Abstract (not to exceed 150 words):

The charges set by hospitals for inpatient procedures lack rigorous methodology and are poorly understood by the public.

**Introduction**

For the uninsured and the underinsured in the United States, the choice to seek medical care in a critical health emergency is often one between their life, and debt. [[1]](#endnote-1) Out of the 3 trillion dollars spent on health care in the United States in 2015, 338.1 billion were paid out of pocket[[2]](#endnote-2), and medical bills have been implicated as a major cause of bankruptcy.[[3]](#endnote-3) Those with medical diagnoses such as cancer have been found to be at a higher risk for bankruptcy compared to their healthy peers.[[4]](#endnote-4) Despite the magnitude of health care spending, and the universal need for health care, hospital pricing structures are opaque, and the way charges are constructed often remains a mystery to patients and their families. The pricing structures generated by hospitals have been described as “chaos behind a veil of secrecy”, in which hospitals determine charges without a rigorous methodology. [[5]](#endnote-5)

From the moment a patient first arrives at a hospital, the facility tracks the services rendered, equipment used, and drugs administered to treat or diagnose a patient’s conditions. A hospital’s master charge list, or ‘chargemaster list’, describes the full menu of tens of thousands of procedures and goods available at a given facility, along with a price for that treatment or item. The prices for the care and commodities used are added up to generate the total bill for the services rendered. However, even when presented with a bill containing the full details of the items included from the chargemaster list, the naming conventions and significance of different line items may be difficult or impossible for consumers to understand. Filled with acronyms, abbreviations, and medical jargon, the list of “services rendered” by the hospital may be unrecognizable to the patient. Different hospitals distribute revenue or profit margin on items used for the same procedure differently, which makes comparisons of the “list price” of individual goods (for example, the cost of a syringe) less meaningful.

Furthermore, most patients and insurance providers receive discounts that are a fraction of the supposed ‘cost’ of treatment. Mediated by insurance and co-pays, the ‘chargemaster’ price of a hospital stay often does not reflect the amount paid by the patient. Insurance companies and hospitals use the chargemaster list as a starting point, but negotiate rates far below the full ‘list price’. For the uninsured, however, the chargemaster price is a more accurate reflection of the bill- although some hospitals offer discounts for those paying out of pocket, those unaware or ineligible for such programs may be facing substantial debt as a result of their care. Although the number of uninsured has declined in recent years, nearly one in ten people still do not have health insurance in the United States. [[6]](#endnote-6)

When permanent residents and citizens of the United States turn 65, they become eligible for the largest insurance program in the country—Medicare. Run by the United States government and serving 57 million persons,[[7]](#endnote-7) Medicare follows an alternate process to determine how much hospitals are paid for services rendered to patients. The Inpatient Prospective Payment System (IPPS) is the foundation for how Medicare determines payments to for inpatient stays, which are covered under Medicare part A. The base price for Medicare Severity Diagnosis Related Group (MS-DRG) is supplemented to account for the area’s cost of living (requiring higher staff costs), whether the hospital has a medical education program, and is utilized by a disproportionate share of low-income and uninsured patients from the surrounding community. For unusually complex or resource-intensive cases, additional payment is disbursed to the hospital though the use of ‘outlier payments’. Through these adjustments, the Inpatient Prospective Payment System seeks to pay hospitals a fair price that will compensate for both the procedure, and the associated overhead of treating the patient.

In May of 2013, the Center for Medicare and Medicaid Services (CMS) began to publish the Provider Utilization and Payment Data Inpatient Public Use File (Inpatient PUF). An unprecedented data release, the Inpatient PUF contains hospital-specific information on how much hospitals were compensated through Medicare’s payment system (payments) compared to the amount billed to Medicare based on chargemaster list pricing (charges) for any disease reporting group with over 10 discharges. This data set presents an opportunity to compare chargemaster pricing structures to the relatively fixed prices set by Medicare at a granular level, by disease reporting group, at each facility between the years of 2011-2014.

Past research utilizing this data source focused on associations between the average charges (the chargemaster list pricing for services) at each hospital without using Medicare payments as a frame of reference.[[8]](#endnote-8) Incorporating information on health outcomes, health behaviors, access to and quality of outpatient care, the physical environment, and socioeconomic factors, researchers Park et al. found that only the percent of children in poverty, and the percentage of the population that is uninsured had statistically significant effects on hospital charges. They concluded that “hospital charges lacked a relationship with population health indicators”. [[9]](#endnote-9) This research examined hospital charges at the facility level as the outcome variable, requiring the authors to generate a standardized metric for each facility that was not dependent on the types of patients seen at each facility. To achieve this, the authors generated “condition-aggregated” charges for each facility, calculating average charges across six conditions.

Using a “markup measure” such that hospital prices are measured in units of Medicare payments or allowable costs has been used to investigate hospital pricing structures in past research. [[10]](#endnote-10),[[11]](#endnote-11) Unlike examining charges directly, or generating condition-aggregated charges, using a markup measure allows the relative cost of each facility to be compared across disease reporting groups, since both the charges and payment measurements are derived from the same patients.

This opens up new questions How much does price markup vary by medical condition? Is the amounts that hospitals charge related to the ability of the communities served by each facility to pay for the services rendered? To what extent does spatial variation in hospital charges still persist, even after controlling for socioeconomic factors that may drive market prices such as income, poverty, and underinsurance?

Variation in medicare payments[[12]](#endnote-12) Not the right citation here, this is about .[[13]](#endnote-13) Past work has found that Medicare Payments, the charge-to-cost ratio, and… varies spatially.

why, then, do chargemaster prices associated with medical treatment, and vary widely based on geographic location?

What spatial patterns are associated with hospital markups?

To what extent are hospitals near one another similar in pricing?

Are hospital markups associated with socioeconomic and demographic properties of the community they serve? If so, what factors in a community are associated with higher or lower markup, and

Previous work has shown that charges for the same procedures are highly inequitable Inequitable

Regional variation in hospital pricing structures

Inpatient hospital stays are rarely of the patients choosing, and may involve ambulance transport to a facility not specified by the patient.

Previous investigations into hospital pricing structure sand markups have resulted in …..

For any disease reporting group in 2014,

In an unprecedented data release in , the Centers for Medicare and Medicaid Services published the average total payment (Medicare’s payment to the hospital, as well as any co-pay or deductibles, or third-party insurance contributions), and the average total charges (the sum of the chargemaster items for that hospital stay) by disease reporting group (DRG) for all

The literal cost of being uninsured is widely varying across the United States.

Treating and diagnosing a human body is remarkably dissimilar from other transactions. Unlike taking a car in for a repair, calling different facilities for a quote for diagnosis and treatment is unheard of.

Prior research on hospital charge variability using this data set is sparse. One analysis, by Park, Kim, and Werner,

**Study Methods**

**Data**

Records of the average total Medicare payments, and the total charges (chargemaster list price) for each disease reporting group (DRG) with over 10 discharges at each hospital registered with Medicare were obtained from the Centers for Medicare and Medicaid Services.[[14]](#endnote-14) The data set is based on information from the Medicare Provider Analysis and Review (MEDPAR) data. Only the top 100 DRGs by number of discharges were included in the data set in 2011-2013, while all DRGs with adequate discharges were included in 2014. The latitude and longitude, county and census tract associated with each facility was determined by geolocating each hospital using the Google Maps API to generate coordinate positions based on the facility address[[15]](#endnote-15). 29 facilities that did not contain adequate location information to generate coordinates were excluded from the study, resulting in a total of 3416 facilities in the final data set, and 670,707 observations. There were facilities located in 1527 out of 3,141 counties or county equivalents within the United States. The data set represents charges and payments for 27,185,017 inpatient discharges from October 1st, 2011 through September 30th, 2014.

<< Section here on census data/etc>>>

Markup for each DRG in each facility-year were calculated by dividing the average total charges by the average total payments.

A variety of different socioeconomic variables were extracted at the county level

Markup was calculated by dividing the total average charges by the total Medicare payments for each disease reporting group in each facility-year.

Covariate data at the county level on population density, education, ….. for each county were derived from the American Community Survey. [[16]](#endnote-16) Information on mortality rates were

**Methods**

Summary statistics . Analysis was conducted in R version 3.3.2[[17]](#endnote-17), using the

Regressions were

A regression analysis with

ssss

Can these pricing discrepancies be explained by the socioeconomic characteristics of the communities in which hospitals operate?

Were obtained

Information on wealth of surrounding community

Mortality rate data per 100,000 population…

Census-tract level stuff to look at local neighborhood

County-level stuff

Ratio of local and county (rich for the surrounding area?)

**Results**

Chargemaster markup in relation to Medicare payment ranged from XX to XX, and was XX on average within the United States as a whole.

According to a recent poll in 2015, close to half (46%) of the uninsured in the United States were uninsured due to the high costs of health insurance.

Over half(XX%?) of the facilities in the upper quartile were within states X, Y, and Z.

On average, the markup ranged from within inpatient hospital stays within the United Statesranged from XX to XX in the

Rather than dealing with theoretical costs, this data set has the advantage of comparing at a patient/discharge aggregated level—what hositals ACTUALLY WANTED for those services.

**Study limitations**

The sample of hospitals within the study was limited to only facilities with over 11 discharges for a given disease reporting group, which may have censored the data to exclude hospitals with smaller patient populations, such as rural areas. The disease reporting groups captured within the dataset may not represent the conditions and injuries faced by more youthful populations.

The data used for this analysis are from a relatively short time period (2011-2014), in which many significant changes in health care policy.

The release of the data in XX year may have changed the way in which hospitals price their goods.

X covariates were used to predict hospital markup,

The data set provided (XXX) provides a

Chargemaster prices have been shown to drive hospital profits.

by a base price

**Discussion**

High chargemaster pricings may incentivize insurance companies to include hospitals within their insurance networks in order to avoid the high costs incurred by patients receiving medical care at an un-discounted facility, and add value to their insurance plan. [[18]](#endnote-18) Increases in chargemaster price have been recognized as a mechanism for increased hospital revenue. [[19]](#endnote-19)

It is fundamentally inequitable that the potential financial penalty for medical treatment while uninsured is so spatially variable within the United States. This work does not seek explain the drivers of cost, but rather suggests that ….. … should be investigated further.

Unlike other services governed by consumer choice and a free market, patients rarely have the ability to make informed choices about where they receive medical care—even if information on pricing structures were readily available, a life-threatening emergency is not a convenient time for price shopping.

A more parsimonious model

Given that the uninsured are often without health coverage due to the financial cost of insurance itself

If Medicare is paying providing reasonable amount for inpatient hospital services, it would stand to reason that prices for the uninsured, who are often financially vulnerable, potentially without would be similar to the amount paid by Medicaid.

<http://kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/>

Evidence of market power[[20]](#endnote-20)

A complex mosaic of factors

Hospitals use chargemaster markups to drive revenue.

A variety of policies and events that may impact the pricing structure of hospitals (both in terms of Medicare payments and charges) occurred preceding and during the time period of this analysis, which may impact the generalizability of these results. The release of the Inpatient Public Use Data File by the Centers for Medicare Services could have had an impact on hospital pricing, as facilities could easily compare themselves to their peers. A variety of changes to insurance requirements resulted from the Affordable Care Act (ACA), which passed in 2010. In addition, ACA enacted some changes in how Medicare reimbursed hospitals for care based on metrics of performance. Starting in fiscal year 2014, hospitals in the worst quartile in terms of hospital-acquired conditions were penalized by 1 percent as an incentive to reduce hospital-acquired cases of diseases such as MRSA, or clostridium difficile.[[21]](#endnote-21) In addition, for discharges beginning in October of 2012, hospitals with excess readmissions also had their payments reduced up to 3 percent. [[22]](#endnote-22) Given that hospital charges differ from Medicare payments in the order of hundreds of percents, these effects are likely to be minor.

Magnified amplified expanded

Medicare is a special case of this phenomenon--

Rising healthcare costs[[23]](#endnote-23)

As the largest insurance provider in the United States, Medicare services over

Not all doctors will take new

Higher costs of care would be understandable if paying more equated to better treatment. However, research linking the costs of care and patient success rates have shown the opposite relationship, such that less expensive facilities often offer better outcomes. [[24]](#endnote-24)

The reasons behind why some hospitals charge more than others are purely academic for the millions of Americans faced with high medical bills.

Health care bills and their contribution to financial insolvency

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    Note: Paper will need to be converted into 12 pt Courier New font with double-spacing and a minimum of 1-inch margins. This applies to all main text, abstract, and notes.

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