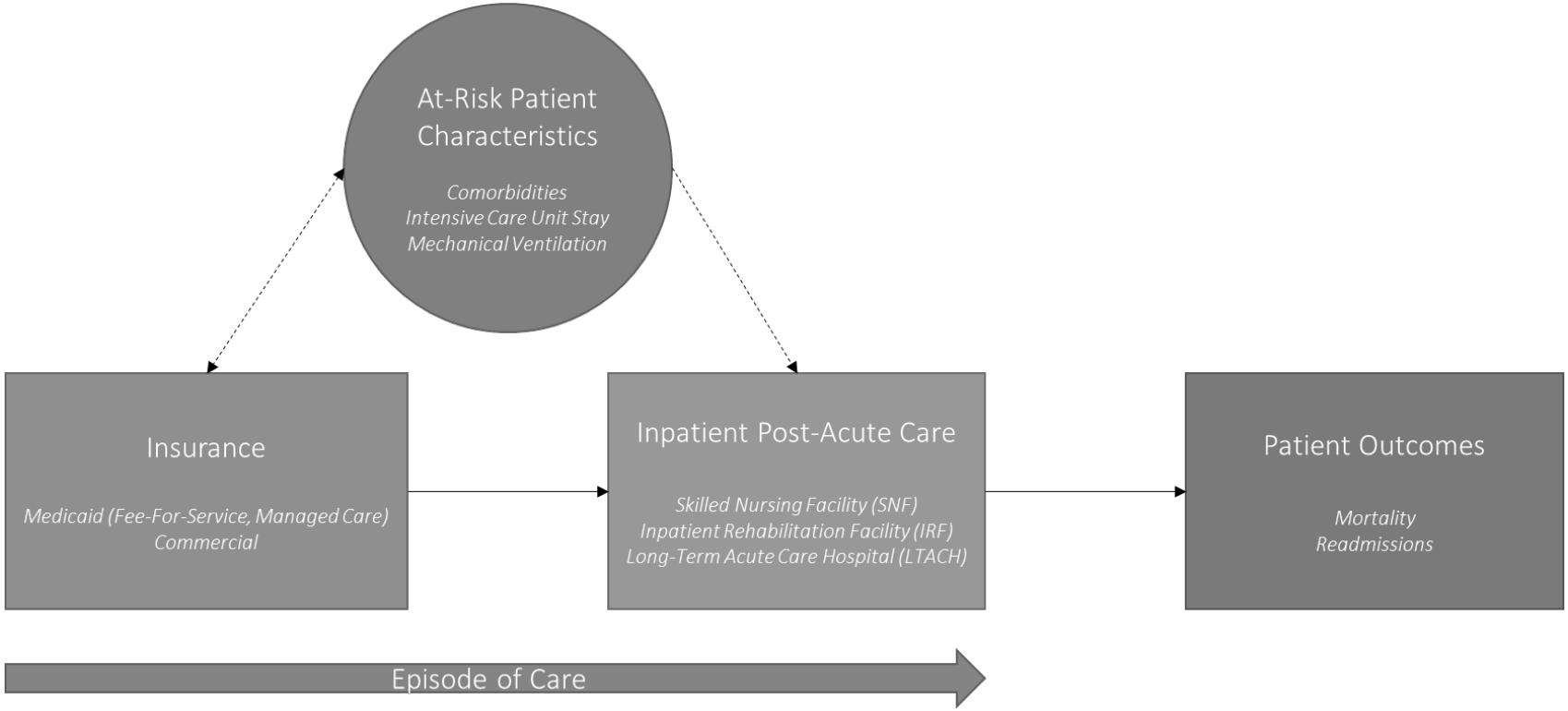

Figure 1. Overall conceptual model

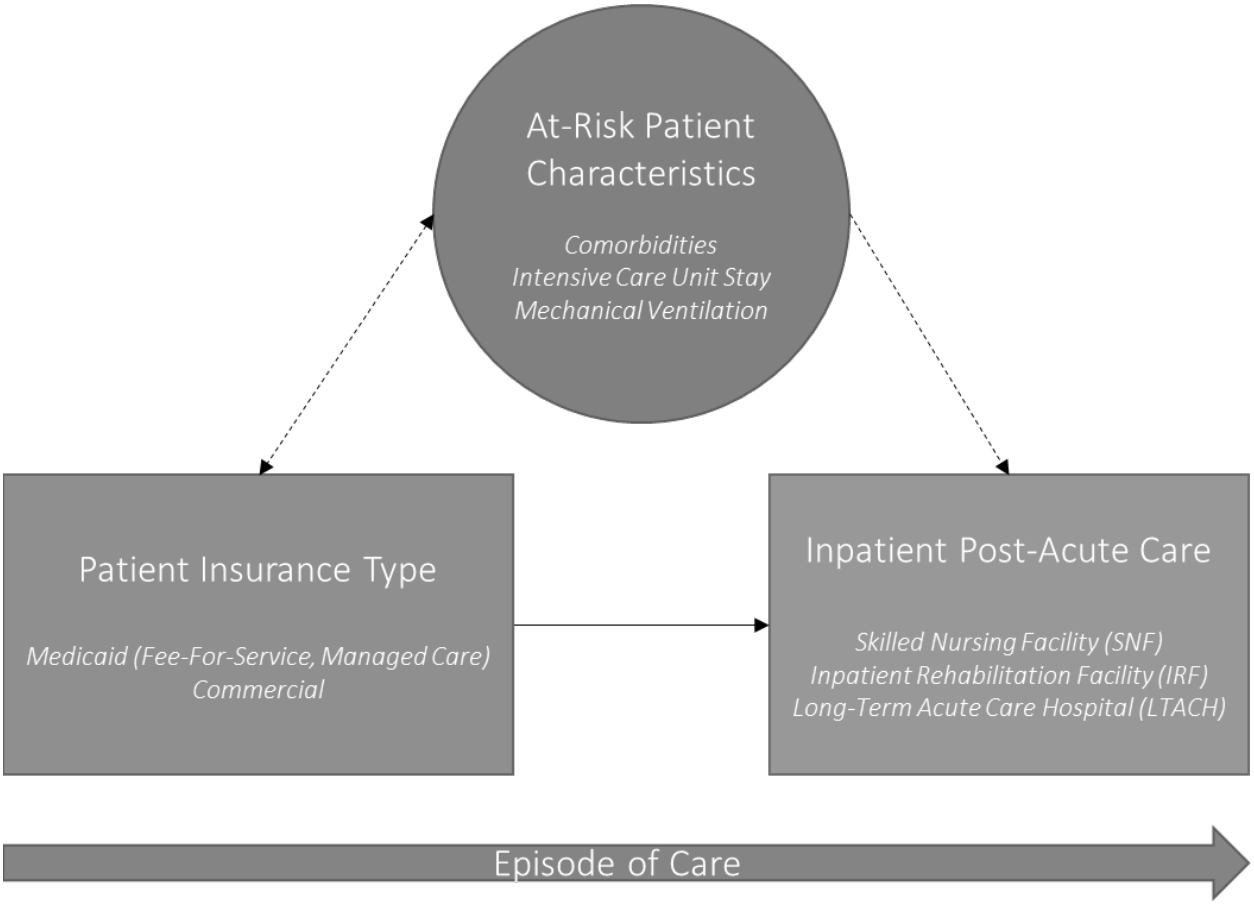

Figure 2. Conceptual model (Paper 1)

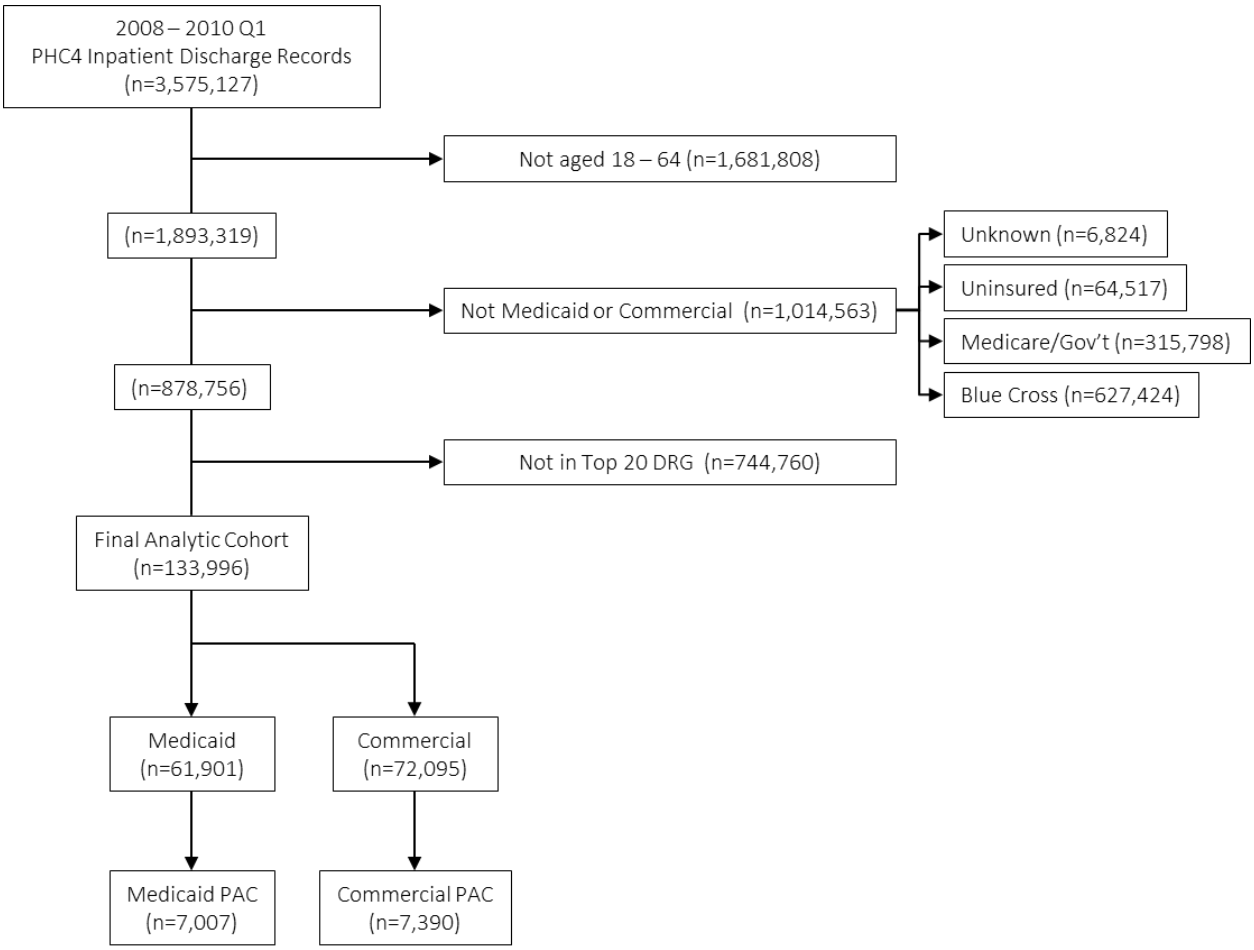

Figure 3. Exclusion criteria and final cohort (Paper 1)

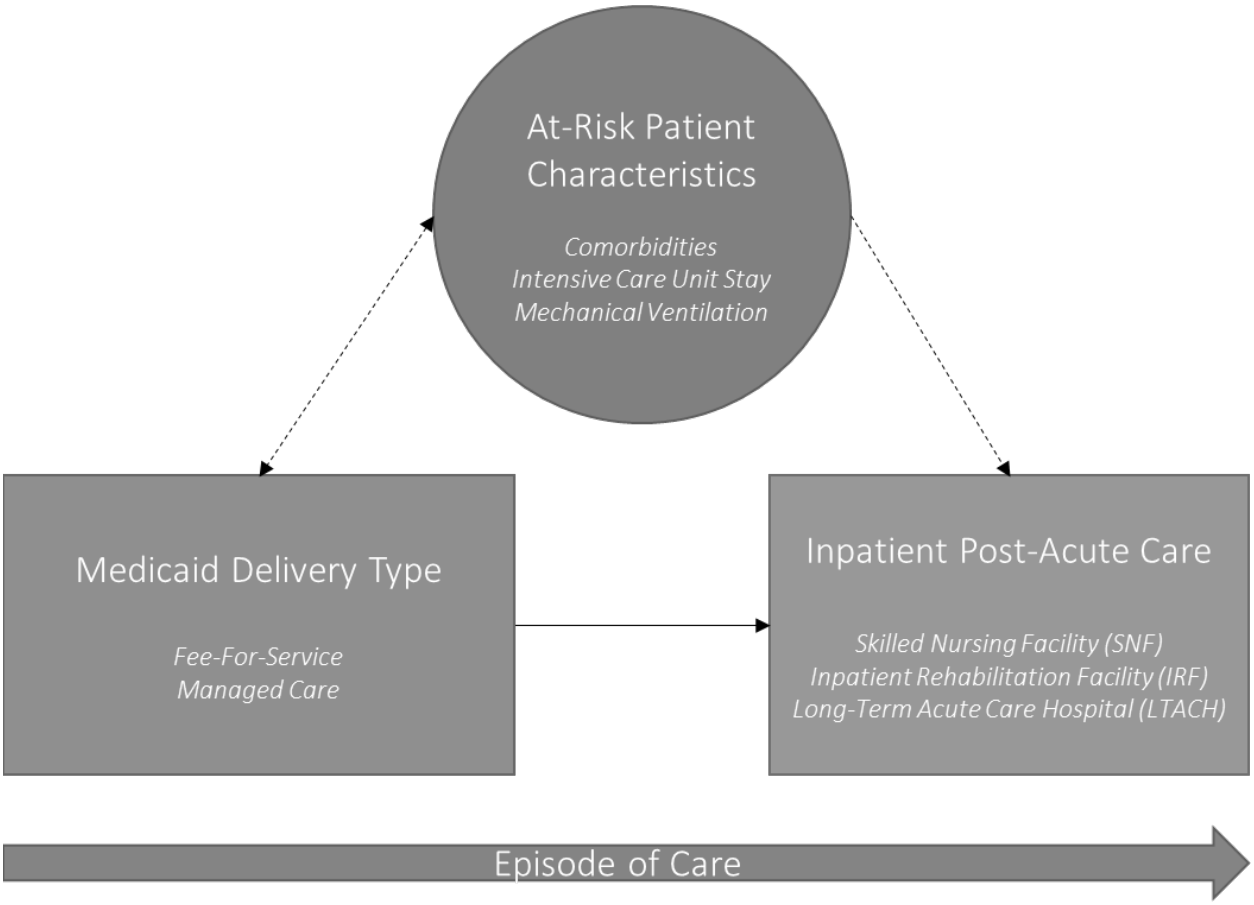

Figure 4. Conceptual model (Paper 2)

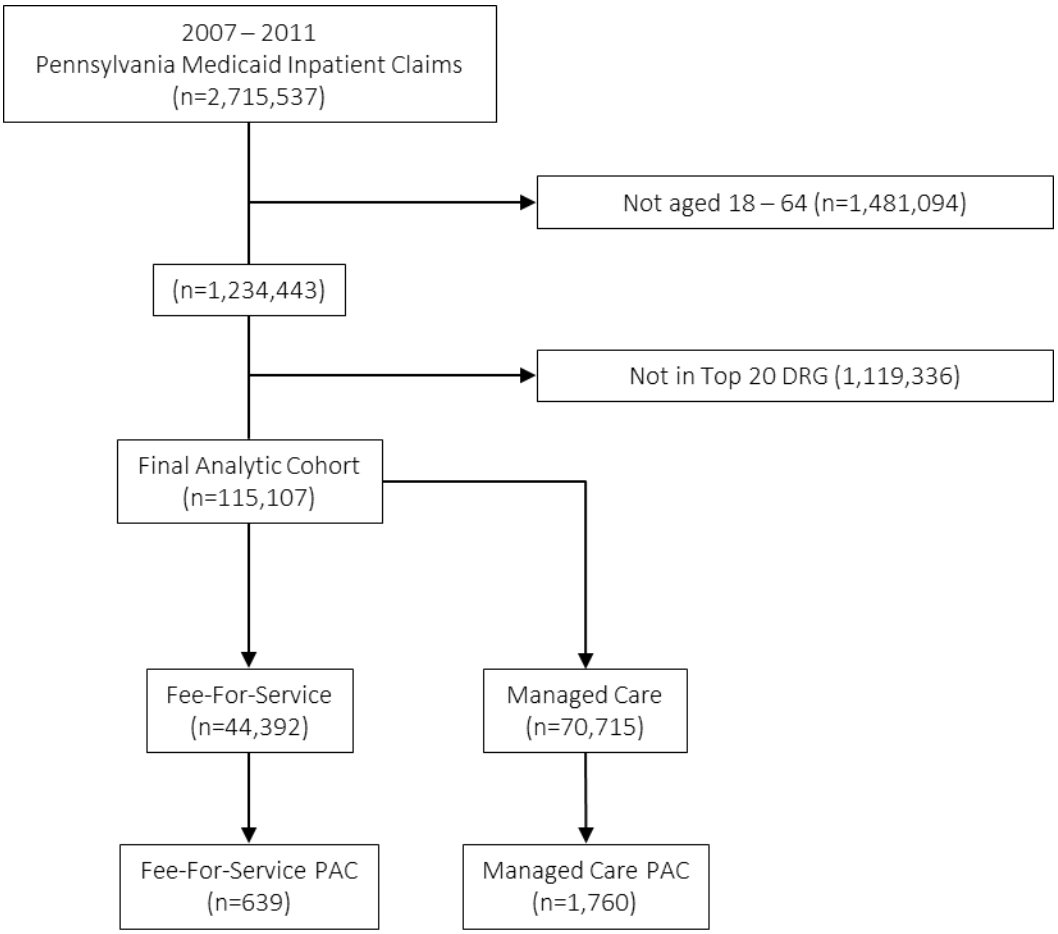

Figure 5. Exclusion criteria and final cohort (Paper 2)

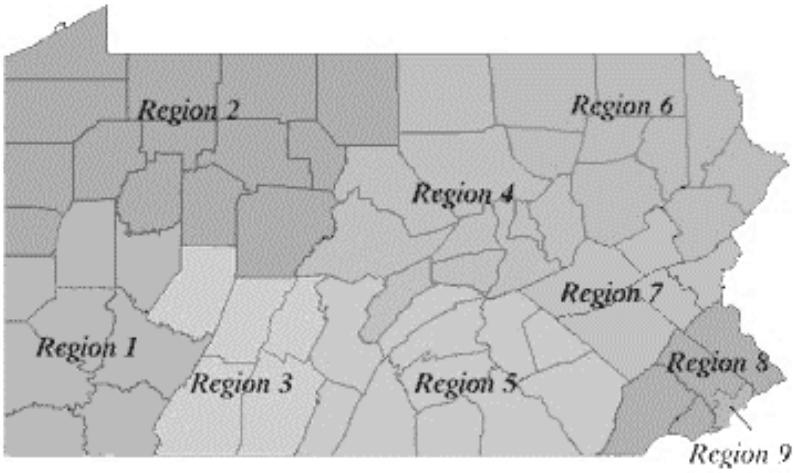

Figure 6. PHC4 regions (Pennsylvania Health Care Cost Containment Council)

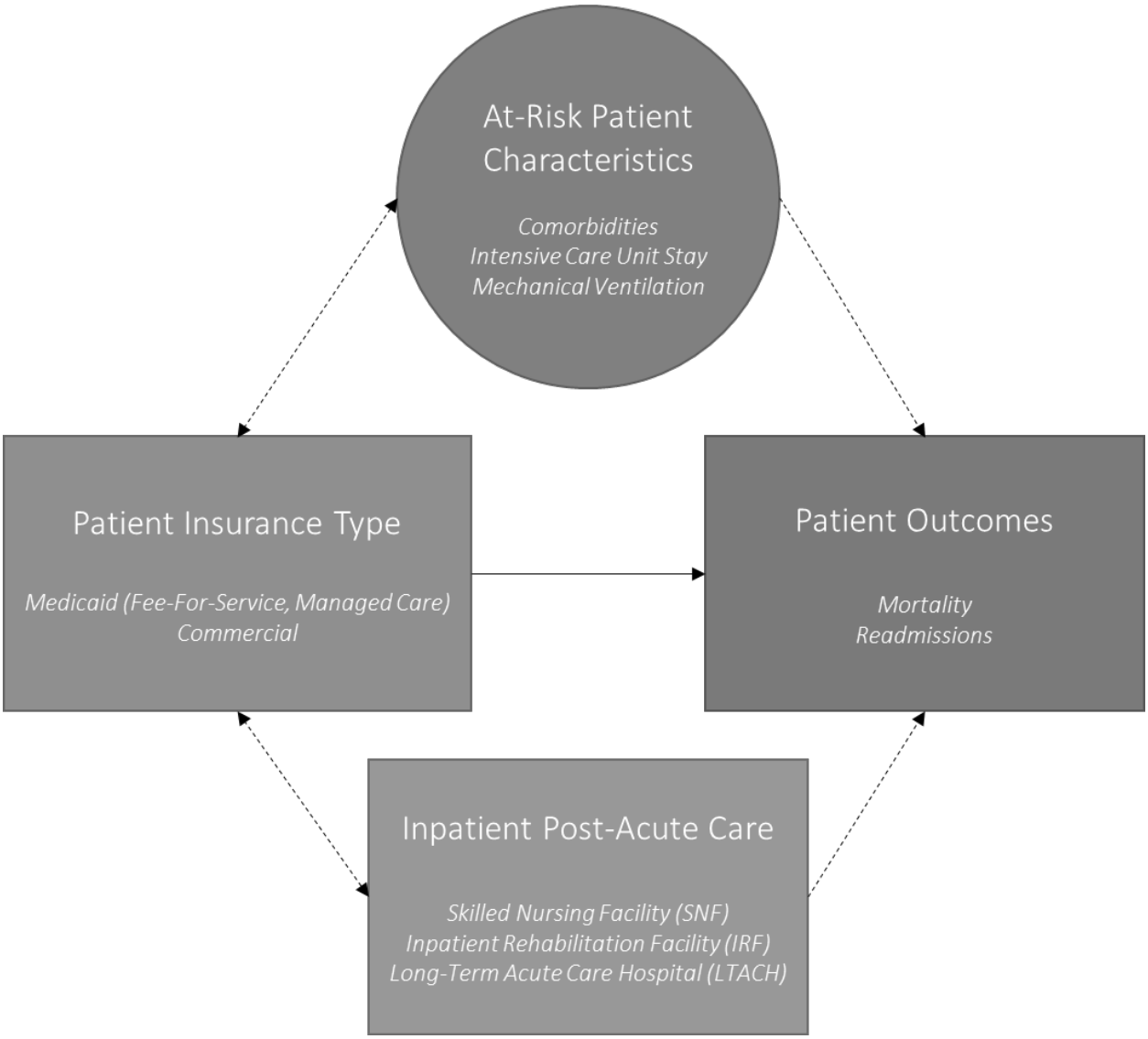

Figure 7. Conceptual model (Paper 3)

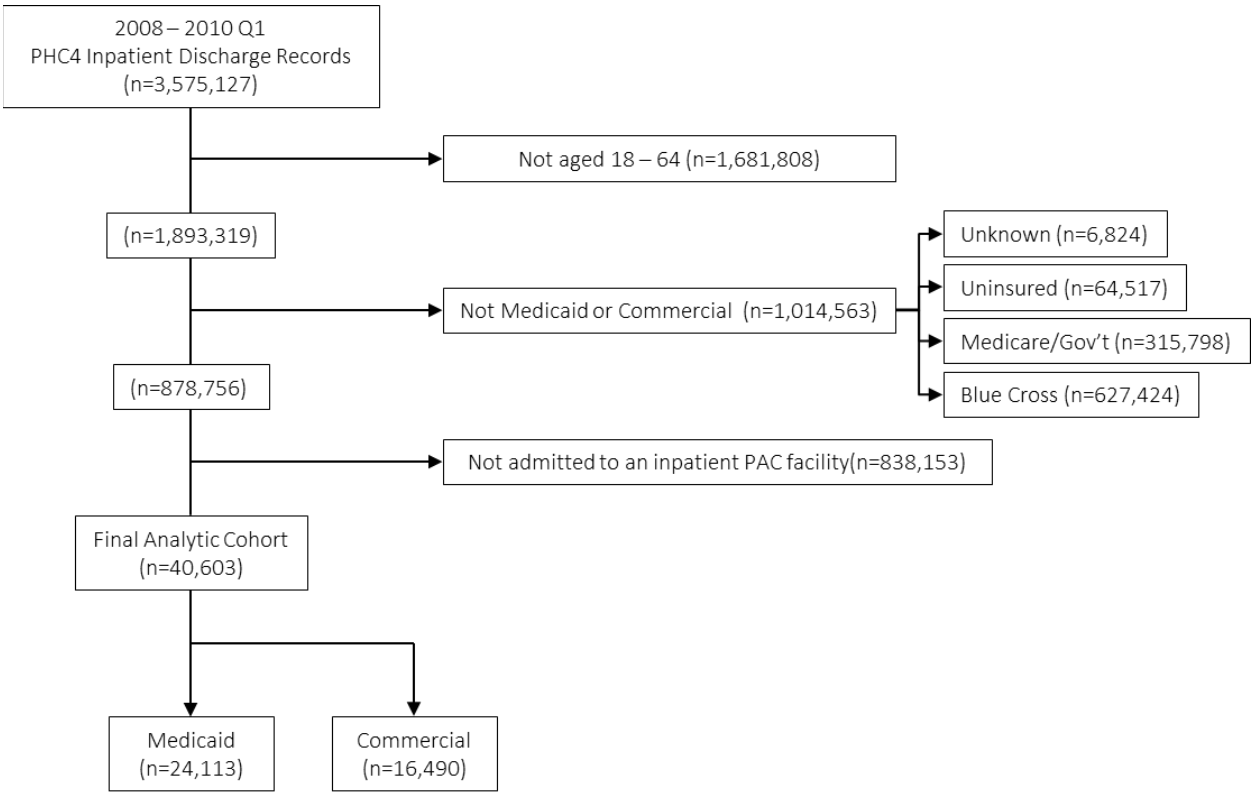

Figure 8. Exclusion criteria and final cohort (Paper 3)

BIBLIOGRAPHY

Agency for Health Care Research and Quality. Comorbidity Software, Version 3.7. Retrieved from https://www.hcup-us.ahrq.gov/toolssoftware/comorbidity/comorbidity.jsp

Alexander, G. (2012). Disproportionate Share and Supplemental Hospital Payments. *Pennsylvania Bulletin, 42*(38), 6048.

Allen, H., Wright, B. J., Harding, K., & Broffman, L. (2014). The role of stigma in access to health care for the poor. *Milbank Quarterly, 92*(2), 289-318.

Allen, L. A., Tomic, K. E. S., Smith, D. M., Wilson, K. L., & Agodoa, I. (2012). Rates and predictors of 30-day readmission among commercially insured and Medicaid-enrolled patients hospitalized with systolic heart failure. *Circulation: Heart Failure, 5*(6), 672-679.

Buntin, M. B., Colla, C. H., Deb, P., Sood, N., & Escarce, J. J. (2010). Medicare spending and outcomes after post-acute care for stroke and hip fracture. *Medical care, 48*(9), 776.

Centers for Medicare and Medicaid Services. (2014). Managed Care in Pennsylvania. Retrieved from http://www.medicaid.gov/medicaid-chip-program-information/by-topics/delivery-systems/managed-care/downloads/pennsylvania-mcp.pdf

Chandra, A., Dalton, M. A., & Holmes, J. (2013). Large increases in spending on postacute care in Medicare point to the potential for cost savings in these settings. *Health Affairs, 32*(5), 864-872.

Cunningham, P. J., & O'Malley, A. S. (2009). Do reimbursement delays discourage Medicaid participation by physicians? *Health Affairs, 28*(1), w17-w28.

Decker, S. L. (2007). Medicaid physician fees and the quality of medical care of Medicaid patients in the USA. *Review of Economics of the Household, 5*(1), 95-112.

Decker, S. L. (2012). In 2011 nearly one-third of physicians said they would not accept new Medicaid patients, but rising fees may help. *Health Affairs, 31*(8), 1673-1679.

Dichter, H. (2010). Disproportionate Share and Supplemental Hospital Payments. *Pennsylvania Bulletin, 40*(39), 5536.

Dorn, S., Francis, N., Rudowitz, R., & Snyder, L. (2015). The Effects of the Medicaid Expansion on State Budgets: An Early Look in Select States. *Kaiser Commission on Medicaid and the Uninsured. http://files. kff. org/attachment/issue-brief-theeffects-of-the-medicaid-expansion-on-state-budgets-an-early-look-in-select-states*.

Elixhauser, A., Steiner, C., Harris, D. R., & Coffey, R. M. (1998). Comorbidity measures for use with administrative data. *Medical care, 36*(1), 8-27.

Freburger, J. K., Holmes, G. M., Ku, L. J. E., Cutchin, M. P., Heatwole-Shank, K., & Edwards, L. J. (2011). Disparities in post–acute rehabilitation care for joint replacement. *Arthritis care & research, 63*(7), 1020-1030.

Graham, R. P., Garber, A., & Newhouse, J. P. (2013). *Interim Report of the Committee on Geographic Variation in Health Care Spending and Promotion of High-Value Health Care:: Preliminary Committee Observations*: National Academies Press.

Gruber, J. (2010). The cost implications of health care reform. *New England Journal of Medicine, 362*(22), 2050-2051.

Howe, C. J., Cole, S. R., Westreich, D. J., Greenland, S., Napravnik, S., & Eron Jr, J. J. (2011). Splines for trend analysis and continuous confounder control. *Epidemiology (Cambridge, Mass.), 22*(6), 874.

Hwabejire, J. O., Kaafarani, H. M., Imam, A. M., Solis, C. V., Verge, J., Sullivan, N. M., . . . Velmahos, G. C. (2013). Excessively Long Hospital Stays After Trauma Are Not Related to the Severity of Illness: Let's Aim to the Right Target! *JAMA surgery, 148*(10), 956-961.

Jha, A. K., Orav, E. J., & Epstein, A. M. (2011). Low-quality, high-cost hospitals, mainly in South, care for sharply higher shares of elderly black, Hispanic, and Medicaid patients. *Health Affairs, 30*(10), 1904-1911.

Jiang, H. J., & Wier, L. M. (2010). All-cause hospital readmissions among non-elderly Medicaid patients, 2007.

Joynt, K. E., & Jha, A. K. (2013). Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. *Jama, 309*(4), 342-343.

Kahn, J. M., & Iwashyna, T. J. (2010). Accuracy of the discharge destination field in administrative data for identifying transfer to a long-term acute care hospital. *BMC research notes, 3*(1), 205.

Kaiser Family Foundation. (2012). Increasing Medicaid Primary Care Fees for Certain Physicians in 2013 and 2014: A Primer on the Health Reform Provision and Final Rule

Kaiser Family Foundation. (2014). *2014 Employer Health Benefits Survey*. Retrieved from

Kaiser Family Foundation. (2015a). Key Facts about the Uninsured Population. Retrieved from http://kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/

Kaiser Family Foundation. (2015b). State Health Facts. Retrieved 5/1/2016 http://kff.org/statedata/

Kaiser Family Foundation. (2015c). Total Monthly Medicaid and CHIP Enrollment. Retrieved from http://kff.org/health-reform/state-indicator/total-monthly-medicaid-and-chip-enrollment/

Keehan, S. P., Cuckler, G. A., Sisko, A. M., Madison, A. J., Smith, S. D., Stone, D. A., . . . Lizonitz, J. M. (2015). National health expenditure projections, 2014–24: spending growth faster than recent trends. *Health Affairs, 34*(8), 1407-1417.

Kelz, R. R., Gimotty, P. A., Polsky, D., Norman, S., Fraker, D., & DeMichele, A. (2004). Morbidity and mortality of colorectal carcinoma surgery differs by insurance status. *Cancer, 101*(10), 2187-2194.

Kramer, A. M., Steiner, J. F., Schlenker, R. E., Eilertsen, T. B., Hrincevich, C. A., Tropea, D. A., . . . Eckhoff, D. G. (1997). Outcomes and costs after hip fracture and stroke: a comparison of rehabilitation settings. *JAMA, 277*(5), 396-404.

Landon, B. E., Schneider, E. C., Normand, S.-L. T., Scholle, S. H., Pawlson, L. G., & Epstein, A. M. (2007). Quality of care in Medicaid managed care and commercial health plans. *Jama, 298*(14), 1674-1681.

LaPar, D. J., Bhamidipati, C. M., Mery, C. M., Stukenborg, G. J., Jones, D. R., Schirmer, B. D., . . . Ailawadi, G. (2010). Primary payer status affects mortality for major surgical operations. *Annals of surgery, 252*(3), 544.

Le, T. (2016). *The Effect of Medicaid Insurance Coverage on Discharge to an Inpatient Post-Acute Care Facility.* University of Pittsburgh.

Mechanic, R. (2014). Post-acute care—the next frontier for controlling Medicare spending. *New England Journal of Medicine, 370*(8), 692-694.

Medicare, C. f., Services, M., Health, U. D. o., & Services, H. (2013). Medicaid Managed Care Enrollment Report 2011.

Medicare, C. f., Services, M., Health, U. D. o., & Services, H. (2015). Medicaid Managed Care Enrollment Report 2013.

Medicare Payment Advisory Commission. (2011). Regional variation in Medicare service use. *Washington (DC): MedPAC*.

Medicare Payment Advisory Commission. (2014). A Data Book: Health care spending and the Medicare program, June 2014. *Washington (DC): MedPAC*.

Medicare Payment Advisory Commission. (2016). Report to the Congress: Medicare payment policy [Internet]. Washington (DC): MedPAC; 2016 Mar.

Mor, V., Intrator, O., Feng, Z., & Grabowski, D. C. (2010). The revolving door of rehospitalization from skilled nursing facilities. *Health Affairs, 29*(1), 57-64.

National Academy for State Health Policy. Map: Where States Stand on Medicaid Expansion Decisions. Retrieved from https://www.statereforum.org/Medicaid-Expansion-Decisions-Map

Newhouse, J. P., & Garber, A. M. (2013). Geographic variation in Medicare services. *New England Journal of Medicine, 368*(16), 1465-1468.

Pennsylvania Department of Human Services. (2012). *Medical Assistance Eligibility Handbook*.

Pennsylvania Health Care Cost Containment Council. Services & Data Requests - Data Descriptions. Retrieved from http://www.phc4.org/services/datarequests/datadescriptions.htm

Pennsylvania Health Care Cost Containment Council. Services & Data Requests - Regional Map. Retrieved from http://www.phc4.org/services/datarequests/regionalmap.htm

Pennsylvania Health Care Cost Containment Council. (2010). *Hospital Peformance Report - Federal Fiscal Year 2009 - Technical Notes*. Retrieved from

Pennsylvania Long Term Care Commission. (2014). Pennsylvania Long Term Care Commission Final Report.

Quan, H., Parsons, G. A., & Ghali, W. A. (2004). Validity of procedure codes in International Classification of Diseases, 9th revision, clinical modification administrative data. *Medical care, 42*(8), 801-809.

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Shen, Y. C., & Zuckerman, S. (2005). The effect of Medicaid payment generosity on access and use among beneficiaries. *Health services research, 40*(3), 723-744.

Skolarus, L., Meurer, W., Burke, J., Bettger, J. P., & Lisabeth, L. (2012). Effect of insurance status on postacute care among working age stroke survivors. *Neurology, 78*(20), 1590-1595.

Skolarus, L. E., Burke, J. F., Morgenstern, L. B., Meurer, W. J., Adelman, E. E., Kerber, K. A., . . . Lisabeth, L. D. (2014). Impact of State Medicaid Coverage on Utilization of Inpatient Rehabilitation Facilities Among Patients With Stroke. *Stroke, 45*(8), 2472-2474.

Smith, V., Gifford, K., & Ellis, E. (2014). Medicaid in an Era of Health and Delivery System Reform.

Squires, D. A. (2012). Explaining high health care spending in the United States: an international comparison of supply, utilization, prices, and quality. *Issue brief (Commonwealth Fund), 10*, 1-14.

StataCorp. 2015. Stata Statistical Software: Release 14. College Station, T. S. L.

Thompson, J. W., Ryan, K. W., Pinidiya, S. D., & Bost, J. E. (2003). Quality of care for children in commercial and Medicaid managed care. *Jama, 290*(11), 1486-1493.

Trudnak, T., Kelley, D., Zerzan, J., Griffith, K., Jiang, H. J., & Fairbrother, G. L. (2014). Medicaid admissions and readmissions: understanding the prevalence, payment, and most common diagnoses. *Health Affairs, 33*(8), 1337-1344.

Zuckerman, S. (2012). How much will Medicaid physician fees for primary care rise in 2013? Evidence from a 2012 survey of Medicaid physician fees.