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ABSTRACT

Hospital readmissions have contributed significantly to rising healthcare costs in the United States. To curb rising costs, the Centers for Medicare and Medicaid Services introduced the Hospital Readmissions Reduction Program (HRRP), a penalty-based program designed to decrease healthcare costs. This research aims to determine if the HRRP has successfully reduced healthcare costs and increased quality outcomes associated with total knee arthroplasty (TKA) or total hip arthroplasty (THA) as defined by a reduction in readmission rates, postoperative complications, and overall costs. Although a positive correlation has been shown between outcomes and costs post-HRRP, more research is needed to tease out the impact of HRRP on these findings, given that these indicators were already positively trending before implementation.

INTRODUCTION

Hospital readmissions are a primary area of preventable cost, with over \$41 billion spent on over 3.3 million readmissions in 2011 alone (NEJM, 2018). To tackle the issue of rising healthcare costs, the Hospital Readmissions Reduction Program (HRRP) was implemented as a Medicare value-based purchasing program to reduce readmissions through the imposition of reimbursement penalties (CMS, 2021). HRRP debuted in the fiscal year 2014 as a 30-day readmission reduction program focused on acute myocardial infarction, heart failure, and pneumonia (CMS, 2013). HRRP was then expanded in fiscal year 3 of the program to target total knee arthroplasty (TKA) and total hip arthroplasty (THA) to prevent readmissions due to preventable conditions such as infection, blood clots, and falls (Hollenbeak et al., 2020). To quantify hospital performance under the HRRP and determine penalties, CMS used the excess readmission ratio (ERR) calculation or the ratio of predicted-to-expected readmission rates for elective THA or TKA to compare among hospitals (CMS, 2021). The penalty for failing to meet ERR guidelines is a negative CMS payment adjustment of up to negative three percent (Keeney et al., 2015).

Given the skyrocketing levels of utilization for these procedures and the fact that CMS bears the majority of the financial burden, the need for cost-reduction programs is evident. TKA and THA have a historically high readmission rate due to postoperative complications and are among the costliest procedures for payers (Saucedo et al., 2014). Furthermore, predictive models anticipate an increase in the volume of total joint arthroplasties such as

TKA and THA in the future due to the aging of the baby boomer population, the increase in obesity, and the increase in end-stage osteoarthritis (Ibrahim et al., 2016; Mature et al., 2022). Based on data from 2000 to 2014, these models estimate that THA rates will increase by 71% and TKA rates will increase by 85% in 2030, with an estimated total of 1.26 million joint replacement procedures performed annually (Mahure et al., 2022).

Postoperative complications persist as an undue source of inefficiency and often result in readmission, leading to an increased cost burden (Mundi et al., 2020). The implementation of the HRRP, which shifts the financial risk to the hospital, should incentivize hospitals to prevent complications or suffer fiscal consequences (McIlvannan, Eapen, & Allen, 2015). To prevent these complications, hospitals have implemented a variety of measures at the patient level to reduce readmissions and improve patient outcomes (McIlvannan, Eapen, & Allen, 2015). Regarding infection prevention, hospitals have introduced measures such as perioperative antibiotics and antibiotic-impregnated cement (Daines, Dennis, & Amann, 2015). Preventing venous thromboembolism measures such as early mobilization and anticoagulation have been proven successful and widely implemented (Talec, Gaujoux, & Samama, 2016). Finally, measures such as post-acute skilled nursing care and physical therapy have been implemented to ensure the quality of recovery for patients after joint replacement (Keeney et al., 2015).

RESULTS

HRRP-Driving Down Readmission Costs by Reducing Surgical Site Infections

A retrospective cohort study of 1,583 THAs occurred in a large academic hospital between July 2009 and June 2011 to identify the risk factors, causes, and financial implications of readmission penalties of unplanned readmissions for the group (Clement et al., 2013). The study showed that the readmission rate for the group was 6.5%, and the primary driver of readmission was surgical site infection with secondary causes of pain and hematoma. The researchers determined that during this time, reimbursement for readmissions had created a net profit of only \$226 after considering a loss of \$11,494 due to HRRP payment reductions (Clement et al., 2013).

A follow-up study from the same period compared the cost of readmission penalties after total joint replacement to the financial gain of readmissions and determined the financial benefit for the hospitals to avoid readmissions (Clement et al., 2017). Researchers observed readmission rates for 2,028 patients who had undergone THA or TKA at a large tertiary academic hospital and found that readmission penalties created a net loss of \$12,184 under HRRP. This financial loss created a tangible incentive to reduce readmissions after THA and TKA (Clement et al., 2017).

Likewise, Hoffman & Yakusheva (2020) performed a retrospective cohort analysis of the readmission data of 2,823 hospitals between fiscal years 2016 and 2019 and measured the hospitals' performance in readmission reduction to prevent readmission penalties after the implementation of the HRRP. In this group, the excessive readmission ratio for THA and TKA was nearly 1.15 in 2016 but decreased to 1.0 and 1.05 in 2019. The researchers concluded that implementing the HRRP resulted in a more significant avoidance of readmissions (Hoffman & Yakusheva, 2020).

One recent study demonstrated the impact of HRRP on readmission rates of patients who underwent THA or TKA by examining Medicare payment data from nearly 2.5 million patients from 2008 through 2016 (Chhabra et al., 2019). Results from this study showed that readmission rates for THA decreased from 8.2% to 5.9%, and the readmission rates for TKA decreased from 7.3% to 5.3% over the 8-year study. Furthermore, the researchers found that readmission rates decreased at a higher rate after the announcement of the HRRP in 2010, suggesting that hospitals began reducing readmission rates in anticipation of readmission penalties (Chhabra et al., 2019).

Similarly, another large-scale study of Medicare and Medicaid populations examined the Healthcare Cost and Utilization Project (HCUP) state inpatient admission data for Florida, Massachusetts, and California (Zwadzki

et al., 2017). This data was then compared to CMS readmission data, and the results demonstrated that prior to the implementation of HRRP, between 33% and 35% of readmissions after THA or TKA were due to infections. The researchers purported that if the occurrence of surgical site infections could be reduced, then readmissions would be reduced as well, thereby lowering the cost burden on the hospitals and the payers, given that each surgical infection resulted in a net cost of \$12,000 to \$60,000 (Zawadzki et al., 2017).

Nevertheless, another study examined hospital readmission data of patients who underwent TKA or THA between January 1 and August 30, 2013, utilizing data from HCUP to determine the primary factors associated with readmission within 30 days (Kurtz et al., 2017). This study found that after the announcement of the HRRP, the readmission rate was 4% for THA, and 3% for TKA, with the most common reason for readmission within 30 days had been from infection. From this data, the researchers concluded that readmissions to the hospital after total joint arthroplasty were costly, and the length of stay had been the main cost driver for readmissions (Kurtz et al., 2017).

Concerning hospital volume, the effect of HRRP readmission penalties was analyzed by Li et al. (2019) in a retrospective study of 2,991 patients who underwent THA or TKA in 143 Florida hospitals from February 2016 until January 2017. The study reported that 76 143 hospitals had an excessive readmission ratio more significant than the HRRP benchmark of 1.0 and received readmission penalties. Furthermore, this research concluded that HRRP implementation decreased readmissions of Medicare patients who had undergone THA and TKA (Li et al., 2019).

Luzzi et al. studied the occurrence, cause, and cost of postoperative complications after a THA or TKA (2018). The authors included 3,018 THA and 5,389 TKA patients assigned a nurse navigator in the perioperative period between January 2015 and April 2016 at a single hospital. After comparing the data to prior collected data from 2004–2008, Luzzi et al. determined that, after the introduction of the HRRP, readmission rates declined from 3.98% to 3.31%, and surgical wound infections declined from 1.99% to 0.87%. Although the researchers determined that patients who completed TKA were more likely to be readmitted with complications than THA patients, both readmission and complication rates declined (Luzzi et al., 2018).

HRRP-Continuation of an Existing Trend?

Despite the majority of the available research supporting a correlation between the introduction of HRRP and the reduction in hospital readmission rates, some researchers maintain that HRRP is merely the continuation of a preexisting trend in reducing readmissions. For instance, Thirukumaran et al. examined the impact of HRRP penalties on readmission rates and complication rates for patients who had undergone total joint replacements from June 2009 until June 2016 at 2,326 hospitals (2020). Before the HRRP inclusion, the mean readmission rate had been 5.38%, and the mean complication rate had been 3.48%. However, the readmission rate declined by 18.41%, and the complication rate declined by 18.88% after implementing the HRRP. Similarly, the rate of complications declined at a similar rate to the decline in readmissions. The researchers concluded that readmission and complication rates had been declining at a similar rate prior to the introduction of the HRRP (Thirukumaran et al., 2020).

Likewise, a retrospective cohort study designed to determine the relationship between hospital readmission rates between total joint arthroplasties after the introduction of the HRRP, and spinal surgeries, which are not included in HRRP, was conducted in 2019 (Ramaswamy et al., 2019). This study examined over 6.6 million cases and found that THA and TKA, under the HRRP, had a decrease in readmissions from 4.8% in 2010 to 4.1% in 2015. In contrast, the non-targeted spinal surgeries had decreased readmission rates from 7.4% in 2010 to 7.3% in 2015. Both types of surgeries did show a decrease in readmission post-HRRP implementation, despite only the THA and TKA surgeries being targeted. Although readmission rates for THA and TKA were more significant than those seen in spinal surgeries, rates for THA and TKA decreased at similar rates prior to introducing readmission penalties (Ramaswamy et al., 2019).

DISCUSSION

Rising healthcare costs in the United States have been an issue for decades, with CMS gripping tighter control over the industry to control costs and increase value. By ensuring that hospitals fix the patient's ailment without creating new issues, costs can be decreased, and the quality of care is increased. In the clinical setting, HRRP is intended to decrease hospital readmission, improve patient outcomes and reduce costs.

Costs associated with TKA and THA are projected to skyrocket over the coming years, primarily due to the aging population. Given the volume of surgeries and the relatively high rates of readmission associated with these procedures, their inclusion within HRRPs targeted procedures was a logical expansion of the program. Surgical site infections are the clear leading cause of readmission for TKA and THA patients, and thus the primary complication hospitals address when attempting to reduce readmission rates. To this end, hospitals have developed a variety of interventions, from clinical best practices to wrap-around services, to decrease complications such as postoperative infection and improve the quality of care. As a direct result of improvements in patient care and surgical innovations, hospitals have seen a continual decline in readmission and complication rates.

Although research clearly shows a decline in readmission rates, there remains no definitive causal relationship between HRRP and readmission rate decline for TKA and THA. Some research suggests that the rate of decline is following the same trajectory as it was prior to the implementation of HRRP and is similar to the rate of readmission decline for other procedures not included in HRRP. The question remains, is the readmission decline a result of HRRP implementation?

However, the argument may also be made that HRRP, given its staggered release, may have motivated health systems to develop interventions that positively impacted the readmission rate before its release. Furthermore, regarding the rate of readmission mirroring the rate of those services not included in HRRP, no research has determined if those services are utilizing interventions developed for TKA and THA and thus reaping the benefits of those gains and positively impacting the readmission rates of those procedures.

CONCLUSION

In conclusion, after the introduction of HRRP, hospitals have decreased readmission rates for patients undergoing THA or TKA. This reduction is associated with reduced postoperative complications, primarily with reduced surgical site infection. Despite the perceived benefits and cost savings of HRRP, research remains to be made clear on the causation of the readmission rates, given that the rates were dropping at a similar rate prior to the implementation of HRRP.

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