Novel methodology using publicly reported data to study percutaneous coronary stent utilization in the United States: Linking centres for medicare medicaid services provider analysis and review inpatient data with hospital and community characteristics

Tushar A Tuliani, Maithili Shenoy, Milind Parikh, Kenneth Jutzy and Anthony Hilliard*

Loma Linda University Medical Center, 11234 Anderson Street, Suite 2426, Loma Linda, CA 92354, USA

Abstract

Background: The Provider Utilization and Payment Data Inpatient Public Use File, released by the Centres for Medicare and Medicaid Services (CMS), contains hospital-specific charges for hospitals that receive Medicare payments based on a rate per discharge using the Medicare Severity Diagnosis Related Group (MS-DRG).

Methods: Linking data from Financial Years 2011 and 2012 CMS Provider Utilization and Payment Data Inpatient Public Use File with socio-demographic and hospital characteristics from Medicare Hospital Referral Region Report, American Hospital Association, and American Community Survey we abstracted data on Drug Eluting and Bare Metal Stent discharges using MS-DRG codes. There were 168,023 and 153,979 discharges from 1,436 and 1,478 hospitals for FY 2011 and 2012 respectively.

Conclusion: Our study demonstrates the utilization of publically available databases to study nationwide trends in coronary stent usage in a large cohort with uniform insurance.

Introduction

Heart disease is the third most common (31%) chronic condition amongst Medicare beneficiaries following hypertension and high cholesterol [1]. Despite a 19.2% decrease in the admission rate for acute myocardial infarction from 1998 to 2008 overall expenditures per patient for CMS increased by 16.5% [2]. Medicare is the federal health insurance program in the United States that is managed by the Centres for Medicare and Medicaid Services (CMS) for people of age 65 years or older, younger people with disabilities and people with end-stage renal disease.

In an effort to make the healthcare system more transparent, affordable, and accountable, the Centres for Medicare & Medicaid Services (CMS) has prepared a public data set, the Provider Utilization and Payment Data Inpatient Public Use File (PUF). In this manuscript, we demonstrate how linking this publicly available dataset with other publicly available data from the American Hospital Association, Medicare Hospital Referral Report, and American Community Survey facilitates our understanding of practice patterns of percutaneous coronary intervention (PCI) across the United States in admitted patients and provides the foundation to other such DRG-based descriptive and outcome-based analyses.

Methods

Study cohort

Centres for Medicare and Medicaid Services released information regarding more than 3,000 U.S. hospitals that receive Medicare IPPS payments for the top 100 most frequently billed discharges, based on a rate per discharge using the MS-DRG for Fiscal Year (FY) 2011 (October1, 2010 to September 30, 2011) and 2012. We abstracted data regarding discharges with MS-DRG codes: 246 (percutaneous cardiovascular procedure with DES with MCC or 4+ vessels/ stents), 247 (percutaneous cardiovascular procedure with DES without MCC) and 249 (percutaneous cardiovascular procedure with non-DES without MCC). MS-DRG 248 (percutaneous cardiovascular procedure with non-DES with MCC) was not one of the 100 most frequently billed MS-DRG's for FY 2011, and thus was not available for this analysis.

Data-points of interest included MS-DRG code, provider identification number, provider name, provider street address, city, state and zip code, hospital referral region (HRR) description, and total discharges. In addition, data regarding average covered charges

(provider's average charge for services covered by Medicare for all discharges in the DRG), average total payments (average total payments to all providers for the MS-DRG including the MS-DRG amount, teaching, disproportionate share, capital, and outlier payments for all cases including co-payment and deductible amounts that the patient is responsible for and any additional payments by third parties for coordination of benefits) and average Medicare payments (average amount Medicare pays to the provider for Medicare's share of the MS-DRG which include the MS-DRG amount, teaching, disproportionate share, capital, and outlier payments for all cases but exclude beneficiary co-payments and deductible amounts and any additional payments from third parties for coordination of benefits) were also released.

To complete this analysis, the PUF was subsequently linked with data from the American Hospital Association, Medicare Hospital Referral Report, and American Community Survey.

Hospital characteristics

Hospital characteristics of each hospital listed in the PUF were obtained from the American Hospital Association. We extracted data about hospital bed-size, ownership status (government non-federal city, government non-federal county, government non-federal district, government non-federal state, non-government not-for-profit, non-government not-for-profit church-operated, non-government not-for-profit other, investor-owned for-profit partnership, investor-owned for-profit individual, investor-owned for-profit corporation), teaching status (major teaching/ minor teaching/ nonteaching), location (urban/ rural; state; census region :north-east, mid-west, south, west) (*http:// www.ahadataviewer.com/quickreport/).*

Demographic characteristics

The Provider Utilization and Payment Data Inpatient Public Use File (PUF) data lacked patient level characteristics. In order to ascertain the racial composition of the PUF data we abstracted data from 2011 Medicare HRR Report for each HRR (https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Geographic-Variation/GV_PUF.html).

HRRs were classified as African American, Hispanic and Caucasian using 90th percentile cutoff for the Medicare population.

Income and area deprivation index

Using provider ZIP code from CMS data 5-year inflation-adjusted estimates of median family income was obtained from American Community Survey 2011 (http://www.census.gov/acs/). In addition, Singh's Area Deprivation Index (ADI) was incorporated using individual hospital zip code [3]. The ADI consists of 21 socioeconomic indicators that are viewed to approximate the material and social conditions and relative socioeconomic disadvantage in a given community [3]. Some of the factors used to compile the ADI include educational distribution, median family income, occupational composition, unemployment rate, etc. [3]. As ADI, has demonstrated previously differences in mortality rates between different areas, it was chosen for this study to help delineate the use between bare metal and drug-eluting stents.

Discussion

Socioeconomic and racial status and type of insurance has consistently been a predictor in the rendering of medical care [4-6]. The Provider Utilization and Payment Data Inpatient Public Use File database can be utilized to study disparities in care of patients with

uniform insurance across the United States. Linkage of PUF data with hospital and socio-demographic characteristics can give unique insights into trends in utilization of medical services across the United States at geographic, hospital and HRR level. Prior research has demonstrated disparities in healthcare delivery based on race, sex, socioeconomic status, and geographic location [7]. Additionally, the 2013 Centers for Disease Control Health Disparities and Inequalities Report notes that minorities continue to be of lower socioeconomic status, resulting in greater barriers to health care access and increased burden of disease [7]. Specifically, Brijinki, *et al.* [5] showed that minorities were less likely to receive carotid revascularization when asymptomatic and Kao *et al.* [4] demonstrated lower DES usage in patients with government insurance and the uninsured population.

Importantly, in addition to the study of utilization of coronary stents PUF data can be used to study readmission trends across individual hospitals, HRRs and geographic regions. Community characteristics and deprivation indices can be used as a marker of hospital readmissions. Studies demonstrate that being socially disadvantaged may lead to worse outcomes [3,8]. Analysis of hospitals with higher readmission rates can be undertaken to identify contribution of community characteristics in readmissions. Hospital characteristics in deprived areas prone to readmissions can be delineated. This can guide spending of healthcare dollars in strengthening post-discharge ancillary services in vulnerable areas. The Provider Utilization and Payment Data Inpatient Public Use File data can be utilized to conduct cost effectiveness analyses to compare related MS-DRGs. Trends in CMS spending across related MS-DRGs can be computed across HRRs, teaching versus non-teaching hospitals, urban versus rural hospitals and based on hospital bedsize/discharge volume. This can help identify wasteful medical spending and streamline healthcare costs. Utilizing PUF data helps accomplish the above without risking patient privacy.

Large nationwide databases help in healthcare quality and efficiency, fraud detection, identification and measurement of quality metrics and streamline treatment protocols for chronic conditions [9]. Large-scale de-identified healthcare data like PUF is easily accessible to the researchers and eliminates the need for individual consent. This data can potentially be used to fund quality improvement initiatives, identify and strengthen vulnerable patient populations and geographic regions and help policy maker's direct healthcare dollars towards the same.

Data limitations

The PUF data is limited to the acute inpatient setting. Findings from the dataset will share challenges of administrative claims data and thus be limited by the clinical detail and oversight accountability. Median income and racial composition were community characteristics, not necessarily representing the individual patient's income/race. Additionally, the Medicare claims data are solely derived from fee-for-service patients older than 65 years; thus, our results may not apply to younger patients, or to patients covered by other types of insurance. Information on secondary insurance coverage in addition to Medicare was not available. Lastly, federal institutions are not included in this dataset.

Conclusion

The proposed methodology described above was used to determine factors involved in the usage of drug-eluting and bare-metal stents. However, data from PUF can be used to study geographic trends in utilization of other MS-DRG services. Although there is no patient

specific data involved, linking the PUF data from CMS with socio-demographic and hospital characteristics from reliable sources, resulted in creation of a nationwide database of a large cohort with uniform insurance and can be used to study trends in utilization of other services as well.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors have contributed to the analysis design and oversight, manuscript conception and drafting, statistical analysis, and/or editorial review of the manuscript, and they have all read and approved the final manuscript.

References

1. Chronic Conditions Among Medicare Beneficiaries: 2012 Edition. http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/Downloads/ 2012Chartbook.pdf.

2. Likosky DS, Zhou W, Malenka DJ, Borden WB, Nallamothu BK, et al. (2013) Growth in medicare expenditures for patients with acute myocardial infarction: a comparison of 1998 through 1999 and 2008. *JAMA Intern Med* 173: 2055-2061. [Crossref]

3. Singh GK (2003) Area deprivation and widening inequalities in US mortality, 1969-1998. *Am J Public Health* 93: 1137-1143. [Crossref]

4. Kao J, Vicuna R, House JA, Rumsfeld JS, Ting HH, et al. (2008) Disparity in drug-eluting stent utilization by insurance type. *Am Heart J* 156: 1133-1140. [Crossref]

5. Brinjikji W, EI-Sayed AM, Kallmes DF, Lanzino G, Cloft HJ (2015) Racial and insurance based disparities in the treatment of carotid artery stenosis: a study of the Nationwide Inpatient Sample. *J Neurointerv Surg* 7: 695-702. [Crossref]

6. Zhang JX, Huang ES, Drum ML, Kirchhoff AC, Schlichting JA, et al. (2009) Insurance status and quality of diabetes care in community health centers. *Am J Public Health* 99: 742-747. [Crossref]

7. Frieden TR; Centers for Disease Control and Prevention (CDC) (2013) CDC Health Disparities and Inequalities Report - United States, 2013. Foreword. *MMWR Suppl* 62: 1-2. [Crossref]

8. Kind AJ, Jencks S, Brock J, Yu M, Bartels C, et al. (2014) Neighborhood socioeconomic disadvantage and 30-day rehospitalization: a retrospective cohort study. *Ann Intern Med* 2014;161 (11):765-774. [Crossref]

9. Klompas M, Eggleston E, McVetta J, Lazarus R, Li L, et al. (2013) Automated detection and classification of type 1 versus type 2 diabetes using electronic health record data. *Diabetes Care* 36: 914-921. [Crossref]