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Changes in Payment Regulation and Acute Care Use for Total Hip Replacement: Trends in Length of Stay, Costs, and Discharge, 1997–2012

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Abstract

Purpose—To describe trends in the length of stay (LOS), costs, mortality, and discharge destination among a national sample of total hip replacement (THR) patients between 1997 and 2012.

Design—Longitudinal retrospective design.

Methods—Descriptive analysis of the Healthcare Utilization Project (HCUP) National Inpatient Sample data.

Findings—A total of 3,516,636 procedures were performed over the study period. Most THR patients were women, and the proportion aged 44–65 years increased. LOS decreased from 5 to 3 days. Charges more than doubled, from \$22,184 to \$53,901. Deaths decreased from 43 to 12 deaths per 10,000 patients. THR patients discharged to an institutional setting declined, while those discharged to the community increased.

Conclusion—We found an increase in THR patients, who were younger, women, had private insurance, and among those discharged to community-based settings.

Clinical Relevance—Findings have implications for patient profiles, workplace environments, quality improvement, and educational preparation of nurses in acute and post-acute settings.

Total hip replacement (THR) is widely considered to be one of the most important orthopedic interventions developed in operative history, relieving pain and improving mobility among people crippled with severe arthritis of the hip joint and/or suffering from a fractured hip (Knight, Aujla, & Biswas, 2011; Learmonth, Young, & Rorabeck, 2007). In

the US, the number of primary total hip replacements (THR) performed grew 36 percent, from 1996 (150,645 procedures) to 2005 (237,645 procedures) (Bang et al., 2010). Further, THRs are projected to reach 511,837 procedures in 2020 (Kurtz, Ong, Lau, & Bozic, 2014). New healthcare policy and population influences, for example, the Affordable Care Act (ACA), coupled with the obesity epidemic and aging Baby Boomers, will likely spur future acute care use for THR. Specifically, health care coverage will expand under the ACA increasing the likelihood of elective procedures such as THR which has implications for increased utilization of health services, costs and clinical capacity when meeting this growing demand (Ghomrawi, Schackman, & Mushlin, 2012). Understanding the ramifications of increased THR procedures requires accurate information regarding service use, costs, mortality, and discharge disposition. Longitudinal research examining large US populations of THR patients such as those with Medicaid or private healthcare coverage have been excluded from previous research (Cram et al., 2012; Cram et al., 2011; Lovald et al., 2014). In light of previous information, the current study fills this critical gap.

The purpose of this study was to describe use of acute care hospital services, costs, mortality, and discharge disposition for THR patients over 16 years. This report presents national summary statistics in THR data over time as a resource for rehabilitation researchers, administrators, policy makers, nurses, patients and their families in quality improvement efforts. With the growing numbers of THRs each year, this study has significance for patients and rehabilitation nurses. First, THR patients and their families may use these data to inform decision-making; share concerns with primary care and specialty providers based on personal care needs, and together, select the most appropriate care settings for continued medical management and rehabilitation. Second, rehabilitation nurses across the health care continuum can improve health outcomes by using best practices to alleviate pain, encourage mobility (using adaptive equipment when needed), prevent complications (i.e., deep vein thrombosis, infection), and facilitate safe care transitions. Third, policy makers may use these data to plan for future utilization of THR procedures and subsequent rehabilitation services, under new policies such as the Affordable Care Act. Fourth, findings may serve as a catalyst for future clinical research questions of interest.

Background

Total hip replacement and service use

Most trend studies on acute care utilization and discharge of THR patients described in the literature have reported findings for Medicare patients (Colla, Escarce, Buntin, & Sood, 2010; Grabowski, Afendulis, & McGuire, 2011; Huckfeldt, Sood, Escarce, Grabowski, & Newhouse, 2014; Sood, Huckfeldt, Grabowski, Newhouse, & Escarce, 2013). Between 1992 and 2004, THR use increased from 62,636 to 93,537 or 40.9% (Cram et al., 2011). THR appears to have become safer – both in-hospital and 30-day mortality decreased significantly – even though hospital lengths of stay (LOS) were shorter (9.1 days in 1991 vs. 3.7 days in 2008; $p=0.02$). During the same period, women outnumbered men by 2:1, with the average age of patients in the mid-70's (Cram et al., 2011). The average per-discharge cost to taxpayers was \$39,348 in 2005, up from \$22,099 in 1993 (Ong et al., 2006). Trends in hospital discharge of THR patients on Medicare have been described in the literature as

well. From 1991 to 2005, discharges to home declined (68% to 42%), while discharges to SNFs increased (18% to 34%)(Cram et al., 2011). Discharges to inpatient rehabilitation facilities increased until 2001 then fell: 13% in 1991, 33% in 2001, 23% in 2006, and 15% in 2008(Cram et al., 2011). Limitations of past research excluded THR patients with Medicaid or private insurance. Further, understanding the ramifications of THR use over time requires accurate information on all patients regardless of payer type.

Medicare spending and payment regulations

Influenced by efforts over 25 years to rein in Medicare spending, payment policies for acute and post-acute care settings were developed causing considerable changes in acute and post-acute utilization. Beginning with the implementation of the prospective payment system for hospitals in 1983, hospital LOS and expenditures decreased, and services for on-going medical management, rehabilitation, and recovery shifted to post-acute care settings, causing Medicare spending for post-acute care services to rise exponentially (Cotterill & Gage, 2002; Gage, 1999). During this period, Medicare spending for post-acute care services increased from \$17 billion in 1993 to \$38 billion in 1997. Medicare spending was highest for SNFs (\$158 million), followed by home health care (\$155 million) and IRFs (\$59 million) (Kaplan, 2007). In response, Congress passed the Balanced Budget Act in 1997, which established the interim payment system for home health agencies in 1997, and prospective payment systems for skilled nursing facilities in 1998, followed by home health agencies in 2000, and inpatient rehabilitation facilities and long-term care hospitals in 2002. In addition, the “60% rule” for inpatient rehabilitation facilities, enforced since 2004, mandated that at least 60% of patients admitted to an IRF must be diagnosed with at least one of 13 specified medical conditions (including hip replacement) in order to receive Medicare reimbursement for services (Centers for Medicare & Medicaid Services [CMS], 2009). Since the implementation of the previously mentioned payment regulations, many researchers have examined their impact on use of acute care hospital and post-acute care services by individual settings, but few have considered how such changes have occurred simultaneously for acute and post-acute care settings over time. Long-term care hospitals were among the post-acute care providers who treat the fewest THR patients (2%) (Medicare Payment Advisory Commission [MedPAC], 2012a), thus were not included in this study.

Three factors lent urgency to the current study. First, given increases in Medicare spending for THR-related post-acute care and differences in payment methods and incentives by post-acute care setting, understanding how these have influenced treatment decisions and resulting outcomes is critical. Second, previous analyses of these trends have not included individuals who participated in Medicaid or private health plans. Third, THRs and post-acute care rehabilitation services after THR are likely to grow in an increasingly aging and obese US population (Tian et al., 2009) – factors that elevate risk of osteoarthritis, the leading indication for joint replacement surgery (Murphy & Helmick, 2012). A better understanding of the discharge placement for patients following THR and use of post-acute care services is important for rehabilitation nurses to identify discharge needs and better plan transitional care programs for these patients. As agents in effective care transitions, nurses must: (1) utilize evidence-based approaches to ensure the exchange of health-related

information for THR patients across multiple health care settings and providers; and (2) summarize evidence in meaningful ways to help THR patients and their families make informed decisions about the post-acute care services available.

Two research questions guided the study: (1) how have trends in THR frequency, costs, in-hospital mortality, and length of stay changed among U.S. adults from 1997 to 2012; and (2) how have TRH discharge disposition and costs for adults entering 3 major types of post-acute care settings changed in the context of changing Medicare policies and payment regulations over this period?

METHODS

Design and Sample

This study used a retrospective descriptive design. The Healthcare Utilization Project (HCUP) included a group of databases (e.g., State Inpatient, State Ambulatory and Surgery State, and State Emergency Department) developed by the Agency for Healthcare Research and Quality to provide health information and statistics on utilization, cost, and overall quality of health services. The National Inpatient Sample (NIS), created from the State Inpatient Database, includes discharge data from a nationally representative sample of approximately 20% of US community hospitals. In 1997, the NIS contained data from 22 states and, by 2009, from a total of 46 states (Agency for Healthcare Research and Quality, 2014). Inclusion criteria included patients admitted to the hospital between the years of 1997 and 2012 with a primary procedure of total hip replacement (ICD-9CM code 81.51).

Variables

Constructs of interest were operationally defined as follows: (1) *discharges* represented utilization of acute services for THR; (2) *length of stay* (LOS) was the number of nights for which the patient remained under hospital care; (3) *charges* were the amount the hospital charged for the entire hospital stay, not including physician fees; (4) *in-hospital mortality* was the number of deaths per 10,000 patients who died during the hospital stay; and (5) *discharge status* was the setting to which the patient was discharged from the hospital, either a routine discharge (home without clinical services) or to a post-acute care setting, including transfer to another short term hospital (a facility with medical staff and necessary personnel to provide diagnosis, care, and treatment to a wide range of acute/chronic conditions and injuries); transfer to another institution (e.g., skilled nursing home, rehabilitation care, intermediate care) or to home health agency care. Patient demographics included age and payer.

Data analysis

HCUPnet, an online query system, was used to evaluate trends in the number of THRs performed between 1997 and 2012. Specifically, HCUPnet provided data from single years and we then combined these data into an excel spreadsheet for analysis. The unit of analysis was the discharge. Data were categorized based on number of discharges, LOS, hospital charges, in-hospital mortality, and discharge destination. A descriptive summary of yearly

aggregated summaries for persons who underwent a total hip replacement and were later discharged from an acute care US hospital between 1997 and 2012 is described below.

RESULTS

HCUP data presented in Table 1 shows utilization of acute care services for THR, stratified by year from 1997 to 2012. In this period, there was an estimated 3,516,636 hospital discharges post-THR. Annual discharges steadily increased from 146,098 in 1997 to 299,590 in 2012 (mean = 219,790 [SD=54,082]). The number of charges increased during the period. Mean hospital charges for THR more than doubled, from \$22,184 in 1997 to \$56,173 in 2011 and later decreased to \$53,901 in 2012. Between 1997 and 2012, in-hospital mortality decreased from 43 to 12 deaths per 10,000 patients, even as length of hospital stay decreased from 5 to 3 days.

Differences in THR patient demographics by age and payer in 1997 and 2012 are shown in Figures 1 & 2, respectively. Consistently, more than half of all THRs were performed on women over the 16-year period (data not shown). The overwhelming majority (95%) of THR patients were 45 years of age and older. During the study period, the percentage of THRs performed increased 23% and 19% among age groups 45 to 64 years and 65 to 84 years, respectively. The percentage of THR patients with Medicare insurance decreased 11% from 1997 to 2012 while the percentage of THR patients with private insurance increased 8% during the same period. Overall, hospital charges for a THR grew, from a mean of \$22,184 in 1997 to \$55,779 in 2011 and later declined to \$53,901 in 2012.

The percentages of THR discharges by setting following hospitalization, from 1997 and 2012 are shown in Figure 3. The percentage of routine discharges of THR patients decreased from 30% in 1997 to 27% in 2012. The percentage of THR patients discharged to a post-acute care setting (inpatient rehabilitation facilities, skilled nursing facilities, and home with home health care) increased from 68% in 1997 to 72% in 2012. Among these, patients discharged to another institution (inpatient rehabilitation or skilled nursing facilities) decreased from 51% in 1997 to 32% in 2012, and those discharged home with home health care increased from 17% in 1997 to 40% in 2012. The percentage of THR patients discharged to another short-term hospital remained relatively unchanged from 1997 and 2012.

DISCUSSION

We showed that THR procedures have been widely performed in hospitals across the US and that Medicare payment reforms implemented in each post-acute care setting may have influenced acute care use for all THR patients and changed the mix of discharge settings for rehabilitation and recovery. This study contributed to the literature by providing the first work reporting trends for THR patients that included Medicare, private, and Medicaid payers and patients aged 45 and 64 years. Two major findings from this analysis warrant further discussion.

First, the number of THRs performed, LOS and mortality post-THR, and costs by payer and age shifted considerably over the past 16 years. The trends we observed for THR patients

with Medicaid and/or private pay insurance were consistent with that observed among THR patients with Medicare, which remained the primary payer for THR procedures. Yet, it is important to note relative changes in payer and age groups of THR patients. Since 1997, the number of THR performed on patients between ages 45–64 years increased from 27% to 42% in 2012. Similarly, the number of THR performed on patients between ages 65–84 years decreased from 60% to 48% in 2012. Consequently, the percentage of THR procedures paid for by Medicare reduced by 11% from 63% in 1997 to 52% in 2012 and the percentage of THR procedures paid for by private pay plans increased by 8% during the study period, from 32% in 1997 to 40% in 2012. These trends or differences in payer and age over time might be explained by several factors. Aging and obesity might be influencing the use of THR and are independent risk factors associated with development of osteoarthritis, or inflammation of a joint(s), which is the most common cause of disability among US adults and the leading indication for joint replacement surgery (Batsis et al., 2009) (Mota, Tarricone, Ciani, Bridges, & Drummond, 2012) (Zhang & Jordan, 2010). Incidence of THRs is expected to increase as a result of both the increase in an aging population and increased prevalence of obesity among young and middle aged U.S. adults (Murphy & Helmick, 2012). Socioeconomic factors, such as rising education and health care insurance coverage, may also have influenced demand for THRs (Mota et al., 2012).

Second, discharge destination for THR patients changed over the study period. THR patients discharged to institutional settings for rehabilitation (e.g., SNF or IRF) declined while those discharged to community-based settings (e.g., with or without home health care) increased. These trends began with the implementation of the SNF PPS in 1998; further declines occurred after implementation of the IRF PPS in 2002. Yet, the largest decline in institutional rehabilitation followed the enforcement of the 60% rule in 2004, fueling substantive growth in home health care use and Medicare spending for home health services. Thus, payment incentives under PPS likely encouraged the use of more home health episodes, payment for which increased from \$4.1 million in 2002 to \$6.8 million in 2010 (Medicare Payment Advisory Commission [MedPAC], 2012b). The amount and type of home health services have changed. Between 1998 and 2009, home health aide services decreased from 48% to 16%, skilled nursing services increased from 41% to 55%, and therapy services increased from 10% to 18% (Medicare Payment Advisory Commission [MedPAC], 2011). Our findings support suggestions that incentive-based payment policies influence where THR patients receive post-acute care and the type of care they receive.

Implications for policy, health services and clinical practice

Findings from this analysis have present and future implications for policy, health services and clinical practice in various acute and post-acute settings.

Policy Implications

Determinants of discharge disposition—Post-acute care payment systems are designed to moderate spending and increase efficiency, but differences in payment levels, incentives, and admission/treatment policies exist across settings (Medicare Payment Advisory Commission [MedPAC], 2009), creating incentives to place patients in post-acute care settings without regard to clinical need (Buntin, Colla, & Escarce, 2009; Colla et al.,

2010; Grabowski et al., 2011; Huckfeldt et al., 2014; Sood et al., 2013). To generate data on patient need, the Deficit Reduction Act (DRA) of 2005 mandated development of the Continuity Assessment Record and Evaluation (CARE) tool, which measures patient information on admission and discharge to acute care hospitals and post-acute care settings. Early demonstrations suggest that the Centers for Medicare and Medicaid Services (CMS) may eventually have more robust evidence of differences in patients and their outcomes across settings than is currently available (Centers for Medicare & Medicaid Services [CMS], 2012).

Readmission post-THR—Based on Section 3025 of the Affordable Care Act's Hospital Readmission Reduction Program (HRRP), the CMS began reducing payments to hospitals with 30-day readmission rates higher than the national risk-adjusted average. Specifically, the maximum penalty was 1% in 2013, the first year of the program, for excess readmissions from heart attack, heart failure, and pneumonia. In 2014, hospitals can lose up to 2% of their Medicare reimbursement. By 2015, the CMS will raise the maximum penalty to 3%, as well as expand the number of conditions to include patients readmitted with hip and knee replacement (Centers for Medicare & Medicaid Services (CMS), 2014). In a recent statistical report, hip replacement (total and partial) ranked 6th highest among 30-day all-cause readmissions in US hospitals (Weiss, Elixhauser, & Steiner, 2006) however no data was reported on patient characteristics for this procedure. More comprehensive programs which reduce hospital readmissions for all THR patients, offers a tremendous opportunity to improve health care quality and reduce spending (Bosco, Karkenny, Hutzler, Slover, & Iorio, 2014).

Access to care—A third policy implication is the potential shortage in provider supply, i.e., orthopedic surgeons, nurses, and therapists across settings. The future supply of providers may be insufficient to reach market equilibrium, which would affect allocation of scarce healthcare resources (Feldstein, 2011). A shortage of providers and facilities may reduce access to care (Fehring et al., 2010). Stimulating the supply of providers might include reestablishment of health professions education programs, e.g., Subchapters V (1944, 1944a) and VI (1944, 1944b) of the Public Health Service Act, which included initiatives to recruit, train, and retain physicians, nurses, and other allied health professions; support scholarships and loan forgiveness programs; increase number of faculty in health care education and training programs; and expand funding support for research.

Health Services Implications

Quality improvement—Health services administrators, payers, and other decision-makers can benchmark their hospitals' performance against these nationally representative data from THR patients. Because THRs represent one of the most frequently performed procedures with rapidly increasing inpatient costs for private insurance plans (Russo, Merrill, & Friedman, 2006), improvements in efficiency and outcomes would result in substantial savings (Daigle, Weinstein, Katz, & Losina, 2012). These data might also be used during certification processes required by accrediting agencies for orthopedic joint replacement programs (DeJong, Tian, et al., 2009).

Clinical Practice Implications

Practice settings—As the percentage of THR patients discharged to different post-acute care settings continues to increase, patient profiles and clinical needs of these patients might also vary. In a comparison of joint replacement patients receiving rehabilitation in post-acute care settings, home health care patients were more independent than IRF or SNF patients in mobility and self-care function on admission (Mallinson et al., 2011). Home health care patients were more likely to be married, to live with others, to be younger, and to be incontinent than either IRF or SNF patients, whereas SNF patients were older and more likely to be widowed, live alone, and have more problems with daily decision making. SNF and home health care patients had more problems with short-term memory than IRF patients, who had more comorbid conditions, were more obese or had more vision problems than home health care or skilled nursing facility patients. Medical complications were particularly prevalent among inpatient rehabilitation facility patients in other work (DeJong, Horn, et al., 2009). Nurses practicing in all post-acute care settings will need expertise in managing comorbid conditions, geriatric syndromes, and medical complications, and SNF nurses will need additional training in caring for the psychosocial needs of THR patients (Bartels et al., 2010; Borson, Bartels, Colenda, Gottlieb, & Meyers, 2001). Improving elders' mental health and strengthening the mental health workforce should be priorities (Evans, Beck, & Buckwalter, 2012).

Management—The increased volume of THR patients with greater medical severity and rehabilitation needs admitted to post-acute care settings will add to nurses' responsibilities and workload (Massey, Aitken, & Chaboyer, 2009). Staffing in rehabilitation settings should reflect workload in order to optimize patient care. Nurse managers in post-acute care settings may ensure adequate staffing levels by adopting organizational characteristics similar to those found in magnet-designated hospitals that demonstrate ability to attract and retain professional nurses and provide quality care (Tomey, 2009). In 137 U.S. home health care agencies, the professional practice environment was negatively associated with nurse-reported adverse patient events and turnover and positively associated with quality of care and job satisfaction (Flynn, 2007). In SNFs, positive organizational climate and communication patterns and stable nursing leadership were protective against staff turnover (Anderson, Corazzini, & McDaniel, 2004). In IRFs, nurse staffing (minimum RN-to-patient ratio, non-RN-to-patient ratio, and patient-acuity-based expertise of non-RN staff) strongly affected patient outcomes (Nelson et al., 2007). Thus, system level strategies may hold promise for improving outcomes in post-acute care settings with increasing numbers of THR patients.

Education and specialty certification—Because musculoskeletal conditions are one of the most common reasons for seeking care in the U.S. (Pfuntner, Wier, & Stocks, 2006), schools of nursing should prepare students for the growing number of patients with orthopedic conditions, diseases, and related treatments. For example, Duke University School of Nursing's Master of Science in nursing degree program offers an orthopedics concentration for Nurse Practitioners (Duke University School of Nursing). Other training opportunities related to clinical competence for care of THR patients include specialty certification in rehabilitation. A Certified Rehabilitation Registered Nurse (CRRN) is an

experienced rehabilitation or restorative nurse who has achieved a level of knowledge in this practice area (Pierce, Gibbons, & Cullen, 1991). Education and specialty training across various practice settings will provide guidance in improving health and quality of life outcomes for THR patients and patients with other musculoskeletal conditions.

Limitations

Strengths of this study (a large representative sample; payer data including Medicare, Medicaid and private-payers; and discharge disposition data for the three most frequently used post-acute care providers) should be considered in light of its limitations. First, findings represent crude estimates of the variables examined and require cautious interpretation. No statistical analyses were conducted to estimate associations between variables or control for confounders. The causal relationships between the trends described and Medicare payment structures were beyond the scope of this study. Second, data were aggregated to the discharge level; specific patient episodes were not examined. Thus outcomes examined were from different patients each year and not a cohort of patients examined longitudinally. Third, this analysis did not distinguish between non-elective and elective THR patients or between types of implant used. Fourth, discharges to SNFs and IRFs were not distinguished but were grouped into one discharge category. Fifth, due to their infrequent use, Long-term Care Hospitals and outpatient clinics were not included in this analysis.

Future Research

In the face of recent payment reforms set forth by the Accountable Care Act (ACA), additional research is needed on appropriate use of post-acute care services for THR patients (Grabowski, Huckfeldt, Sood, Escarce, & Newhouse, 2012). Given that THR patients' full recovery likely requires medical supervision and rehabilitation beyond the first post-acute care setting and/or a combination of rehabilitation services spanning several post-acute care settings (Tian, DeJong, Munin, & Smout, 2010), setting-specific payment methods and outcome measures might become less relevant (Dejong, 2014). Rather, studies which examine the full range of post-acute care options as identified over an entire episode of care for THR patients while taking into account socio-demographic characteristics (i.e., race, age, and payer) should be considered. Then, research should identify those episodes-of-care trajectories found to be most beneficial to THR patients and, subsequently, which payment incentives (e.g. bundled payment and pay for performance) in relation to costs and patient outcomes can be used to assure THR patients maximize their opportunity for full recovery as they transition from one care setting to the next.

To date, many studies have reported on the value of transitional care (Coleman, Parry, Chalmers, & Min, 2006; Naylor et al., 2004; Naylor, Feldman, et al., 2009; Parry, Min, Chugh, Chalmers, & Coleman, 2009). Key outcomes included reductions in rehospitalization and costs, as well as improvement in patient satisfaction and quality of care (Naylor, 2004; Naylor, Kurtzman, & Pauly, 2009). Provisions within the ACA support the aim of making health care safer and less costly through the development and translation of evidence-based transitional care programs. Given the essential role nurses play in the care transitions, more research is needed to evaluate the nurse-led models of transitional care and

their unique contributions to improving patient outcomes, facilitating communication between post-acute care providers, and controlling costs.

CONCLUSION

We examined changes in utilization of acute care services for patients following THR in U.S. hospitals in relation to changing payment regulations for acute and post-acute care providers during 1997 to 2012. Until 2012, total discharges and charges for THR consistently increased, while the average LOS decreased. In addition, the proportions of THR patients discharged to different post-acute care settings changed. Early in the period, the majority of THR patients were routinely discharged home without care, followed by discharged to home health care, and skilled nursing facilities and other rehabilitation settings. By the end of the period, THR patients were increasingly discharged home with home health services, to skilled nursing facilities and other rehabilitation settings, and home without care, respectively. Given these trends, it is increasingly important to examine patterns of care and determine which post-acute care settings are most effective in treating THR patients and improving outcomes. Nurses with rehabilitation knowledge and skills are uniquely positioned to help THR patients achieve their highest level of functional independence across all settings of care.

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References

- 1944, Public Health Service Act of. Title 42 U.S.C. § Chapter 6A - Subchapter V - Health Professions Education. 1944a. from www.gpo.gov/fdsys/pkg/USCODE-2010-title42
- 1944, Public Health Service Act of. Title 42 U.S.C. § Chapter 6A - Subchapter VI -Nursing Workforce Development. 1944b. from www.gpo.gov/fdsys/pkg/USCODE-2010-title42
- Agency for Healthcare Research and Quality. [Retrieved October 2, 2014] Overview of the National (Nationwide) Inpatient Sample (NIS). 2014. from <http://www.hcup-us.ahrq.gov/nisoverview.jsp>
- Anderson RA, Corazzini KN, McDaniel RR Jr. Complexity science and the dynamics of climate and communication: reducing nursing home turnover. *Gerontologist*. 2004; 44(3):378–388. [PubMed: 15197292]
- Bang H, Chiu YL, Memtsoudis SG, Mandl LA, Della Valle AG, Mushlin AI, Mazumdar M. Total hip and total knee arthroplasties: trends and disparities revisited. *Am J Orthop (Belle Mead NJ)*. 2010; 39(9):E95–E102. [PubMed: 21290031]
- Bartels SJ, Lebowitz BD, Reynolds CF 3rd, Bruce ML, Halpain M, Faison WE, Kirwin PD. Programs for developing the pipeline of early-career geriatric mental health researchers: outcomes and implications for other fields. *Acad Med*. 2010; 85(1):26–35. [PubMed: 20042817]
- Batsis JA, Naessens JM, Keegan MT, Wagie AE, Huddleston PM, Huddleston JM. Impact of body mass on hospital resource use in total hip arthroplasty. *Public Health Nutr*. 2009; 12(8):1122–1132. [PubMed: 19278565]
- Borson S, Bartels SJ, Colenda CC, Gottlieb GL, Meyers B. Geriatric mental health services research: Strategic Plan for an Aging Population: Report of the Health Services Work Group of the American

- Association for Geriatric Psychiatry. Am J Geriatr Psychiatry. 2001; 9(3):191–204. [PubMed: 11481126]
- Bosco JA 3rd, Karkenny AJ, Hutzler LH, Slover JD, Iorio R. Cost burden of 30-day readmissions following Medicare total hip and knee arthroplasty. J Arthroplasty. 2014; 29(5):903–905. [PubMed: 24332969]
- Buntin MB, Colla CH, Escarce JJ. Effects of payment changes on trends in post-acute care. Health Services Research. 2009; 44(4):1188–1210. [PubMed: 19490159]
- Centers for Medicare & Medicaid Services (CMS). [Retrieved October 4 2014] Readmissions Reduction Program. 2014. from <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html>
- Centers for Medicare & Medicaid Services [CMS]. Medicare Program: Inpatient Rehabilitation Facility Prospective Payment System for Federal Fiscal Year 2010. Final Rule. [Federal Register Doc. E9-18616 of August 7, 2009 (74 FR 39762)]. Washington, DC: Government Printing Office; 2009. Retrieved from <http://www.gpo.gov/fdsys/pkg/FR-2009-08-07/pdf/E9-18616.pdf>.
- Centers for Medicare & Medicaid Services [CMS]. Washington, DC: 2012. Report to Congress: Post Acute Care Payment Reform Demonstration (PAC-PRD).
- Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: results of a randomized controlled trial. Arch Intern Med. 2006; 166(17):1822–1828. [PubMed: 17000937]
- Colla CH, Escarce JJ, Buntin MB, Sood N. Effects of competition on the cost and quality of inpatient rehabilitation care under prospective payment. Health Services Research. 2010; 45(6 Pt 2):1981–2006. [PubMed: 21029086]
- Cotterill PG, Gage BJ. Overview: Medicare post-acute care since the Balanced Budget Act of 1997. Health Care Financ Rev. 2002; 24(2):1–6. [PubMed: 12690691]
- Cram P, Lu X, Callaghan JJ, Vaughan-Sarrazin MS, Cai X, Li Y. Long-term trends in hip arthroplasty use and volume. J Arthroplasty. 2012; 27(2):278–285. e272. [PubMed: 21752578]
- Cram P, Lu X, Kaboli PJ, Vaughan-Sarrazin MS, Cai X, Wolf BR, Li Y. Clinical characteristics and outcomes of Medicare patients undergoing total hip arthroplasty, 1991–2008. JAMA. 2011; 305(15):1560–1567. [PubMed: 21505134]
- Daigle ME, Weinstein AM, Katz JN, Losina E. The cost-effectiveness of total joint arthroplasty: a systematic review of published literature. Best Pract Res Clin Rheumatol. 2012; 26(5):649–658. [PubMed: 23218429]
- Dejong G. Are we asking the right question about postacute settings of care? Arch Phys Med Rehabil. 2014; 95(2):218–221. [PubMed: 24189328]
- DeJong G, Horn SD, Smout RJ, Tian W, Putman K, Gassaway J. Joint replacement rehabilitation outcomes on discharge from skilled nursing facilities and inpatient rehabilitation facilities. Archives of Physical Medicine and Rehabilitation. 2009; 90(8):1284–1296. [PubMed: 19651262]
- DeJong G, Tian W, Smout RJ, Horn SD, Putman K, Smith P, Davanzo JE. Use of rehabilitation and other health care services by patients with joint replacement after discharge from skilled nursing and inpatient rehabilitation facilities. Archives of Physical Medicine and Rehabilitation. 2009; 90(8):1297–1305. [PubMed: 19651263]
- Duke University School of Nursing. Orthopedics Specialty. from <http://nursing.duke.edu/academics/programs/msn/orthopedics-specialty>.
- Evans LK, Beck C, Buckwalter KC. Carpe diem: nursing making inroads to improve mental health for elders. Nurs Outlook. 2012; 60(2):107–108. [PubMed: 22514796]
- Fehring TK, Odum SM, Troyer JL, Iorio R, Kurtz SM, Lau EC. Joint replacement access in 2016: a supply side crisis. Journal of Arthroplasty. 2010; 25(8):1175–1181. [PubMed: 20870384]
- Feldstein, PJ. Health Care Economics. 7th ed.. Clifton Park, NY: Delmar Cengage Learning; 2011.
- Flynn L. Extending work environment research into home health settings. West J Nurs Res. 2007; 29(2):200–212. [PubMed: 17337622]
- Gage B. Impact of the BBA on post-acute utilization. Health Care Financ Rev. 1999; 20(4):103–126. [PubMed: 11482117]
- Ghomrawi HM, Schackman BR, Mushlin AI. Appropriateness criteria and elective procedures--total joint arthroplasty. N Engl J Med. 2012; 367(26):2467–2469. [PubMed: 23268663]

- Grabowski DC, Afendulis CC, McGuire TG. Medicare prospective payment and the volume and intensity of skilled nursing facility services. *J Health Econ.* 2011; 30(4):675–684. [PubMed: 21705100]
- Grabowski DC, Huckfeldt PJ, Sood N, Escarce JJ, Newhouse JP. Medicare postacute care payment reforms have potential to improve efficiency of care, but may need changes to cut costs. *Health Aff (Millwood).* 2012; 31(9):1941–1950. [PubMed: 22949442]
- Huckfeldt PJ, Sood N, Escarce JJ, Grabowski DC, Newhouse JP. Effects of Medicare payment reform: evidence from the home health interim and prospective payment systems. *J Health Econ.* 2014; 34:1–18. [PubMed: 24395018]
- Kaplan SJ. Growth and payment adequacy of medicare postacute care rehabilitation. *Archives of Physical Medicine and Rehabilitation.* 2007; 88(11):1494–1499. [PubMed: 17964895]
- Knight SR, Aujla R, Biswas SP. Total Hip Arthroplasty - over 100 years of operative history. *Orthop Rev (Pavia).* 2011; 3(2):e16. [PubMed: 22355482]
- Kurtz SM, Ong KL, Lau E, Bozic KJ. Impact of the economic downturn on total joint replacement demand in the United States: updated projections to 2021. *J Bone Joint Surg Am.* 2014; 96(8):624–630. [PubMed: 24740658]
- Learmonth ID, Young C, Rorabeck C. The operation of the century: total hip replacement. *Lancet.* 2007; 370(9597):1508–1519. [PubMed: 17964352]
- Lovald ST, Ong KL, Lau EC, Schmier JK, Bozic KJ, Kurtz SM. Mortality, cost, and downstream disease of total hip arthroplasty patients in the medicare population. *J Arthroplasty.* 2014; 29(1):242–246. [PubMed: 23711799]
- Mallinson TR, Bateman J, Tseng HY, Manheim L, Almagor O, Deutsch A, Heinemann AW. A comparison of discharge functional status after rehabilitation in skilled nursing, home health, and medical rehabilitation settings for patients after lower-extremity joint replacement surgery. *Arch Phys Med Rehabil.* 2011; 92(5):712–720. [PubMed: 21530718]
- Massey D, Aitken LM, Chaboyer W. What factors influence suboptimal ward care in the acutely ill ward patient? *Intensive Crit Care Nurs.* 2009; 25(4):169–180. [PubMed: 19406644]
- Medicare Payment Advisory Commission [MedPAC]. Skilled nursing facilities, home health agencies, long-term care hospitals, inpatient rehabilitation facilities (Section 9)A Data Book: Health Care Spending and the Medicare Program (June 2009). Washington, DC: MedPAC; Post-acute care. Retrieved from <http://www.medpac.gov/chapters/Jun09DataBookSec9.pdf>.
- Medicare Payment Advisory Commission [MedPAC]. Report to the Congress: Medicare Payment Policy. Washington, DC: MedPAC; 2011.
- Medicare Payment Advisory Commission [MedPAC]. Post-acute care (Section 8)A data book: Health care spending and the Medicare program (pp. 115–138). Washington, DC: Medicare Payment Advisory Commission (MedPAC); 2012a. Retrieved from <http://www.medpac.gov/documents/Jun12DataBookEntireReport.pdf>.
- Medicare Payment Advisory Commission [MedPAC]. Report to the Congress: Medicare Payment Policy. Washington, DC: MedPAC; 2012b.
- Mota RE, Tarricone R, Ciani O, Bridges JF, Drummond M. Determinants of demand for total hip and knee arthroplasty: a systematic literature review. *BMC Health Serv Res.* 2012; 12:225. [PubMed: 22846144]
- Murphy L, Helmick CG. The impact of osteoarthritis in the United States: a population-health perspective. *Am J Nurs.* 2012; 112(3 Suppl 1):S13–S19. [PubMed: 22373741]
- Naylor MD. Transitional care for older adults: a cost-effective model. *LDI Issue Brief.* 2004; 9(6):1–4. [PubMed: 15181894]
- Naylor MD, Brooten DA, Campbell RL, Maislin G, McCauley KM, Schwartz JS. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. *J Am Geriatr Soc.* 2004; 52(5):675–684. [PubMed: 15086645]
- Naylor MD, Feldman PH, Keating S, Koren MJ, Kurtzman ET, Maccoby MC, Krakauer R. Translating research into practice: transitional care for older adults. *J Eval Clin Pract.* 2009; 15(6):1164–1170. [PubMed: 20367721]
- Naylor MD, Kurtzman ET, Pauly MV. Transitions of elders between long-term care and hospitals. *Policy Polit Nurs Pract.* 2009; 10(3):187–194. [PubMed: 20026453]

- Nelson A, Powell-Cope G, Palacios P, Luther SL, Black T, Hillman T, Gross JC. Nurse staffing and patient outcomes in inpatient rehabilitation settings. *Rehabil Nurs*. 2007; 32(5):179–202. [PubMed: 17899990]
- Ong KL, Mowat FS, Chan N, Lau E, Halpern MT, Kurtz SM. Economic burden of revision hip and knee arthroplasty in Medicare enrollees. *Clin Orthop Relat Res*. 2006; 446:22–28. [PubMed: 16672867]
- Parry C, Min SJ, Chugh A, Chalmers S, Coleman EA. Further application of the care transitions intervention: results of a randomized controlled trial conducted in a fee-for-service setting. *Home Health Care Serv Q*. 2009; 28(2–3):84–99. [PubMed: 20182958]
- Pfuntner, A.; Wier, LM.; Stocks, C. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville MD: 2006. Most Frequent Conditions in U.S. Hospitals, 2011: Statistical Brief #162.
- Pierce LL, Gibbons KB, Cullen JM. The CRRN examination: preparation and strategies. *Rehabil Nurs*. 1991; 16(3):148–153. [PubMed: 2034882]
- Russo, CA.; Merrill, CT.; Friedman, B. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville MD: 2006. Procedures with the Most Rapidly Increasing Hospital Costs, 2000–2004: Statistical Brief #28.
- Sood N, Huckfeldt PJ, Grabowski DC, Newhouse JP, Escarce JJ. The effect of prospective payment on admission and treatment policy: evidence from inpatient rehabilitation facilities. *J Health Econ*. 2013; 32(5):965–979. [PubMed: 23994598]
- Tian W, DeJong G, Brown M, Hsieh CH, Zamfirov ZP, Horn SD. Looking upstream: factors shaping the demand for postacute joint replacement rehabilitation. *Archives of Physical Medicine and Rehabilitation*. 2009; 90(8):1260–1268. [PubMed: 19651260]
- Tian W, DeJong G, Munin MC, Smout R. Patterns of rehabilitation after hip arthroplasty and the association with outcomes: an episode of care view. *Am J Phys Med Rehabil*. 2010; 89(11):905–918. [PubMed: 20962601]
- Tomey AM. Nursing leadership and management effects work environments. *J Nurs Manag*. 2009; 17(1):15–25. [PubMed: 19166518]
- Weiss, AJ.; Elixhauser, A.; Steiner, C. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville MD: 2006. Readmissions to U.S. Hospitals by Procedure, 2010: Statistical Brief #154.
- Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med*. 2010; 26(3):355–369. [PubMed: 20699159]

Table 1.
Age group of THR patients while hospitalized between 1997 and 2012

Table 2.
Payer status for THR patients while hospitalized, between 1997 and 2012

Table 3.
Destination following hospital discharge for THR Patients, between 1997 and 2012

Table 1

Trends in utilization of acute care services for THR stratified by year, 1997–2012.

Variable	Year															
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total number of discharges	146,098	150,254	152,447	159,695	179,234	194,355	195,619	219,188	230,336	221,639	244,247	265,768	274,090	290,959	293,117	299,590
Mean LOS (days)	4.9	4.6	4.6	4.6	4.5	4.3	4.3	4.1	4.0	4.0	3.8	3.6	3.5	3.4	3.3	3.2
Mean charges in US \$	22,184	21,957	22,967	25,333	27,561	30,452	34,832	36,857	39,395	41,664	45,492	48,419	48,266	51,108	56,173	53,901
In-hospital deaths (Death rate per 10,000)	43	42	41	33	33	31	31	27	21	19	21	18	16	14	15	12
Routine discharge	43,541	43,999	41,636	45,078	42,576	47,689	49,019	47,852	49,763	47,993	55,435	64,291	58,715	71,512	71,528	81,895
Another short-term hospital	2,136	1,752	1,751	2,669	2,079	*	1,088	838	1,042	1,747	1,648	2,338	*	*	1,672	2,550
Another institution (nursing home, rehab)	73,994	79,016	77,046	80,956	95,972	96,752	91,053	103,912	103,184	93,349	95,994	94,175	98,320	95,791	99,386	95,420
Home health care	25,414	24,628	31,213	30,245	37,738	44,909	50,471	65,762	75,301	77,825	90,443	104,059	112,390	119,131	119,348	119,250

Source: HCUPnet. Retrieved from: <http://hcupnet.ahrq.gov/> "Statistics based on estimates with a relative standard error (standard error / weighted estimate) greater than 0.30 or with standard error = 0 in the nationwide statistics (NIS, NEDS, and KID) are not reliable. These statistics are suppressed and are designated with an asterisk (*). The estimates of standard errors in HCUPnet were calculated using SUDAAN software. These estimates may differ slightly if other software packages are used to calculate variances."