Can Improved Health Literacy
Prevent Unnecessary
Hospitalizations?

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The Association between Health Literacy and Preventable Hospitalizations in Missouri: Implications in an Era of Reform

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Objective: To evaluate the association between health literacy and preventable hospitalizations on a population level in Missouri, and the extent to which differing levels of health literacy are associated with county preventable hospitalization rates and associated charges.

Data Sources/Study Setting: Secondary data from the 2008 Missouri Information for Community Assessment and Missouri Health Literacy Mapping Tool was used to determine health literacy and preventable hospitalization rates for the 114 counties and city of St. Louis comprising Missouri.

Study Design: Using correlation analysis, simple hierarchical regression models and nonparametric analysis, we investigated whether lower health literacy rates were associated with increased levels of preventable hospitalizations and charges, by county.

Principal Findings: Health literacy was found to be inversely associated with preventable hospitalization rates on a population level, accounting for 21 percent of the variation in preventable hospitalization rates. Preventable hospitalization rates significantly differed for counties with the highest and lowest health literacy levels.

Conclusions: Lower levels of health literacy are significantly associated with increased rates of preventable hospitalizations and charges in a population-level analysis of Missouri counties. Additional research is needed to quantify the effects of successful community health literacy interventions.

Key words: *health literacy, preventable hospitalization, access to care, health care costs, health outcomes*

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Introduction

With the implementation of health care reform, it has become more important to understand not only how much is being spent on health care, but also where those funds are spent. The Medicaid budget increase that is set to roll out in 2013 under the Patient Protection and Affordable Care Act of 2010 elevates the need to try. The health care reform legislation has received criticism for attempting to provide universal health care coverage by relying heavily on state Medicaid programs.[1] Medicaid spending historically has varied by region, with states differing in the amount spent on both the volume of services, as well as the price of those services.[2] In this new era of health care reform, the distribution of monetary resources to support various health care programs will likely become integral to an individual state's ability to provide adequate universal coverage.

From 2001 to 2005, Missouri's state budget was slashed by $2.4 billion dollars. These cuts significantly impacted Missouri Medicaid by implementing additional restrictions on Medicaid enrollee eligibility and spending, resulting in a 10.8 percent increase in the number of uninsured.[3] Despite the new enrollee eligibility restrictions, the continuing economic recession has resulted in increases in Medicaid enrollee numbers and thus, ongoing budget constraints related to increasing Medicaid costs in recent years.[4] Although Missouri Medicaid spending has noticeably increased from 2006 through 2010, the proportion of the state-funded Medicaid budget in 2006 through 2008 (approximately 37-38 percent) decreased to only 28 percent of the total budget in 2009,[5] a change that has been sustained through 2011.[6]

When Medicaid eligibility is expanded in January 2014, the eligible income limit for nonelderly and nondisabled citizens will be raised from 18 percent to 133 percent of the federal poverty level, resulting in a drastic increase in the number of individuals covered by Medicaid.[7] In addition, Missouri will also be required to provide coverage for childless adults.[8] This influx of patients, despite increased federal funds during the first years of implementation, will result in additional financial strain on a system already strapped for cash.

In an effort to reduce health care costs and save money, research in 2009 has considered the cost savings afforded by investing in public health. One investment model posits that investing $10 per person per year into proven community-based disease prevention programs would result in a substantial return on investment. For Missouri, a $10 per payer investment was estimated to result in state Medicaid savings of more than $2 million within one to two years and more than $12 million in five years.[9] Missouri has ranked 43rd in the nation for federal public health funding since 2009, in 2011 receiving just over $100 billion, or $17.12 per capita, which is more than $3 under the national average. In addition, Missouri's state public health budget for FY 2010-2011 was just above $35 million or $5.90 per capita, ranking 50th in the nation for the third year running.[10] Given the fiscal challenges Missouri is facing in a time of economic recession and budget constraints, policymakers are presented with the challenge of considering how to most appropriately allocate funds to enact the most effective changes in health care utilization, cost, and quality.

Among the major objectives of health care reform legislation—for example, the

Patient Protection and Affordable Care Act and the Health Education and Reconciliation Act, enacted in March 2010—are several provisions that address health care costs, quality, and access, with the ultimate goal of improving health outcomes and health status among the US population. Many of these provisions reflect a patient-centered, consumer-driven approach to health, and place essential health care decision-making and management responsibilities in the hands of patients. However, informed health care decision-making and management necessitates adequate levels of functional health literacy. Research has indicated that patients with inadequate levels of functional health literacy are consistently more likely to report poor health status when compared to patients with adequate levels of health literacy.[11] Moreover, research has well established the association of low health literacy with higher costs, as well as poorer health outcomes and quality—two major issues addressed by health care reform. Accordingly, improving health literacy may play an important role in the success of some of health care reform's major objectives by lowering health care costs, advancing high quality coverage, and ultimately improving health outcomes in society. Health literacy's association with the other main issue of reform, access to care, is less understood.

The National Assessment of Adult Literacy (NAAL), a commonly used measurement of health literacy, defines health literacy as the ability to use health-related *"printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential."*[12] Health literacy refers to the degree to which people have the ability to obtain, process, and understand health information and services in order to make appropriate and informed health decisions.[13] Health literacy impacts an individual's capacity to identify health-related information, to recognize the importance of prevention and screening, and to comprehend health information and services commonly available in everyday society to facilitate the incorporation of healthy behaviors into patients' lifestyles and manage health conditions and chronic diseases. According to the 2003 NAAL, 36 percent of adults had "*Basic*" or "*Below Basic*" health literacy, and between 57 percent and 60 percent of adults covered by Medicare or Medicaid had "*Basic*" or "*Below Basic*" health literacy, respectively.[14] This pervasiveness of low health literacy portends a significant public health problem, which may have serious societal implications—especially in light of the recently passed health care reform legislation.

This study considers the importance of understanding health literacy to include not only individual-level education, but also population- or community-level involvement. This concept of community or public health literacy considers not only consumer understanding of health literature to improve utilization of health care services when needed, but also the "*social, political, environmental, and economic forces*" that influence prevention.[15] In the 2010 *Action Plan to Improve Health Literacy*, the US Department of Health & Human Services notes the importance of eliminating barriers to health literacy using various channels of communication among individuals, families, and communities, and the necessity of spanning socioeconomic barriers and communication mediums across populations to address deficits in health literacy in the United States.[16] This study addresses consumer access to

care by using preventable hospitalizations as a representative indicator.

On a basic level, preventable hospitalizations are defined as inpatient treatment of certain conditions, that is, Ambulatory Care Sensitive Conditions (ACSC) for which "*timely and effective*" use of primary care (outpatient care) should have reduced the likelihood of hospital admission.[17] ACSCs, as a type of preventive quality indicator, function best as a general measure of health care quality from a community, or population level.[18] Because these hospitalizations could have potentially been avoided with effective prevention, diagnosis, treatment, or management of a disease or condition on an outpatient basis or with effective primary care, the number of preventable hospitalizations is a commonly used measure of access to this care.[19] Although hospitalization for preventable conditions also serves as an indicator of poor quality of care and increased treatment costs, quality and cost of treatment for preventable hospitalizations become issues that arise only after health care has been accessed. Accordingly, preventable hospitalizations fundamentally function as an indicator of access.

Previous studies have reported conflicting findings regarding whether access to care is detrimentally influenced by inadequate health literacy.[20] Some studies have indicated that patients with low health literacy have been averted from accessing health care due to intimidation, fear of embarrassment, or problems navigating the system or facility.[21] Other studies have examined the relationship between health literacy and outpatient physician services.[22] Quantitative research studies about health literacy have used various outcome variables, for example, morbidity, mortality, hospital admissions and readmis-

sions, and increased hospital and emergency care access.[23] However, few studies have evaluated the influence that factors outside the direct control of the clinical setting, such as health literacy, may have on preventable hospitalizations, and none, to the authors' knowledge, have done so on an aggregate, population-level analysis. Additionally, systematic reviews have found a dearth of literature concerning health literacy within the context of policy interventions related to health care reform.[24]

In light of the recently passed health care reform legislation, this study highlights the potential importance of a patient's health literacy with regard to a quality health care outcome, that is, preventable hospitalizations. Prior to the passage of recent health care reform legislation, research found that approximately 75 percent of those who had low health literacy were already insured.[25] Without the adequate health literacy necessary to make appropriate health care decisions, simply providing access to health care coverage may be an insufficient step towards achieving health care reform goals. How to achieve necessary health literacy levels remains a concern, and recent research has found a need for future studies regarding the effectiveness of health literacy programs and interventions.[26] Additionally, health care reform invests significant resources in primary care and prevention efforts, but low health literacy might adversely impact the understanding of the importance and benefits of these preventive services, and consequently, the utilization of them. Moreover, the vast prevalence of low health literacy in the United States may result in unintended consequences and an unexpected burden on the health care system, as an estimated 34 million uninsured individuals will be

entering the health care system over the next several years,[27] many of whom will have difficulty making appropriate health care decisions. Accordingly, this study aims to inform policymakers, practitioners, patients, and other stakeholders of the potential importance of health literacy with regard to its association with access to care in this time of reform, which necessitates an informed and engaged patient population to increase accessibility, quality, and safety of health care, and ultimately to improve the quality of life of millions of people.

In addition to the societal implications of low health literacy, as federal and state policymakers face significant budgetary constraints during this time of economic downturn, low health literacy and preventable hospitalizations represent significant burdens to financially strapped health care systems. Among all types of insurance nationwide, Medicaid recipients represent the highest percentage of individuals with inadequate health literacy.[28] Studies have shown that Medicaid recipients with low reading skills have fewer primary care physician visits, poor compliance with prescribed treatment regimens, more hospitalizations, and higher medical costs and health care charges in comparison to people with higher literacy.[29] Additionally, the disproportionally high number of Medicaid beneficiaries with low health literacy has been shown to cost states a significant amount in Medicaid expenditures.[30]

In the state of Missouri, research findings indicate that approximately 1.6 million or 36 percent of the adult population, has inadequate health literacy.[31] The annual cost attributable to low health literacy in Missouri is estimated between $3.3 billion and $7.5 billion.[32] In 2008, the state of Missouri had approximately 78,000 preventable hospitalizations, which cost the state an estimated $3.1 billion, or a charge of nearly $35,000 per preventable hospitalization incident.[33] If increased rates of health literacy can be associated with a reduction in preventable hospitalizations then investment in state efforts to improve health literacy and reduce the prevalence of preventable hospitalizations in Missouri may be an effective means to improving quality of care and patient outcomes, while concurrently lowering health care expenditures.

Research Objectives

In this study, we evaluated the association between population-level health literacy and preventable hospitalizations in Missouri. We hope to provide a better understanding of whether access to health care, represented by preventable hospitalization rates, is negatively related to inadequate levels of community health literacy. Although many studies have examined the association between health literacy, as well as various health outcomes and quality outcome indicators—for example, diabetes, heart disease, and hospital readmissions—few have considered a population-level association between health literacy and access to care. This research seeks to fill that gap by using preventable hospitalizations as an indicator for health care access, considered within the context of changes brought about by health care reform policy. To accomplish these objectives, we attempted to answer the following research questions: (1) is there an association between health literacy scores and preventable hospitalizations on a population level, and (2) what proportion of preventable hospitalizations in the Mis-

souri population are accounted for by below-average health literacy levels?

Methods

This study uses aggregate level data to evaluate the association between health literacy level and preventable hospitalizations on a population level. The study analyzes county-level data for health literacy as a predictor of preventable hospitalizations in the 114 counties of Missouri and the city of St. Louis.

Health literacy was divided into four levels for the purpose of this analysis: *Below Basic* (NAAL scores 0-184), which indicates no more than the most simple and concrete literacy skills; *Basic* (NAAL scores 185-225), indicating skills necessary to perform simple and everyday literacy activities; *Intermediate* (NAAL scores 226-309), indicating skills necessary to perform moderately challenging literacy activities; and *Proficient* (NAAL scores 310-500), indicating skills necessary to perform more complex and challenging literacy activities (see Figure 1. Selected Health Tasks by Health Literacy Score).[34] The main predictor variables in our analysis were mean health literacy scores by county and the percentage

Figure 1. Selected Health Tasks by Health Literacy Score

National Research Council Performance Levels and Corresponding NAAL	Examples of Activities
Proficient (310-500)	• Calculating one's personal share of employer health costs using a table. • Finding definitions for complex medical terms. • Interpreting legal documents and applying the information to specific health care situations.
Intermediate (226-309)	• Determining a healthy weight range for one's height based on a BMI graph. • Finding the age range for certain childhood vaccines using a recommendation chart. • Determining the times at which one can take a medication, based on instructions on the prescription label. • Identifying three substances that may interact negatively with an over-the-counter drug to produce side effects, based on the information provided on the package.
Basic (185-225)	• Interpreting a clearly written pamphlet to determine two reasons a person should be tested for a disease even without symptoms. • Explaining how a chronic disease may be asymptomatic based on a one-page article about the medical condition.
Below Basic (0-184)	• Interpreting a clearly written pamphlet to determine how often one should have a certain medical test. • Identifying what one can and cannot drink before a medical test based on a short set of instructions. • Circling the date of a medical appointment on an appointment slip.

of residents by county with *Basic* or *Below Basic* health literacy scores. The outcome variables in our analysis were preventable hospitalization rates (stratified by age and gender) and charges per preventable hospitalizations. Relevant demographic and socioeconomic characteristics of each county were also included in this analysis, that is, insurance status, poverty level, education, race, age, and gender.

County-specific health literacy data was obtained by using the Missouri Health Literacy Mapping Tool. The tool is an interactive, Web-based, mapping prototype based on data from the NAAL that predicts and estimates levels of health literacy in small geographic areas, such as census tracts and counties.[35] Using the county-level geographic setting, we obtained an estimated mean literacy score per county, as well as the percentage and number of individuals with *Basic* or *Below Basic* health literacy skills.

County-specific preventable hospitalization data for the 22 preventable hospitalization categories utilized in 2008 was obtained from the Missouri Information for Community Assessment (MICA). These rates include acute care hospital discharges of Missouri residents from federal, nonfederal, and nonstate short-term general and specialty hospitals whose facilities are open to the general public.[36] The MICA Web site uses information provided by the Missouri Patient Abstract System, which is compiled from hospital discharge records that are filed with Missouri Department of Health and Senior Services (MDHSS) as required by state law. The rates were age-adjusted using the US 2000 Census standard population, and were reported per 10,000 population. In addition to obtaining the age-adjusted rates,

we also obtained the frequency of each type of preventable hospitalization by county.

Charge data for preventable hospitalizations in 2008 were estimated using the MICA Hospital Discharges, Charges, and Days of Care Database. "*Charges*" are defined by MICA as the unadjusted total amount of billed charges for the hospital stay, but not necessarily reflective of the amount reimbursed or cost of services provided during the stay. This database provides principal diagnosis categories associated with each ACSC from which we created a cross-tabulation table to estimate the charges and the length of stay for preventable hospitalizations for each county. We then converted these raw estimates into rates of preventable hospitalization, per 10,000 population. (See Figure 2. Ambulatory Care Sensitive Conditions and Associated ICD-9 Codes.)

Analyses were conducted using PAWS (formerly SPSS) version 19. Because of the highly positive, skewed nature and unequal variances of the preventable hospitalization rates and charges, all analyses were repeated using a natural log transformation of the data to create an approximation of normal distribution and homogeneity of variance. A correlation analysis using Kendall's Tau and Spearman's Rho was conducted to evaluate simple correlation between predictor variables, potential confounding variables, and the outcome variables of interest. We then conducted hierarchical linear regression models to explore the association between community health literacy and preventable hospitalizations, while incorporating some or all of the following covariates: insurance status, poverty, educational attainment, race, gender, and age.

Finally, we divided the counties into three ranked categories according to average

Figure 2. Ambulatory Care Sensitive Conditions and Associated ICD-9 Codes

Ambulatory Care Sensitive Conditions (ACSC)	ICD-9 Code
Angina	Principal diagnosis of 4111, 4118, 413x and not with any procedure below 87000.
Asthma	Principal diagnosis of 493x.
Bacterial Pneumonia	Principal diagnosis of 481x, 4822, 4823, 4829, 483x, 485x, 486x and any secondary diagnosis that is not 2826 and age is 60 days and above.
Cellulitis	Principal diagnosis of 681x, 682x, 683x, or 686x and not with any procedure below 87000, except when the only procedure performed is one of 86000 through 86099.
Chronic Obstructive Pulmonary	Principal diagnosis of 491x, 492x, 494x, 496x or a principal diagnosis of 4660 with a secondary diagnosis of 491x, 492x, 494x, 496x.
Congenital Syphilis	Principal Diagnosis is V3x (newborn) and any secondary diagnosis of 090x.
Congestive Heart Failure	Principal diagnosis of 428x, 40201, 40211, 40291, 5184 and not with any procedure code of 3601, 3602, 3605, 3610-36199, 375x, 3770-37799.
Convulsions	Principal diagnosis of 7803 and excludes newborns.
Dehydration—Volume Depletion	Principal diagnosis of 2765.
Dental Conditions	Principal diagnosis of 521x, 522x, 523x, 525x, 528x.
Diabetes	Principal diagnosis of 2500-2503, 2508-2509.
Ear, Nose, Throat—Severe Infections	Principal diagnosis of 382x, 462x, 463x, 465x, 4721 and not a procedure of 2001.
Epilepsy	Principal diagnosis of 345x.
Failure to Thrive	Principal diagnosis of 7834 and age is not 1 or above.
Gastroenteritis	Principal diagnosis of 5589.
Hypertension	Principal diagnosis of 401x (but not 4010 or 4019), 40200, 40210, 40290 and not with any procedure code of 3601, 3602, 3605, 3610-36199, 375x, 3770-37799.
Hypoglycemia	Principal diagnosis of 2512.
Immunization Preventable	Principal diagnosis of 033x, 390x, 391x, 037x, 045x or a principal diagnosis of 3200 for ages greater than 0 but less than 6.
Kidney/Urinary Infection	Principal diagnosis of 590x, 5990, 5999.
Nutritional Deficiencies (Includes Iron Deficiency Anemia)	Principal diagnosis of 260x, 261x, 262x, 2680, 2681 or a principal diagnosis of 2801, 2808, 2809 for ages greater than 0 but less than 6.
Pelvic Inflammatory Disease	Principal diagnosis of 614x and sex is female and not with any procedure from 68300 through 68999.
Tuberculosis—Pulmonary	Principal diagnosis of 011x 012x, 013x, 014x, 015x, 016x, 017x, 018x.

county health literacy score ranking (lowest, moderate, and highest) and conducted a Multiple Comparisons: Independent-Samples Kruskall-Wallis Test to analyze differences in the preventable hospitalizations according to health literacy ranks. In all analyses, a two-sided p-value of 0.05 was chosen as the criterion for statistical significance.

Results

The majority of the study population self-identified as White (69.9 percent), with those identifying as Black or Other/Unknown comprising the remaining 26.4 percent and 3.7 percent of the study population, respectively. The mean rate of preventable hospitalizations (calculated per 10,000 population) is greatest within the White subset of the study population (508.4), and within the Black subset of the population the mean is 145.4. Females make up 57.9 percent of the study population and have a slightly higher mean rate of preventable hospitalizations than males (176.5 vs. 141.1, respectively). Of the age groups surveyed, the 45-64 year old age group had the highest average rate of preventable hospitalizations (292.5), more than twice that of the next highest ranked age group (<15 years old, rate of 134.7). Note that the greater-than-65 year old age group was not included in these calculations due to the small group size. It is not surprising that the majority of counties with the highest rate of preventable hospitalizations by race, gender, and age are located in the Bootheel of Missouri—an area known for having a higher rate of poverty and chronic disease burden compared to other areas of Missouri. (See Figure 3. Description of Health Literacy and Preventable Hospitalizations in Missouri Counties.)

Average health literacy scores by county all fell within the Intermediate level based on NAAL scoring, ranging from 231.0 (Pemiscot County) to 259.0 (St. Charles County). St. Louis City and Pemiscot County had the highest percentage of their population with *Basic* or *Below Basic* health literacy at 44.6 percent and 44.7 percent, respectively. Boone County and St. Charles County had the lowest percentage of their population found to have *Basic* or *Below Basic* health literacy, at 23.3 percent and 23.6 percent, respectively. The average number of preventable hospitalizations per 10,000 population for the Missouri population and Medicaid population subset were 158.4 and 49.9, respectively, with Pemiscot County exhibiting the highest rate of preventable hospitalizations for the entire surveyed population (703.9) and for the Medicaid population (321.4). Mean charges for all preventable hospitalizations per county and those associated with Medicaid payors were $12,669,424 and $2,660,923, respectively.

Regression analysis indicated a significant inverse correlation between health literacy and the rate of preventable hospitalizations, as well as the charges of preventable hospitalizations. This significant correlation remained when analyzing health literacy's relationship to Medicaid-specific preventable hospitalization indicators, after controlling for the effect of poverty and insurance status. The strongest correlation was observed between the health literacy score and the rate of preventable hospitalizations among Medicaid recipients. (See Figure 4. Correlation Matrix.) Based on a simple linear regression model, health literacy score explained more than 20 percent of the variation in county preventable hospitalization rates. (See Figure 5. Regression Model Summary.)

Figure 3. Population Demographics and Description of Health Literacy and Preventable Hospitalization (PH) in Missouri Counties

Indicator	Total Number (%) of Population	Mean (SD)	County with Lowest (Average) [Total]	County with Highest (Average) [Total]
County Health Literacy Score		244.9 (5.3)	Pemiscot (231.0), St. Louis City (231.6)	Boone (259.9), St. Charles (259.0)
Percent below Basic Health Literacy		34.2 (4.0)	Boone (23.3%), St. Charles (23.6%)	Pemiscot (44.7%), St. Louis City (44.6%)
Rate of Preventable Hospitalizations (All)		158.4 (78.6)	Douglas (58.3)	Pemiscot (703.9)
Rate of Preventable Hospitalizations (Medicaid)		49.9 (39.4)	Polk (12.2)	Pemiscot (321.4)
Total Preventable Hospitalization Charges per County (All)		$12,669,424 ($28,106,867)	Worth [$42,065]	St. Louis County [$208,494,496]
Total Preventable Hospitalization Charges per county (Medicaid)		$2,660,923 ($6,690,874)	Worth [50,690]	St. Louis County [$42,859,735]
Percent Uninsured		16.88 (2.97)	Pemiscot (9.8%)	Scotland (24.2%)
Percent Poverty		16.51 (4.79)	St. Charles (5.0%)	Pemiscot (31.7%)

Preventable Hospitalizations by Race	Total Number (%) of Population	Mean (SD) Rate of PH	County with Lowest Average Rate of PH	County with Highest Average Rate of PH
White	605,796 (69.9)	508.4 (933.9)	Worth (24)	St. Louis County (7161)
Black	228,100 (26.4)	145.4 (759.9)	0*	St. Louis County (5544)
Other/Unknown	32,144 (3.7)	18.0 (58.8)	0*	Jackson (495)
Preventable Hospitalizations by Gender				
Male	141.1 (67.6)	141.1 (67.6)	Douglas (50.2)	Pemiscot (640.2)
Female	176.5 (92.8)	176.5 (92.8)	Douglas (65.9)	Pemiscot (762.1)
Preventable Hospitalizations by Age**				
<15	134.7 (89.5)	134.7 (89.5)	Douglas (24.8)	Dunklin (656.3)
15–24	79.6 (45.5)	79.6 (45.5)	Worth (0.0)	Pemiscot (267.3)
25–44	116.1 (71.3)	116.1 (71.3)	Shelby (40.6)	Pemiscot (661.8)
45–64	292.5 (138.8)	292.5 (138.8)	Douglas (97.6)	Pemiscot (1342.4)
≥65	87,850 (10.2)	N/A	N/A	N/A

* For some variables, the lowest scores of "0" applied to multiple Missouri counties.
** N/A - Data could not be analyzed for ≥65 age group due to the small sample size.
All rates are calculated per 10,000 population.

Figure 4. Correlation Matrix

Indicators	Prev. Hosp. Rates	Prev. Hosp. Charges	Medicaid Prev. Hosp. Rates	Medicaid Prev. Hosp. Charges
		Kendall's Tau/Spearman's Rho		
Mean HL Score	−0.275*/−0.403*	0.278*/0.396*	−0.404*/−0.565*	0.185*/0.269*
Percent below Mean HL	−0.275*/0.401*	−0.290*/−0.412*	N/A	N/A
Percent Uninsured	−0.112*/0.160	−0.427*/−0.579*	N/A	N/A
Percent Poverty	0.226*/0.323	−0.103*/−0.157	N/A	N/A

* Correlation is significant at the 0.01 level (2-tailed)

Figure 5. Regression Model Summary

Indicator	R^2	Adjusted R^2	P-value	Standardized Beta (P-value)
Mean Health Literacy Score	0.210	0.204	<0.001	−0.459 (<0.001)
Mean Health Literacy and Insurance Status	0.283	0.277	<0.001	−0.361 (<0.005) −0.259 (<0.005)
Mean Health Literacy, Insurance Status and Poverty	0.311	0.293	<0.001	−0.391 (<0.005) −0.250 (<0.005) 0.255 (<0.005)

A Bonferroni post hoc test was applied to further evaluate the relationship between health literacy and preventable hospitalizations. It appears that rates of preventable hospitalizations were no different between counties with the lowest levels of health literacy and counties with moderate levels of health literacy (p=0.368) and moderate levels of health literacy and highest levels of health literacy (p=0.119). When county health literacy rates were highest, however, preventable hospitalization rates were significantly lower than those counties in which health literacy rates were lowest (p=0.001). The effect size of this relationship was estimated using Spearman's rho (r=-0.403, p<0.001 (two tailed)) and Kendall's tau (r = -0.275, p<0.001 (two tailed)).

Discussion

Although preventable hospitalizations have traditionally been thought of as indicators of access to quality care, estimations of the effects of health literacy on preventable hospitalizations at a population level is a relatively nontraditional approach to understanding the degree to which health literacy impacts the effectiveness of preventive care, primary care, and public health efforts. Further, many studies that evaluate hospitalization for ACSCs do not consider

factors outside of the direct control of the clinical setting, such as attributes that may affect a patient's ability or willingness to adhere to recommendations for prevention, or early treatment or management of these conditions, for example, health literacy. Our analysis indicates that mean health literacy scores are inversely associated with rates of preventable hospitalizations in Missouri counties at a significant level, and to an even greater extent among the Medicaid population. In addition, the results indicate that for Missouri counties with the lowest levels of mean health literacy scores, rates of preventable hospitalizations are significantly higher compared to preventable hospitalization rates in counties that have the highest levels of mean health literacy scores.

Study Limitations

The study has several limitations worth noting. First, only secondary data was analyzed. Accordingly, we are unable to account for error associated with the collection and management of the primary data utilized. Additionally, because the units of analysis were at the county level, the sample was relatively small.

The limited methods available for measuring health literacy are another limitation. The health literacy score data is based on results from the NAAL and it therefore reflects just one accepted method of scoring health literacy. There are in fact several alternative scoring mechanisms, but the NAAL was chosen due to the large size of the study and because it comprehensively assesses functional health literacy, such as through the measurement of the ability to read a medicine label. Additionally, the health literacy variables are not results of

actual surveys conducted in each county, but are predictions based on statistical analysis. Further, the health literacy data is predicted based on tests administered and completed in 2004, but the mean health literacy score per county is derived from demographic data and extrapolated onto Missouri counties by the RAND Missouri Health Literacy mapping tool project. The most recent demographic data used in these extrapolations is from 2007. The health literacy data also did not include specific estimations for the Medicaid population. However, note that the two counties exhibiting the lowest average county health literacy scores, namely Pemiscot County and St. Louis City, are among those areas with some of the largest percentages of the county population enrolled in Medicaid.[37]

As preventable hospitalization data was obtained from general ICD-9 charge data reported on the State Inpatient Database, the charges incurred due to preventable hospitalizations are a crude estimate that may overstate the actual charges. As such, it is possible that some of the charges described as relating to preventable hospitalizations are in actuality attributable to hospitalizations that do not fall under our definition of preventable hospitalizations.

A final limitation of this study is the rather simplistic statistical methods and regression employed for data analysis. However, as this study is only intended to estimate the general direction and magnitude of health literacy's impact on preventable hospitalizations, the chosen analytical methods are suitable for the purposes of these research questions. Because the results of this study are nonspecific in nature, they cannot be reliably used to predict the effect that a change in health literacy scores may have on preventable

hospitalization rates. Lastly, the results and conclusions drawn from this study may only be applied to Missouri, and may not be representative of the association between health literacy scores and preventable hospitalizations in other states or in a national population-level study.

Suggestions for Future Research

Public health literacy has been described as an ethical imperative for public health agencies, organizations, and professionals.[38] As such, addressing health literacy is not the sole responsibility of those individuals actually providing health care services, but rather it involves a multitude of stakeholders, including health care policymakers, purchasers and payers, regulatory entities, and health care patients and consumers. One conceptual model of health literacy posits that health literacy is dependent on not only individual ability, but also on the health care system or environment.[39] Research has shown the value of using an ecological method for health promotion that considers both intra-personal and environmental factors.[40] Accordingly, an ecological approach provides a more comprehensive, robust contextualization of the challenge of low health literacy. This process is necessary to identify individuals and populations with poor health literacy and to develop effective, long-term solutions to address the problem of low health literacy, solutions that cannot be achieved without the involvement and collaboration of multiple stakeholders. Inherent in this approach is an understanding that health literacy is not solely a result of individual attributes, but is collectively impacted by social, economic, environmental, and policy factors.[41]

It is hoped that this study will encourage policymakers in Missouri to better allocate resources that can promote public health literacy. Although Missouri is among the states that receive some of the lowest levels of federal and state public health funding, research has shown that local public health agencies receiving a higher proportion of federal and state funding also are actually more likely to generate higher local revenues as opposed to allowing significant outside funds to offset lower local spending.[42] Additionally, we suggest that future research should seek to identify and develop strategies to effectively measure health literacy, to increase and sustain desirable changes to health literacy rates in low-literacy communities, and to compare the costs associated with state-funded intervention efforts that demonstrate a measurable increase in health literacy with the amount of taxpayer-funded preventable hospitalizations of Missouri Medicaid patients. A health literacy framework that emphasizes how individuals can change their own behavior to improve their health status is likely insufficient to address these problems. There is currently a paucity of research and evidence regarding successful initiatives to significantly improve and sustain public health literacy and the quantitative and qualitative effects of such interventions on health outcomes, both at the individual and community levels.

Ultimately, we encourage the promotion of more efficient Medicaid spending by highlighting the relationship between low health literacy and preventable hospitalizations in Missouri. With state and local policymakers considering alternative methods to improve health outcomes, such as expanding insurance coverage and providing more cost-effective ways to improve safety-net

performance, understanding health literacy's impact on outcomes and performance could result in considerable cost savings to the state Medicaid budget, both through more efficient use of resources and better overall health outcomes.

Conclusion

Every day, individuals receive health-related information that leaves them with more questions than answers. Obtaining appropriate health care necessitates having the proper skills to read and fill out medical and health insurance forms and prescriptions, communicate with health care providers, and follow instructions and medical advice, including discharge-planning instructions. As such, for individuals to make appropriate decisions about their health, they need to be health literate. Unfortunately, many Missourians have difficulty obtaining, processing, and understanding basic everyday health information. Improving health literacy may be the critical component necessary for

achieving overall health and wellness goals in Missouri. With a better understanding of health literacy's practical and associated financial impact on preventable hospitalizations, public health officials and policy makers can emphasize, promote, and enhance investment in health literacy initiatives, which may in turn promote significant long-term savings in Medicaid and other health care expenditures.

Many current health policy debates include issues surrounding Medicare and Medicaid, health insurance costs and coverage, patient's bills of rights, health information privacy, and electronic medical records. As state and local policymakers consider alternatives to expanding insurance coverage to ensure access to effective care, this study highlights the importance of health literacy as a factor that affects and influences the overall health of a community. This study is a call to action for those who influence, develop, or implement policies that will lead the way to resolution of the issue of low health literacy in Missouri.

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Adopting Customers' Empowerment and Social Networks to Encourage Participations in E-Health Services

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The aim of this article is to present an e-health model that embeds empowerment and social network intervention that may extend the role of customers in health care settings. A 25-item Likert-type survey instrument was specifically developed for this study and administered to a sample of 108 participants in Indonesia from October to November 2012. The data were analyzed to provide ideas on how to move forward with the e-health initiative as a means to improve e-health services. The survey revealed that there is a high demand for customers' empowerment and involvement in social networks to improve their health literacy and customer satisfaction. Regardless of the limitations of the study, the participants have responded with great support for the abilities of the prototype systems drawn from the survey. The survey results were used as requirements to develop a system prototype that incorporates the expectations of the people. The prototype (namely Clinic 2.0) was derived from the model and confirmed from the survey. Participants were selected to use the system for three months, after which we measured its impact towards their health literacy and customer satisfaction. The results show that the system intervention through Clinic 2.0 leads to a high level of customer satisfaction and health literacy.
Key words: *empowerment, social networks, health care services, E-health*

Introduction

A health care organization is successful when it provides and maintains good quality services. In a competitive environment, the effort to attract a customer (that is, patient) can take a month or more, but they are quite easy to lose. Therefore, there must be policies of pleasing customers, satisfying the customer's need, and building long-lasting relationships between customers and the organization.[1] As a business entity, a health care organization stands in need of the same standards of customer service as other industries or business organizations. The fact that customer service expectations in health care organizations are high poses a serious challenge for health care providers as they must make an exceptional impression on each and every customer (that is, patient). In the competitive commercial health care market, poor service leads customers to switch health care providers because poor service indicates inefficiency, higher costs, and lower quality of care.

Nowadays, patients have more choices in seeking care and in the way they interact with their health care providers. Great customer

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service can lead to major improvements in the health care system. Customer service is not an "extra"; it is an essential requirement for providing high quality health care and for remaining in this highly competitive business.[2] Patients are making clear choices about where they receive care based on service experiences. It is crucial for organizations and governments to create an institutional ability to sense and respond empathetically.[3]

In the traditional health care paradigm, a customer's empowerment was often neglected because patients were viewed as recipients of care while health care providers solely decided the diagnosis and treatment of the patients. This implies that there is minimal or no participation from the patients. This mindset is the main obstacle for the empowerment of patients. However, there will always be circumstances in which patients choose to hand over responsibility for decisions about their health care to providers. It is due to the difficulty of the choices, low health literacy, or the time involved in gaining an understanding of the health problem and the options. These do not undermine the propositions that customers' empowerment will promote efficiency and that decisions should be made from the consumer's perspective.[4]

Empowerment is a process of helping people to assert control over the factors that affect their lives.[5] It encompasses both the individual responsibility in health care and the broader institutional or societal responsibilities in enabling people to assume responsibility for their own health. Empowerment can be viewed as the result of both an interactive and a personal process, in which the emergence of "power" (or potential) is facilitated by a caring relationship, and not merely given by someone, nor created within someone.[6] In other words, the emergence of

a person's potential occurs because of an empowerment process that may be viewed as a co-creation within a true partnership.

Social networks use Web 2.0 to describe social characteristics and support among individuals in groups that can promote collaborative sharing.[7] Web 2.0 is commonly associated with technologies such as weblogs (blogs), social bookmarking, wikis, podcasts, RSS (Really Simple Syndication) feeds, and other forms of group-to-group publishing), social software, and Web application programming.[8]

The advancement of Web 2.0 has brought the possibility to extend social aspects such as enabling patients, or patients' families, and the community at large to participate more actively in the health care process of education, health promotion, and even prevention through social media. In fact, Web 2.0 has opened up opportunities to translate customers' empowerment in social media where they can share and discuss their concerns regarding health and health care.[9] This study concerns the implementation of Social Customer Relationship Management (Social CRM) or CRM 2.0, which is based on social networking, to support multiple ways interactions such as interactions between health care providers and customers, and between customers in different social media.

The aim of this article is to present a model architecture that embeds customer empowerment and social networks through Social CRM in e-health services to encourage the participation of patients. A survey was designed to gather requirements and expectations from customers based on the models and subsequently, a prototype called Clinic 2.0 has also been developed, which is based on the model and the survey's results. The prototype was tested with potential participants

for about three months to measure its impact towards their level of customer satisfaction and health literacy before and after interaction with the Clinic 2.0. The results show that the system intervening through Clinic 2.0 can improve the level of customers' satisfaction and health literacy. The structure of the article is as follows: In the next section, we provide the literature review, followed by our proposed conceptual model and prototype. The next section contains the discussion, followed by the conclusion of this work.

Literature Review

Adoption of Information and Communication Technology (ICT) in a health care organization can improve the quality of service in health care information management.[10] The quality of service in health care relates to customer satisfaction, which in turn can affect the health literacy of patients. In addition, some have argued that ICT drives the change of health care's paradigm from Industrial Age Medicine to Information Age Health Care.[11] This "paradigm shift" is reshaping health systems, and customers have been empowered to seek information. The notions of health care services have been transformed from physically based services that rely fully on a patient's physical presence at a health care center, to home-based services where some health care activities can be performed, focusing on preventing diseases, promoting health, and giving patients their health care in their comfort times anywhere, anytime, which makes them more proficient in dealing with their health conditions.[12]

The conventional paradigm holds that customers (patients) are recipients of medical care, and they do not have a significant role in their own health care decision-making. The advancement of Web 2.0 offers customers a greater role in the decision-making process as they are empowered with the ability to access and control personalized information.[13] However, providing customer empowerment in e-health through social networking tools or Web 2.0 is a challenging task because of the complex nature of the health care business. This implies that there is minimal or no participation from the patient. This perspective is the main obstacle for the empowerment of patients. Nevertheless, there will always be circumstances in which patients choose to hand over responsibility for decisions about their health care to providers. Is it due to the difficulty of the choices, or the time involved in gaining an understanding of the health problem and the options? These do not undermine the proposition that a customer will promote efficiency and that decisions are made from the perspective of the customer.[14]

Customer Empowerment in Health Care

Empowerment closely relates to the concept of CRM in managing good relationships with the customers. However, the gap between managing CRM and customers' needs becomes more complex. This complexity increases due to changing customer behaviors, which are driven by technological advancement. When customers become more empowered, their relationship with an organization that serves them will be enhanced. The CRM model was expected to contribute to determining dimensions of the e-health business process with the empowerment perspective.

Empowerment is well supported in the health care literature, and it relates to customers and health care services over the past decade.[15] In the health care organization, empowerment implies the provision of necessary tools to staff so that they are able

to resolve, on the spot, most problems or questions faced by customers. In addition, staff can deal with customers directly and so reduce the number of dissatisfied customers who would otherwise have complained, but now, simply switch brands. Empowerment is a result of both interactive and personal processes, in which the emergence of "power" (or potential power) is facilitated by caring relationships.[16] Empowerment as an interactive process suggests that power is "transferred" by one person to another, whereas empowerment as a personal process suggests that power is "created" by and within the person. Although the expected outcome is the same, that is, the gain of more power over one's life, the nature of the two processes is very different.[17] In the first case power can emerge through active co-creation and collaboration in an empowering relationship. Since CRM 2.0 facilitates interactions and collaborations, it can be used as a tool to implement empowerment.

Many researchers have discussed the issue of empowerment in health care organizations. Empowerment can be analyzed from the perspective of patient-health care provider interactions,[18] or from the point of view of the patient alone.[19] In addition, analysis can encompass both of the above-mentioned perspectives.[20] However, research that specifically discusses the issue of empowerment through CRM, and particularly Social CRM, in the domain of e-health is still quite limited.

In terms of empowering individuals in e-health service, Australia is the pioneer with the introduction of the Personally Controlled Electronic Health Record (PCEHR). PCEHR enables patients in Australia to view their medical records online.[21] However, not much literature discusses the issue of empowerment that integrates individual, social, and medical aspects. There is a knowledge gap in addressing the way health care providers develop a mechanism(s) to encourage customers' responsibility and taking a greater role in decisions about their own care and delivery.[22] These arrangements will empower providers in health care service delivery to meet increasing demands and expectations of customers while optimizing the cost of service. Recent discussion of empowerment is supported in the health literature, and it has been used for customers and health care services over the past decade. The proposed model was developed to enhance existing theory of empowerment in e-health business processes with the help of recent Web technology.

A significant element of patient empowerment has been achieved by allowing patients to view their medical information electronically. However, PCEHR has only enabled patients to view their Electronic Health Record (EHR); it has not utilized features of CRM 2.0 that allow collaboration and conversation between patients or between patients and their health care providers.

Social Networks

In managing the customer relationship, the Internet has become a crucial medium in supporting CRM efforts. Indeed, Web technology is a powerful channel that is available for organizations to develop, enhance interactions, and implement relationship practices with customers.[23] Web 2.0 is becoming a trend in Web technology and Web design. We are witnessing the acceptance of a second generation of Web-based communities such as wikis, blogs, and social networking sites that aim to facilitate creativity, collaboration, and sharing among users rather than just sending or receiving emails and retrieving some information. It is important to note that Web

2.0 users can own and exercise control over their data.[24] Web 2.0 is therefore an important tool for the development of social networks.

Social networking can generate a way to strengthen the relationship between organizations and their customers. It can be used as an enabler in creating close and long-term relationships between an organization and its customers.[25] The booming number of social networking groups and supports groups for patients on the Internet and their influence on health behavior is only beginning to be explored.[26] This is an important area for future research. The concept of a social network defines an organization as a system that contains such objects as people, groups, and other organizations linked together by a range of relationships.[27] Some organizations are building online social networks to engage customers and export ideas, innovations of new services or products, quick feedback, and technologies from people outside the organization.[28]

Web 2.0, which plays a significant part in the CRM transition, drives social change that affects all institutions including business and health care organizations. It is a revolution on the way people communicate. The concept of Social CRM is a philosophy and a business strategy, supported by a technology platform, business rules, processes, and social characteristics, designed to engage the customer in a collaborative conversation to provide mutually beneficial value in a trusted and transparent business environment.[29] It is the company's response to the customer's ownership of the conversation. In this study, the terms Social CRM and CRM 2.0 are used interchangeably. Both share new, special capabilities of social media and social networks that provide powerful new approaches to surpass traditional CRM.

Cipriani described the fundamental changes that Social CRM is introducing to the current, traditional CRM in terms of landscape.[30] Figure 1 is the reflection of the

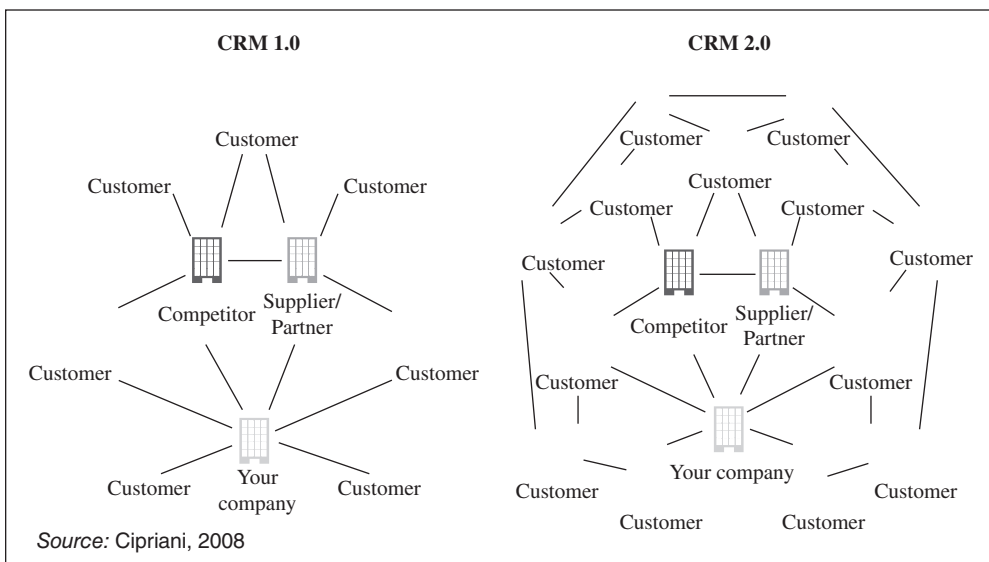**Figure 1. Evolution of CRM landscape**

Source: Cipriani, 2008

Table 1. Comparison CRM 1.0 and CRM 2.0

Type	CRM 1.0	CRM 2.0
Relationship	Focus on individual relationship (C2C, C2B)	Focus on collaborative relationship (engaging a more complex relationship network)
Connection	Limited view of the customer and his community preferences, habits, etc.	Multiple connections allow better understanding of the customer and his community
Generated Value	Targeted messages generate value	Conversation generates value

Source: Cipriani, 2008

evolving CRM 2.0, which is different from CRM 1.0. It is a revolution in the way people communicate. Customers establish conversation, not only with the service provider, but also with others. Table 1 summarizes the difference of CRM 2.0 from CRM 1.0 based on type of relationship, connection, and how value is generated. Relationship type in CRM 1.0 focuses on the individual relationship; Customer to Customer or Customer to Business in CRM 2.0 offers collaborative relationship and engages a more complex relationship network. Connection type in CRM 1.0 is a limited view of the customer which affects a less informed customer, on the other hand, CRM 2.0 enables for multiple connections allowing better understanding and a more knowledgeable customer. CRM 1.0 of value creation is constructed from targeted messages, and CRM 2.0 offers diverse value creation even from informal conversations with customers within social networks.

With Social CRM, patients can easily participate in social networks to exchange information and knowledge.[31] It facilitates peer-to-peer collaboration and easy access to real-time communication. Patients can share information and knowledge about their diagnoses, medications, health care experiences, and other related information. It is often in the form of unstructured communication, which can provide new insights for people involved in the management of health status and chronic-care conditions.

Methodology

Figure 2 below is the research roadmap of the study, which applies the specific methodology in each phase respectively. It employs

Figure 2. Roadmap of the Study

Source: Authors' Conceptualization
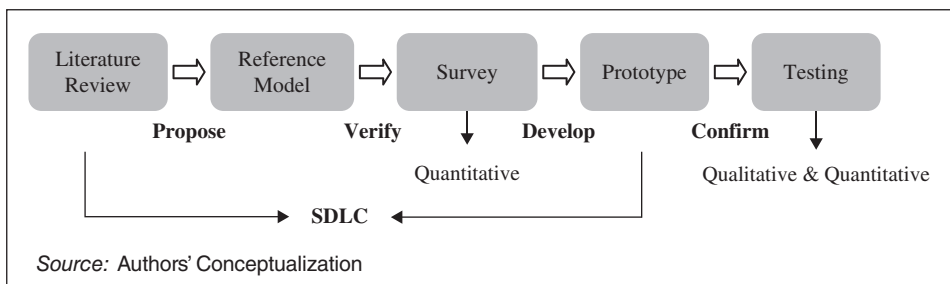
a combination of system development life cycle (SDLC), quantitative, and qualitative methods. Relevance and related literature are foundations to develop the model. A modelling framework is employed to derive survey instruments. The survey results are used as feedback requirements to develop a prototype. The prototype (Clinic 2.0) was tested to measure health literacy and customer satisfaction.

The Model

The study proposes the Social CRM model to accommodate empowerment and social networks. CRM functionalities were composed from Marketing, Sales, and Customer Services, which are operated to achieve the business strategy of a health care organization. The scope of research is customer service that will offer distinct value for each activity—especially accommodating

customers' participation in the proposed systems. Social CRM in e-health accommodates various features and components of empowerment in health care systems, as its central role entails self-managed data and authorization to encourage customers to provide full health information. This is important to health care organizations as it also enables customers to access more information.

Figure 3 presents a proposed model of Social CRM in health care organizations. It offers a starting point for identifying possible theoretical mechanisms that might account for ways in which Social CRM provides a one-stop service for building relationships between health care organizations, patients, and the community at large. The model was developed from External Social Networks, Internal Social Networks, listening tools, and health care value configuration (that is, registration, patient care, discharge, marketing, and post service).

Figure 3. Enterprise Architecture

Source: Authors' Conceptualization
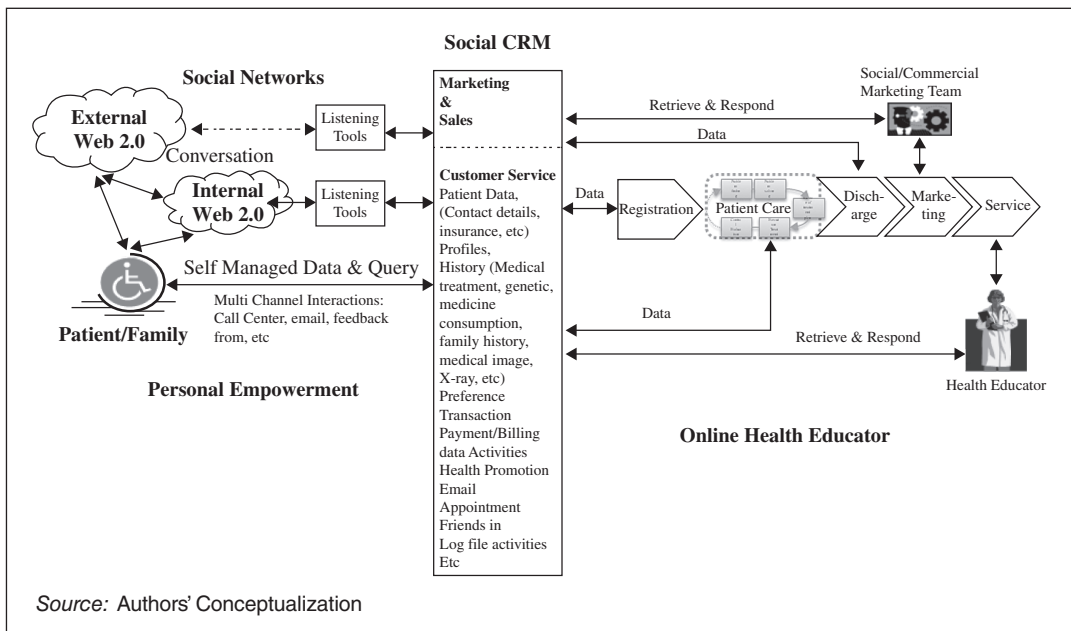
The term "social networks" (Figure 3) refers to any social media where patients or their families may share and converse. We focus on two different types of interconnection: external social networks and internal social networks. The external social networks refer to such popular Web 2.0 applications as Facebook, Twitter, LinkedIn, MySpace and Friendster that may serve as platforms for interaction between customers. The dashed line connecting external social networks and CRM systems means that none of these networks has direct control over the others. However, constructive conversation and information from external social networks should be captured for creating strategies, innovations, better services, and accurate responses to emerging challenges. Furthermore, the model accommodates internal social networks that are operating within the health care organization's infrastructure. The pivotal target is a conversation between patients or patients' families and others for sharing and supporting in social media. For example, patients with similar conditions like diabetes will be motivated to share their experiences, processes of learning and knowledge.

In general, the aim for having external and internal social networks is to engage patients and export ideas, foster innovations of new services, and ensure quick response or feedback for existing services and technologies from people inside and outside the organization. Both provide a range of roles for patients or their families.[32]

Social CRM empowers patients to control their own data. Once the patient registers for the service from the health care provider, it will enable her or him to enjoy the benefits of a personalized e-health system with CRM 2.0 as the frontline of the system. Authorization will be provided for each patient. Hence,

the authorization and self-managed account or service grants access to all applications and data offered by the system. Technical assistance is provided by the manual or by a health informatics officer (just like any other customer service in a business or an organization), who is available online and assists patients and their families in using the system. Furthermore, since all information (for example, medical records) can be accessed online anywhere and at any time it can contribute to a collaborative treatment.

The model adopts a modular approach; it will assist a health care provider to initiate empowerment by stages, and measure the performance gradually. Some of the features available to the users include the update of personal data, access to medical records and history (for example, medical treatment received, medicine consumption history, family illness history, genetic information, medical imaging, and x-ray), preference services, transaction, payment and billing data, patient activities, personal health promotion and education, e-mail, appointments, friends in networks, forums, chatting, and so forth.

Finally, a health care business scenario is a critical process that affects personal health as much as it affects health care organizations. It is important for health care organizations to ensure that Social CRM is fully utilized by their customers. Patients need to collaborate with health care providers to gain sufficient knowledge to use electronic and online services effectively. To support this function, we propose an Online Health Educator (OHE), which enables patients to attain better knowledge and control over their health data and contributes to the basic communication between patients and health care providers. Additionally, the OHE determines the success of the implementation as

it ensures that there is a group of staff dedicated to guarantying that e-health services are managed in a professional way.

Business Model Architecture

The business model is a derivation of the architectural model presented in Figure 3. It is constructed by modifying the process of value configuration,[33] value shop,[34] Social CRM, and empowerment in health care. The dimension of empowerment is in the form of personal, social, and medical components. The cyclic model adopts from the value shop's model that the process of health care is a repetitive and closed loop. Figure 4 depicts the model in which the role of customers expands into three distinct functions as individual, social, and medical. Each role represents a module in which each module is a set of sub-modules detailing the function and set of activities within e-health's context. The advantage of the modular approach is extendible so that new entities can be easily embedded in the future.

From the perspective of the object-oriented paradigm, the mode is composed of three districts object classes: personal,

Figure 4. The Model of E-Health Featuring Empowerment
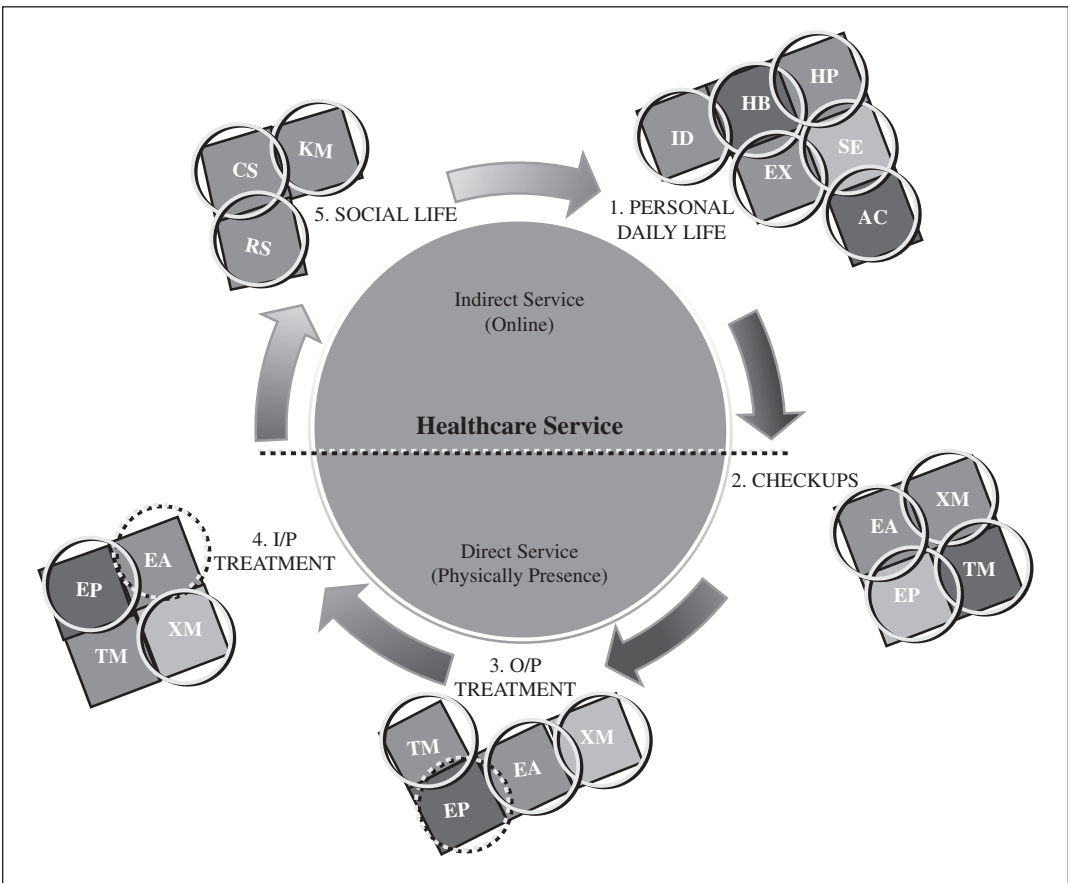
social, and medical. The impact of introducing an object-oriented approach in e-health systems can affect the process of medical or health recording. For instance, in the conventional e-health system, electronic medical records (EMR) are static, recording data that is mostly generated by health care staffs. The model proposes new terminology such as Electronic Health Object (EHO), which represents sets of objects and some objects' data that can be empowered to customers in generating them. The term "object" in EHO is different from the term "record" in EMR. The object is a dynamic entity that contains data, attributes, and action for multi-users depending on their respective roles. Furthermore, the record is static data generated by specific individuals such as health care staff.

The model comprises object class personal, social health agents, and medical agents. The object class personal functions through personal health actors that expose all personal health objects as individual patients affecting their health status and services. These objects are personal identity (ID), personal habits of the patient (HB), exercise activities (EX), spiritual and emotional activities (SE), personal health plans (HP), and personal account information (AC). For instance, object ID consists of personal information such as name, address, phone number, email address, login ID, password, and so on. HB is a daily habit of the individual that can be included in this category, such as eating, sleeping, and any other habits that may affect personal health. The EX includes routine exercising activities of the individual that may provide benefits when they are recorded in the systems. All sub-modules span this category, as discussed earlier, and can be empowered fully to the customers, which means the customers (patients) can manage the categories by themselves. The process will replace a conventional approach in which the health staffs normally enter patient information into their systems. The customers will do it on their own. Obviously, it is empowering customers as personal health actors for all activities under their own control, in other words, "give them the right to do what they can do by themselves".

The social object class empowers individuals and the community as social health agents for others. Customers as social health agents provide a broad range of activities to use social networks within e-health services. Sharing in social networks may become a virtual support group that can enrich and strengthen their motivation to fight for better health. Sub-modules in this category are conversation (CS), chat, update status, forum, wikis, blog, knowledge management (KM), personal knowledge, group knowledge, and asking for a specific service (RS). CS consists of standard social network activities such as sharing and conversation in social media. Currently, people use social networks in their daily lives. Updating status in social networks triggers conversation among their circle of friends. Bringing this scenario into e-health services is an interesting issue and challenging. For instance, patients with the same illness like diabetes may share their experiences with other patients in social networks. Therefore, adopting Social CRM in this category is imperative.

Object medical class transforms the role of the patient in an e-health business scenario. Object medical class enables customers to take greater participation in the object in which they were assigned privileges to have access to or contribute in generating relevant health information. Because of this participation and empowerment given to customers, the position shifts customers from recipients of care

that is passive to accepting any kind of services provided to becoming a partner of care in which customers take an active role in the whole medical care process.[35] Customers can be involved in any stage of medical treatment activities starting from the e-appointment to accessing medical information.

Sub-modules in this section are examination (XM), e-appointment (EA), e-prescription (EP), and e-treatment (TM). XM is an online consultation between patients and medical staffs that can generate an electronic medical record (EMR). It is a common service in any e-health initiative; however, when there is empowerment in these processes of medical activities, the result of e-consultation can be different with the e-health system without empowerment's features. For instance, many health care providers prevent customers from accessing their EMRs prior to consultation time. Those patients cannot track their medical history by themselves, so whenever the patient needs a consultation, the diagnosis will be likely from the beginning. When visiting three different doctors for opinions, the patient will have to explain the situation from beginning regarding their symptoms to those three doctors respectively. As the aim of WHO (the World Health Organization) in defining e-health, the systems should able to educate patients about their health status, condition, and history. Therefore, participation through empowerment in this category helps to educate patients about their medical history so that they can expect to improve their health literacy. The empowerment may allow customers to access their own EMRs. The EP is another subset of EMR that can empower customers. Allowing customers to access EP will speed up the process of managing a prescription, and customers will be better consumers due to their ability to

access and acquire the information anywhere in their own time. In summary, empowerment in online medical activities may shift the role of a patient from a recipient of care to a partner of care. The ability to access knowledge and contents (EMRs) makes them partners for medical staffs in the health care process, which is beneficial for health decision-making.

In terms of the ability of customers to generate content, patients are able to produce electronic health contents that may help health care staff in the comprehensive diagnosis of a patient based on the content he or she generated. It is opposite to the conventional e-health system where the ability to generate content is not available to the patient. The model helps health care providers in empowering their customers. The yellow circle in the sub-module indicates that the provider empowers its customers to have control on that specific sub-module, while the dashed circle indicates that the provider only gives partial empowerment to customers. In addition, no circle means the health care providers do not provide any empowerment to the customers. The model accommodates the empowerment of integrative participation and interaction that is beneficial for either customers or health care organizations. Empowerment is an important feature recognized as a strategy for e-health services to improve health literacy and customers' satisfaction. Furthermore, the integrated approach can help health care organizations in defining which scope of empowerment they will implement. The modular approach will assist health care organizations to initiate empowerment by stages and later on to measure the empowerment process and performance. The features described in the model were used to develop questionnaires in the survey.

Survey

There is no published research on the subject of empowerment and social networks about e-health focusing on Indonesia. This article is prepared to fill that gap. The survey instruments were derived from the features of the model proposed in the previous section. It covers many empowerment topics in e-health such as health information accessibility, social support, and social networking. The first part of the survey was demographic information. Critical characteristics of participants, such as their ages, genders, ethical and cultural identities, and socioeconomic situations, influence their health states, their access to health care, and the ways they are likely to use e-health innovations.[36] The first section of our survey questionnaire was designed to gather data on employment type, gender, age composition, living arrangements, level of education, frequency of computer usage, and frequency of Internet usage. Table 2 covers the demographic

Table 2. Demographic Characteristics (2012)

Variable	Component	Percent
Employment	Administrative Health staff	7.4%
	Doctors	9.3%
	Nurses	29.6%
	Others	53.7%
Gender	Male	27%
	Female	73%
Age	20 years or younger	7.4%
	21–30	76%
	31–40	11%
	41–50	3.7%
	51 years or older	1.9%
Education	Completed high school	24.3%
	Completed Diploma	42.12%
	Completed Degree	31.8%
	Completed Postgraduate	1.9%
ICT Literacy	Not at all	7.4%
	Basic User	17.6%
	Medium User	48.1%
	Advance User	26.9%
Internet Usage	At least daily	75%
	Weekly	20.4%
	Monthly	1.9%
	Never	2.8%

characteristics of the 108 respondents. Data gathered from the survey were used to formulate recommendations for the future direction of empowerment in e-health systems.

There are many issues that we asked the respondents about, including health information on the Internet, empowerment features in health service, availability of online health education, social networks in e-health services, and the effect of those services to improve health literacy and customer satisfaction (Table 3). We asked the respondents whether they also use the Internet to obtain health-related information, health science, or as a health reference, and found that 96 percent of them did use the Internet to get health related information while 4 percent did not. We followed up this question and asked them what they were looking for on the Internet. We found that 57 percent

looked for information about diseases and their treatment, 22 percent looked for information about healthy lifestyles, 7 percent looked for information about health support and recommendation, and 13 percent looked for information about health care services.

Personal Empowerment

The questionnaires concentrated on customers' online accessibility of health information. The first question asked about their agreement with the ability of a service that enabled them to access their medical records online so that they could monitor their own medical record anywhere and anytime. The study shows that 22 percent (strongly agree) and 47 percent (agree) of the respondents prefer to view and have control of their medical records online. These are interesting

Table 3. Survey Results (2012)

Survey's Component	Result
Personal Empowerment: Patients able to	
• View EMR/EHR	69%
• Record health activities online	75%
• Pay for services online	39%
Social Networks Empowerment: Patients able to	
• Discuss health services in social networks	72%
• Find support groups in social networks	93%
• Discuss with patients with a similar condition	80%
Medical Empowerment: Patients able to	
• Consult with health care providers online	83%
• Find online health educators	92%
Extended E-Health Services:	
• In overall, improve health literacy	64%
• In overall, improve customer satisfaction	87%

results that indicate patients can self-monitor their medical records. The knowledge of the medical status of historical data available in the medical records may lead to improved health care awareness and self-managed health care. In addition, the online medical record may help them to make sure that they have the right health details to avoid miscommunications. Furthermore, the online medical records are used as a guideline in making any decisions relating to their own health. Although most of the respondents prefer online medical records, some respondents (26 percent disagree and 4 percent strongly disagree) were uncomfortable with the idea of online medical records accessibility. This is mainly due to the hesitation of medical staffs to disclose medical records. The issue becomes a challenging task for future research in the e-health direction, especially regarding the issue of change management.

Furthermore, we asked the preference of customers to have the ability to record their own health-related activities and habits. Seventy-five percent of respondents agreed to record their daily habits and activities. Most respondents were happy to record their health-related activities online. These activities may include a personal health diary that the respondents can access anytime and anywhere, facilitating their daily plans and programs for a healthy lifestyle. This service could be used to monitor their health status and could help them in making health decisions. For instance, customers can record their personal habits like eating, exercise, hobby, weight, and even blood pressure. Those records would be used when they had consultations with medical practitioners. Twenty-five percent of respondents disagreed, fearing that there could be a breach of information or manipulation of records.

Social Networks Empowerment

Generally, people connect at several different social networking sites. They share and discuss many issues concerning their own personal interests. In the study, we were interested in the effect of social media in health care settings. First, we asked the respondents of their agreement on the ability of customers to share their experiences in the social networks in regard to the service they receive from health care providers. The study shows that 24 percent (strongly agree) and 48 percent (agree) of respondents will share their experiences in dealing with health care providers. There are 18 percent (disagree) and 10 percent (strongly disagree), who believe that social networks should have nothing to do with health care services.

Furthermore, we asked whether sharing between patients with similar conditions in social networks would create mutual benefit and support. The survey reveals that most of the respondents (20% agree and 60% strongly agree would want to get in touch with other patients who have the similar condition with them through social networks. People with similar problems can easily share their experiences and knowledge online, which may lead to support for each other, at least morally, in facing their problems. Finally, we pointed out that group support through social networks will make them more resilient and confident about decisions regarding their health, and it shows that 93% of respondents confirmed, while only 7% disagreed that supporting groups are achieved via social networks.

Medical Empowerment

The customer-centric paradigm views customers (or in this case patients) as partners in the health care process. However, many people still worry about the reliability

and information quality provided by e-health services. This issue can be overcome by assigning an *online health educator* to ensure the reliability of information flow within electronic channels. This section discusses the online health educator and her or his role. In the survey, we asked about their agreement that health care organizations can provide e-health service guided by online health educators. Almost all participants had the same opinion—they agree (27 percent strongly agree and 56 percent agree) to use the service if it is offered.

The question was whether an online health educator should respond effectively to any online queries without any delay. The result shows 32 percent strongly agree and 60 percent agree. It indicates that almost all participants expect online health educators to support the existence of e-health and, most importantly, quick responses are required to make customers satisfied with the e-health services. On the other hand, 8 percent of respondents disagreed because no clear rewards and compensation were received in order to provide extra service to customers. In response to the previous question, we were interested to find the preference of customers regarding whether they are willing to pay for an extra online service. Interesting facts show that less than half of the respondents agreed to pay for the online health services (39 percent), while the majority (61 percent) prefer not to pay for the service. Furthermore, we asked about their agreement regarding the idea that physical health is also affected by the emotional, psychological, and spiritual condition of the individual. Surprisingly, the result revealed that 65 percent strongly agree with the statement, 35 percent agree, and none of them disagree. This result will trigger further research in this topic.

Finally, the last two questions on the survey were regarding health literacy and customer satisfaction. E-health activities such as online access to medical records, online consultation, and online discussions with other patients can improve health literacy. The survey showed that 22 percent of respondents strongly agree, 42 percent agree, 30 percent disagree, and 6 percent strongly disagree. It is believed that embracing Web 2.0 in e-health service can improve health literacy. In addition, the survey asked whether customers (patients) would be more satisfied with the service if a health care organization provides an online service through which the patients are able to access their online medical records, and have online consultations and online discussions with other patients. The result shows that the majority of respondents confirm (30 percent strongly agree and 57 percent agree) that those facilities will make them more satisfied if they are offered. It signifies that e-health service with Web 2.0 tools is believed to improve their health literacy and customer satisfaction. The findings of this section will be used to recommend the implementation of Web 2.0 in an e-health environment.

Prototype

Clinic 2.0 is derived from survey results and the proposed model (Figure 4) in the previous section. It describes the online tools and systems that facilitate interaction, exchange of information, and online contents generated by customers (patients). The system developed through the process of System Development Life Cycle (SDLC). SDLC is used in information systems, systems engineering, and software engineering as a process of creating new or altering

existing systems. The SDLC can be thought of as a concept that lies beneath a number of software development methodologies currently employed throughout industries including health care information systems. Clinic 2.0 is a prototype of an e-health system that implements the concept of Electronic Health Object (EHO) as discussed above. It transforms the paradigm of an interactive health care system in which any business process is represented as an object that has its own data, attributes, and method to act and interact with other objects. With the concept of object oriented (OO), customers can be assigned data, attributes, and methods to interact with other objects. Though the system does not contain the complete modules as proposed in business architecture (Figure 4), nevertheless it extends multiple ways of customers' participation. Three possible participations involve patient self-interaction, patient-to-patient interactions, and patient with health care provider interactions.

The main menu is user friendly and has a clear navigation design allowing users to find and access information effectively. The top menu consists of the following sections: a search box, "My Health," medical records, logout, "Message of The Day" (MOTD), status, conversation, profile, and group designations. The search gives visitors a quick way to find the information they need. My Health is a representation of object personal class in the business process design. It represents the activities of the cyclic model. Medical Records are representations of object medical class or medical activities as shown in the snapshot of Figure 5.

Figure 5. Home Page Menu

Source: Authors' compilation

The quick logout component adds a new menu type to Clinic 2.0 that allows a single-click "logout" menu item (without requiring user confirmation to logout). One of the special features in the home menu is the MOTD. The MOTD is a message managed by the health educator to send a reminder message to each user (patients or staff) that is customized based on the needs of each user. This means MOTD is different for each patient. For instance, the patient with diabetes will be likely to receive alerts or reminders from the health care educator based on his recent health condition. The online health educator updates the MOTD at regular intervals. Next, after the MOTD comes notification for the user. The notification appears when there is a friend request or new message in the inbox from other users. The next section is status updates, which allows users to post personal messages for their friends to read or share with others. In turn, friends can respond with their own comments, as well as clicking the "Like" button. A user's most recent updates appear at the top of their Timeline/Wall and are also noted in the "Recently Updated" section of a user's friend list. The purpose of this feature is to allow users to inform their friends of their status.

Right after update status is a news feed. When users logged into Clinic 2.0, they were presented with a customizable version of their own profile. The new layout, by contrast, creates an alternative home page in which users see a constantly updated list of their friends' activities. The '"News Feed" highlights information that includes profile changes, upcoming events, and birthdays, among other updates. On the left side, there are menus of favorites, profile, group, friend suggestions, and online friends. Favorites consist of messages, knowledge, and the

forum. The message menu is used to send and receive messages from other users. Knowledge is a resource center for all users where online health educators, medical staffs, and physicians share topics on health and medical treatment. Patients can only ask about the topic posted by the online health educators, while the forum is the medium of exchange and sharing, where patients can post and share any knowledge and experiences.

The difference between menu knowledge and the forum is in the quality of information being posted. In the knowledge menu, the health and medical information are reliable because the sources are medical staffs or online health educators, and the knowledge management is maintained to ensure the quality of information. The forum is unverified information because the source is from patients, and it has not been tested in clinical research. The profile menu consists of basic information, profile pictures, friends and family, education and employment, philosophy, entertainment, sport, interests and hobbies, and contact information. Patients can also join interest groups. The group menu is optional for patients to join any available group of social networks such as diabetes, cancer, heart disease, and so on. Clinic 2.0 allows different networks and groups, which many users can join. This is essentially equivalent to control of a blog for the administrators. The suggested friends menu shows an option to invite others to become a friend on social networks and groups. Finally, the online friend menu shows friends who are currently online. The user can initiate chat and conversation with online friends. The next section discusses the results of customers' participation before and after interaction with Clinic 2.0, focusing on customer satisfaction and health literacy.

Patient Participation

A testing scenario was conducted at a clinic *Aisyiah* in Malang East Java, Indonesia. The reasons for using this clinic range from support of health care management and willingness of the medical staff to participate during the testing process. The health care staff also proposed and recommended potential participants to use the systems. In exchange, the participants benefited from free health care services related to the testing purposes and the testing period at the clinic.

Malang is one of the autonomous regions and is the second big city in East Java after Surabaya. Clinic *Aisyiah* is one of the business units owned by a nongovernment organization under the umbrella of the largest Islamic organization in the country. In 2007, it had about 73 health care centers with 800,000 inhabitants.[37] The clinic *Aisyiah* teams consist of health care professionals dedicated to guiding individuals and families through diagnostic and treatment processes. The clinic provides outpatient, inpatient, and emergency services. An Online Health Educator (OHE) was a dedicated medical doctor for the testing purpose. Regular visitors are about 150 patients monthly for primary care, and 25 percent of the patients suffer from chronic conditions such as diabetes type 2. Recent health information systems (HIS) in clinic *Aisyiah* run basic records of Electronic Medical Records systems (EMR-S) of each patient in the form of office applications as well as hard copies. The office applications manage reporting, financial accounting, and bookkeeping. The clinic also has access to the Internet for reporting to the central office located in Malang.

There were 12 patients who participated in the testing. In qualitative research, there are no set rules regarding sample size, and the size of the sample should be guided by the ability to provide rich information.[38] Patients who were at least 18 years old were ideal for this research because it was likely that they were old enough to make decisions about their own health concerns. The participants include two males and ten females. Participants were willing to participate in research for several reasons. Some hoped to get free access to health care services and consultation. Others participated because they wanted to know the online services in Clinic 2.0. Without this important relationship between research participants and researcher, it would be much more difficult to engage in testing scenarios. Participants' experiences were assessed with a survey and follow-up interviews. The confidentiality of individual responses and ethics were safeguarded. There was no financial inducement to take part in the testing process. To encourage participation, researchers sponsored participants whenever they made a direct consultation during the three months of testing periods.

The clearest understanding of someone's experience comes from an insider's perspective.[39] Therefore, the study also employed qualitative methods on data collection from interviews with the OHE and participants. Qualitative methods have been commonly used in health research such as health service research, health/medical education, and health technology assessment.[40] Qualitative research has inclusive and flexible methods of data collection of inquiry by participants and medical staffs. A qualitative method is used to contextualize the research process regarding the nature of knowledge and the researcher's assumption about knowledge.[41] Knowledge is best constructed as humans interact with the world.[42] It considers online health educators to be the best informants

when it comes to describing what and how tools differ. The researcher listened to the online health educator's feedback and used the opinions to understand responses from a first-hand perspective.

Accordingly, the researcher proceeded to analyze, interpret, and reconstruct the participants' individual truths and the OHE's feedback to address the questions that directed this research. The researcher used inquiry to give a holistic view of processes to examine and draw conclusions based on the multiple realities of the way participants responded to Clinic 2.0. In the inquiry, experiences must be examined with three dimensions through interaction (personal and social), continuity (past, present, and future), and situation (place).[43] Interview and inquiry were appropriate for this study because the methodology is useful in illustrating and representing the lives and experiences of groups in society who have experienced the health care system and process during their lifetime. In this research, inquiry allows participants and online health educators to express their views that have never been channelled before.

Clinic 2.0 was uploaded online before the interview. The researcher ensured that the system was accessible even with a slow Internet connection. Participants and an online health educator were trained on how to use and navigate the systems respectively. The researcher demonstrated in front of the OHE how to navigate the systems, and then the researcher asked the OHE to practice, navigate, and interact with the system. If any problems were encountered during interaction with the system, the researcher encouraged the OHE to contact her or him for further assistance.

Each interview was scheduled for 45 minutes. All interviews were held in clinic *Aisyiah*. The location was selected because

it allowed participants maximum privacy and convenience to express themselves. Key points from the interviews were recorded. Primarily, the researcher took notes, focusing on answers to the questions. The researcher began each first interview by welcoming and thanking the participants for their participation. The researcher took a few minutes to engage in casual conversation before beginning with the questions. The researcher reminded participants of measures that would be taken to maintain their confidentiality. The researcher explained that their identity and others mentioned during their interviews would be masked in all reports and presentations. Participants were told that only the researcher would record their interviews, and the clinic staff would only receive a description of overall findings from which all identifying information would be deleted. The following section discusses the interview results for the factors that affect customers' satisfaction and health literacy.

Customer Satisfaction

From a health care organization's perspective, patient satisfaction was viewed as a valid measure of efficiency in a health care business process as a means to attract potential customers and maintain them for future services. Many factors and aspects of health care determine an individual's opinion regarding satisfaction after interacting with Clinic 2.0. The questions posed to the participants was whether they were more satisfied with the system and what made them more satisfied after using this system. The answers were categorized into three independent variables of this study. Table 4 covers the points given by the participants during the interview session.

Table 4. Summary of Interviews on Customer Satisfaction

Features	The Results
Empowerment	• Appointment time accelerated to avoid patient waiting for a long time (Accessible) • Easily look at health result (Accessible) • Easy to access and comprehend by all users (Usability) • Easy to use (Usability) • Good for those who do not have much time (Accessible) • Provide convenience to all • Accessibility is much more convenient for the patient (Accessible) • System and accessibility give convenience • Convenience and time saving (Accessible) • We can make an online appointment because as patients we are able to save time and it is more convenient for both the health care center and the patients (Accessible) • Good for quick access (Accessible y) • Empowerment, accessibility (Accessible) • Provide better service in terms of service quality (Quality of Service) • Easy, save time, more info to improve our health (Quality of Service) • Faster service, manageable, and easy (Quality of Service) • I hope Clinic 2.0 will be expanded to include all aspects of health (Usability) • I like to have control of my medical records (Accessible)
Online Health Educator	• Asking the doctor for advice about medicines can be made easier (Consultation made easy) • Ease the connection between the doctor and the patients (Consultation made easy) • Someone looks after the service (Consultation made easy) • Good for patients who do not have much time to see the doctor, because limited waiting time. (Efficient) • Easy to refer and discuss my health-related problem (Simplicity) • Good as doctor and patient can save time (Efficient) • Doctor provides e-service faster, precision, and high quality (Quality of Information) • Save patient's time, knowing you are dealing with the right professional, people seek advice on health issues, getting the health information at the touch of a button. (Quality of Information) • Efficient in making consultation and user friendly • Doctor gives quick service, management, and easier to contact • It helps patients in communicating with health care providers, and I hope it will soon be fully implemented (Consultation made easy) • It helps patients in communicating with health care providers easier.

Table 4. Summary of Interviews on Customer Satisfaction *(Continued)*

Social Networks	• Strongly approved support groups make people interact and share (Support)
	• The information and knowledge in social networks is highly beneficial for user learning and it should be monitored regularly to achieve the objectives and avoid scams or promotion. (Knowledge Sharing)
	• Easy access-can be accessed through phone, fast uploading, user friendly, and instant messaging with friends. (conectivity)
	• I am hoping Clinic 2.0 will soon be implemented fully to ease the process and group discussion helpful and give information from the perspective of others that we may hard meet physically, though I observe, may be because new, not people are utilizing it (Support).
	• This helps anyone to access more information and share it anytime. (Knowledge sharing)
	• Communications between patients are well recommended. I like health promotion program online in groups and social networks (Knowledge sharing)
	• It is easier to update the status of personal health if a person wanted to

Source: Authors' Compilation, 2012

The interview revealed some important factors from empowerment, social networks, and online health educators. Empowerment affects customer satisfaction because of accessibility, usability, comprehensiveness, and quality of service (QoS). The outcome of empowerment relates to disease and treatment such as self-management, perceived control over the information, self-determination of health and treatment, level of health literacy, and so on. Social networks affect customer satisfaction as the networks provide platforms for connectivity and knowledge sharing among customers. Finally, an OHE helps to improve customer satisfaction through quick responses to customers' queries, knowledge sharing, and online consultations.

Health Literacy

The question posed to the participants was whether they could improve their health knowledge and literacy after using the system. What factors made them improve their health literacy? The answers were categorized into three research variables: empowerment, social networks, and online health educators. Table 5 covers the summary given by the participants during the interview session.

The most important attribute of Social CRM is the empowerment of customers to participate actively in creating value in the health care process. Empowerment is one of the key variables of this study supported by quotes from the participants as the primary form of analysis of data. The participants agreed that empowerment could improve their understanding and knowledge of health conditions. Many expressions unfolded from the interview regarding the relationship between empowerment and health literacy. From the interview sessions, empowerment in Clinic 2.0 provides participants with the ability to control the

Table 5. Summary of Interview on Health Literacy

Features	The Results
Empowerment	• I strongly agree with this system. This system can help me to view my medical records online as well as make an appointment online. (Control process)
	• It can help me to update my medical records online (Control Data)
	• Consultation made easy with the option provided (Personalization)
	• I can share my online medical records even with another doctor from another hospital; my health record can be seen by only me and my trusted doctor. (Control Data & Process, Decision Making)
	• Make appointment online is good; a great idea to refill for prescription online; I like to request for referral online; I like to communicate or consult my health status with the doctor online; Clinic 2.0 is designed to meet the need of patients not the health provider. Security of personal information must be 100%. (Control Process and Decision Making)
	• I like to have control of my medical records; it makes me aware of my personal health conditions.
	• Easier to control and update status of personal health
	• It feels convenience and trust with the process of consultation (Trust)
	• The medical records are reliable and give me a better understanding of my health. (Trust)
	• It gives a solution that allows us to access medicines (Control data)
	• It is nice when we can refill prescription our medicine online and to make an appointment online; other than that I want my medical history to be private just between me and the doctor. (Accessibility)
	• Personalized service can help patients determine what they information they need to know and what they do not need. (Personalization)
	• In certain cases, e-health system is essential for our country for the improvement and efficient communication; also to cut down waste of time and this is in line with the developed nations or worldwide
Online Health Educator	• Medical staffs at Clinic 2.0 open to guide us from any misunderstanding about any illness and sickness. (Online guidance)
	• Clinic 2.0 is very efficient; ensure that the technician is aware of all the systems; information accuracy must be accounted for. (Information Quality)
	• It should be or have easy reference not just very long explanation. People mostly only need info of their health on treatments, alternative method of prevention, medicines that are effective. They need those infos from Clinic 2.0 (Guidance)
	• The person in charge is good if it can also provide important information on various diseases. However, at present it is still not so important, except for patients with some common serious diseases such as diabetes, kidney cancer, and heart problems." (Information Quality)
	• This is a good idea and makes it easier to monitor our health and ask for an explanation in instant time (Quality of Service)

Table 5. Summary of Interview on Health Literacy *(Continued)*

	• More discuss with the professional doctors online
	• Make us easier to get an appointment with the doctor; we care for our health by the update from systems; discuss with the doctor (Quality of Service)
	• Weekly update for our information (Quality of Service)
	• Clinic 2.0 can provide reminder for patients. Given more advice how to be a healthy person. (Quality of Service)
	• Clinic 2.0 allows patients and doctors to discuss about health conditions of patients without seeing the doctor. This could be a faster way to get advice rather than seeing the doctor individually. This should be improved to be more user friendly. (Quality of Service)
	• Every month must check health (Quality of Service)
	• Admin should update regularly
Social Networks	• It also can help us to *get in touch* with other patients who have the same condition. (**Sharing**)
	• Provide easy access and frequent update, many medical information will be helpful (**Rich Contents**)
	• Sharing medical records is fine but it depends on the individual. It must be an option whether to share their information or not to protect their privacy (**Sharing**)
	• More information on living a healthy lifestyle for instance, healthy food, activities, others (**Rich Contents**)
	• We can know which are the most popular diseases and post how they can approach to reduce and anticipate. (**Sharing**)
	• Clinic 2.0 is expected to make life *easier* and help the country to control the health status of any citizens. (**Informality**)
	• The person is a proponent of Clinic 2.0. However, this person is also concerned that patient confidentiality may be compromised if electronic health records can be accessed by a third party. The use of social networking and online support groups in digging for relevant information will reduce patients' concerns on their current health condition, or doctor's diagnosis. (**Support**)
	• Discussion on health promotion program online beneficial to gain more health information. (**Support**)

Source: Authors' Compilation, 2012

data and processes, decision-making, trust, and personalization of services. According to participants, these factors improve health literacy. The majority of the participants appreciated the empowerment process in the systems. They explained how participants benefit from increased access to knowledge. They are not only obtaining health information that is relevant and tailored to their needs, but most importantly they are also personalizing information leading to the process of personal decision-making. The participant may act based on records, such as the decision to take part in

planning future treatment and prevention programs.

How can social networks in Clinic 2.0 support health literacy? Data collection revealed that sharing in social media, conversation among users, and the ability of users including patients to participate in creating value and knowledge-based management have a role in improving health literacy of the participants. While e-health has transformed into more complex online services, featuring Web 2.0 tools requires an extended role and scope of duty for the health care professional to specifically look after these services. As discussed above, the new entity introduced, the Online Health Educator (OHE), is a dedicated health staffer who is responsible for establishing relationships, communications, education, and consultations with the patients. The OHEs are dedicated health staffs who are specifically responsible for patients at Clinic 2.0. From the study, the factors that form relationships between online health educators and health literacy are guidance, quality of service, and quality of information.

Conclusion

We conducted a survey to verify empowerment features established in the CRM 2.0 model. The results of the survey confirm that customers prefer the empowerment features derived from the model. They prefer to have control over information on their health and other applications that may affect their health. Moreover, the survey also confirms that the availability of online health educators proposed in the model are important to achieve the goals of e-health in educating and promoting better health to customers. CRM 2.0 shares the exceptional capabilities of social media and social networks that provide a new approach, which transcends traditional CRM. The majority of respondents agreed that both social networks and social support online should be part of an e-health system. The future direction of the study is to design a prototype based on our model. The prototype will be used to validate our model and to confirm that the empowerment featured by an e-health system is essential and is backed by reliable research.

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Determinants of Differentials in Pneumonia Mortality in the UK and France

Rizwan ul Haq, Patrick Rivers, Muhammad Umar, and Yohannes D. Wado

Pneumonia is one of the major causes of death in the world. Age-adjusted mortality from pneumonia in the United Kingdom was three times higher than it was in France in 2004. The purpose of this article is to find the underlying determinants of pneumonia mortality differences between these two countries. The main research question is "what are the determinants of pneumonia mortality in the UK and France?" Reviewing the underlying determinants of health inequalities, we expected that behavioral factors, environmental factors, and the health care system would account for the differences, but they do not actually account for much of the differences in Pneumonia mortality between the UK and France. The main difference is due to data quality problems particularly relating to diagnosis and certification in both countries.

Add **Keywords**:

1. Introduction

1.1. Background

Pneumonia is an inflammatory lung disease normally caused by bacteria, a virus or chemical irritants. Moreover any lung injury or illness such as lung cancer or alcohol abuse may also cause the disease. Pneumonia belongs to a respiratory disease group that ranks among the top 10 causes of death in the world. Viruses cause half the reported pneumonia cases and are believed to cause less severe illness than bacteria-caused pneumonia.[1]

Pneumonia is more common in the United Kingdom (UK) than in France. Age-standardized mortality from pneumonia was about 33 per 100,000 people in the UK and 9 per 100,000 people in France in 2004.[2] Children and elderly people most commonly get pneumonia, and the autumn or winter are the two seasons in which most of the pneumonia cases are reported.[3]

The symptoms depend on the severity and type of infection. Most common complications include pleural effusion (an accumulation of fluid around the lungs), breathing difficulties, septicemia (a spread of the infection to the patient's blood), and < the most dangerous one, blood poisoning.[4]

The main determinants of pneumonia mortality include environmental, demographic, and behavioral factors, as well as the health care system of a country. Being in poor health, old age, smoking, alcohol abuse, heart disease, lung diseases, and low immunity to infection (AIDS) are among the major predisposing factors for pneumonia. A pneumococcal vaccine is available for preventing pneumonia caused by Streptococcus pneumonia infection. Eradication of bad habits including smoking and drinking may also reduce the susceptibility of pneumonia.

1.2. Research Question and Objective

The main objective of this study is to find out the main determinants of differences in pneumonia mortality between the UK and France. The main research question is "what are the determinants of pneumonia mortality in the UK and France?" The specific research questions are:

- What is pneumonia, and what are its causes and prevalence?
- What are the differences in the socio-economic and demographic characteristics of populations of the UK and France?
- What are the differences in behavioral and environmental factors in the subject populations and how do these differences relate to differences in pneumonia mortality?
- How do the health care systems of the two countries differ?

The article is organized in to five sections. In section one research questions with the objective of the article are discussed. Section two deals with theory and the conceptual framework. Data sources and methods are discussed in section three. Section four contains the results followed by the conclusion in section five.

2. Theory and Conceptual Framework

2.1. What Is Pneumonia?

Bacteria are the main cause of the infection leading to "typical pneumonia," including Streptococcus pneumonia, which causes pneumococcal pneumonia. Other microorganisms that can cause other forms of pneumonia are classed as "atypical pneumonia" and include Legionnaire's disease (caused by a bacterium) and SARS (severe acute respiratory syndrome, which is caused by a virus). Moreover, Pneumonia can be noninfectious and is normally known as "aspiration pneumonia." The major cause of this type of pneumonia includes inhaling substances, such as caustic chemicals, food, or vomit, into the lungs.

The symptoms of pneumonia include fever, dry cough, headache, muscle pain, weakness, and increasing breathlessness, which are similar to influenza symptoms.[5] The symptoms may be quite acute beginning with a dry cough and eventually progressing to a cough with a green/yellow or rust-colored smelly phlegm.

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A few immunizations are available to prevent the causes of pneumonia. For example, Haemophilus influenza type B vaccine ("Hib" vaccine) prevents flu. Normally a single dose of the vaccination is given on annual basis to babies, to the elderly, and to those with chronic lung, heart, or kidney diseases, or with a weakened immune system.[6]

2.2. Theory

Pneumonia morbidity and mortality may vary with age, sex, ethnicity, and related demographic characteristics. As mentioned

above, the elderly, children and those with certain health problem, including chronic obstructive pulmonary disease (COPD), diabetes, diabetes mellitus, congestive heart failure, and sickle cell anemia. High vulnerable groups include people with AIDS, those undertaking cancer therapy, those who have had an organ transplant, and chronically ill patients.[7] Thus, pneumonia triggers with a viral upper-respiratory-tract infection or, among the elderly, with flu, and in most case people with some pre-existing conditions, infections, or weakened immune systems fall prey to this disease.

Studies on the influence of gender as a risk factor for pneumonia provide contradictory results. According to "An Atlas on Mortality in the European Union," produced by the European communities, influenza and pneumonia are responsible for 3 percent of male deaths and 4 percent of female deaths in the European Union.[8] These infectious diseases have a greater impact on female mortality than chronic diseases, in contrast to the situation for men. The large number of older — and hence more susceptible — women explains why the differences in mortality between the sexes are less marked for these pathologies. Others suggest that males as compared with females and Blacks as compared with Caucasians are more likely to get pneumonia.[9] The latter is mainly attributed to socioeconomic differences between the two groups.

There is a common argument and extensive literature suggesting that behavioral (lifestyle) factors such as smoking, alcohol consumption, diets, and exercise contribute to health inequalities among populations. Smoking is one of the behaviors that predisposes individuals to various diseases and causes premature deaths. Cigarette smoking leads to impaired immune defenses and increases the risk of certain infections.[10] Further, smoking alters the responsiveness of inflammatory cells and lung function suffers an accelerated rate of decline with age. In a prospective cohort study using data from 40 years of follow-up of smokers, Doll, et al., observed the strongest cause-specific associations between smoking and respiratory and cardiovascular diseases.[11] However, smoking and pneumonia demonstrated a weak but statistically significant relation for people belonging to various age groups.[12]

Like smoking, consuming excess alcohol is also a predisposing factor to various diseases. The vulnerability of alcohol users to various infectious diseases – among those, bacterial pneumonia exerts the strongest association with alcohol use – increases due to its suppressive effects on the immune system; however, the underlying mechanism of such a relationship continues to evolve.[13]

Based on animal experiments, which may not be demonstrated epidemiologically in humans, Pistelli, et al., attributed the ambient air pollution along with smoking as main reason for increasing incidents of respiratory infections.[14] Components of air pollution, such as ozone and nitrous oxide, and exposure to tobacco smoke damage clearance of bacteria from mouse lungs and increase fatality rates following acute infection.

2.3. Conceptual Framework

Figure 1, below, shows the conceptual framework of the study. The demographic factors of the two subject populations, the UK and France, like the age distribution of the population, have an effect on individual behavior. It has been observed that age is quite important as children and the elderly

Figure 1. Conceptual Framework of the Study
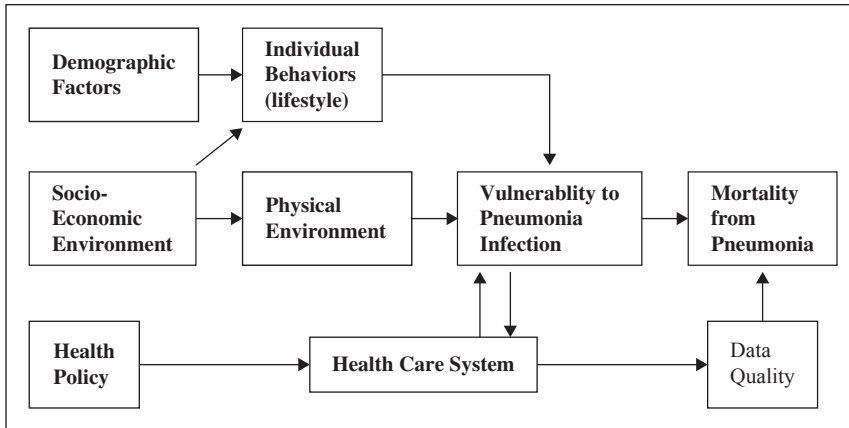
populations are the most vulnerable groups. The elements of age and gender also have been included in the model because it is assumed that both influence habits, nutrition, lifestyles (sedentary or active), and risky behaviors (smoking, drinking, and so on). This behavior affects the vulnerability of the individual to acquire pneumonia and eventually leads to the higher or lower level of mortality caused by pneumonia.

It is assumed that the physical environment, including climate and topography of the country, will have a direct effect on the population's vulnerability to pneumonia. The vulnerability increases in a cold and wet climate, which ultimately increases mortality. Other environmental factors such as pollution, density of population, and congested housing facilities, all are influenced by the socio-economic environment. These factors determine the vulnerability of the individual to acquire pneumonia and eventually will affect the individual's mortality by pneumonia.

The health policies of the countries under study has been given importance, and they

are included in the model. The favorable and conducive health policies are supposed to create a better health care system (hospitals, doctors, paramedical staff, clinics, immunizations, and sanitation system). An efficient, need-based, and modern health care system is assumed to decrease the vulnerability of the individual, while an inefficient and out-of-date health care system is supposed to increase the vulnerability of the individual, which has an ultimate effect on mortality by pneumonia. It is also pertinent to mention that the vulnerability for pneumonia infection also affects the health care system. For instance, if there are a large number of vulnerable people, the health care system may fail to provide better health care facilities and services to them.

The connection of vulnerability to pneumonia to mortality by pneumonia can also pass through the health care system. If the vulnerable population (persons having a greater risk of acquiring pneumonia) is provided with better health facilities and a better care system, they can be cured, or the chances of mortality can be reduced.

3. Data and Methods

The crude death rates from pneumonia are 17.8 and 60.7 per 100,000 in the UK and France respectively.[15] These statistics are taken from the Eurostat, and all the diseases in categories J12 to J18 are classified as due to pneumonia from the International Classification of Death (ICD). The actual data is provided by the member countries to the Eurostat. Eurostat has a quality check on the data, which includes consistency checks, to identify incoherent data. The quality of the Eurostat data is subject to classification and the coding procedure in each country, especially in certification processes and diagnosis.

To explain the differences in the death rates due to pneumonia in the UK and France, we used literature review and data on health care utilization, behavior and lifestyle, physical environment, socio-economic status, and demographic characteristics. Health policies in the two countries were also studied. Data quality and comparability was also analyzed.

Secondary data was taken mainly from the World Health Organization (WHO), Eurostat databases, the Office for National Statistics for the UK, and the Institute for Alcohol Studies. Since the data are taken from different sources comparability may be questionable.

4. Results

4.1. Demographic Factors

Mortality from pneumonia in the European Union (25 countries) was estimated at 15.8 deaths per 100,000 people in 2004. At this period, the highest age-adjusted mortality rates from pneumonia were observed in Ireland (42) and the UK (33).[16] According to data from Eurostat, France had a lower mortality from pneumonia compared to the UK during the periods 2001 to 2005. Table 1 below shows the age adjusted mortality rates from Pneumonia by sex.

The data given in Table 1 is age standardized. The use of standard death rates based on the standard European population improves comparability over time and between regions, as most causes of death vary significantly with people's age and sex. The data in Table 1 clearly shows that the UK has a higher mortality from pneumonia after adjusting for age.

Table 1. Pneumonia Mortality in France and the UK by Sex, 2001–2005

Mortality per 100,000 People						
	United Kingdom			France		
Year	Total	Men	women	Total	Men	Women
2001	33.8	38.9	30.6	10.1	14.1	7.6
2002	34.6	38.9	31.6	10.6	14.8	8.2
2003	36.4	40.5	33.5	11.4	15.6	8.9
2004	33.0	35.7	30.8	9.0	12.5	7.0
2005	33.0	35.5	30.9	-	-	-

Source: Eurostat, 2007[17]

In addition, it is observed that the age composition of the two populations (France and the UK), as shown in Table 2, is almost similar. In both populations the proportion of children and the elderly is 18 percent and 16 percent respectively in 2004. But, female life expectancy is slightly higher in France than in the UK. Life expectancy at birth is 77 years for males and 84 years for females in France, while it is 77 years and 81 years for males and females respectively in the UK.[18] This means that age does not help to explain the difference in reported pneumonia mortality between France and the UK.

Though data on age-specific incidence of pneumonia is limited for this analysis, it is observed from studies that both the incidence and severity of pneumonia infections are higher among children younger than five years of age and in the elderly (above 60 years old). In children, the majority of deaths occur among infants. In the UK, the incidence rate of community acquired Pneumonia is estimated at 34 per 1,000 in people aged 75 years and older.[20]

Differences in pneumonia mortality between men and women was observed in both the UK and France. Mortality from pneumonia was higher among men than women in both the UK and France.

4.2. Behavioral (Lifestyle) Factors

Smoking and Pneumonia

In the UK half of about 13 million smokers may die prematurely due to smoking with an average loss of eight years of life.[21] There will also be an increase in deaths due to smoking worldwide. Smoking accounts for 20 percent of deaths in England.[22] Further, about 17 percent of pneumonia deaths were caused by smoking in 2002.[23] In France, it is estimated that 66,000 people die as a result of smoking, and 90 percent of lung cancers are caused by smoking.[24]

Alcohol and Pneumonia

In both France and the UK, alcohol consumption is among the highest in world, but with a different trend in the past years. The UK has been a relatively moderate consumer compared to other Western European countries previously. France had one of the highest known levels of alcohol consumption in the world. But, in the last decades, alcohol consumption has fallen in France, while it continued to rise in the UK. Yet alcohol consumption is still higher in France than the UK. In 2003, per capita pure alcohol consumption was estimated at 12.3 liters per adults older than age 15 in France, while it was 11.4 liters for the UK.[25] In both countries, the figure was higher than the average EU per-capita consumption

The date in text is 2005, but the only entry in the list of references is dated 2004. Please confirm that this is the correct reference for this note. Also, there are two Websites shown in the reference. Please confirm that the second Website should go with Note 29.

Table 2. Population Age Distribution & Life Expectancy at Birth, France & UK, 2004

Country	Total population	% under age 15	% age 15–64	% age 65–79	% age 80+	Life Expectancy, Male	Life Expectancy, Female
France	62,130,243	18.5	65,1	12	4.4	76.7	83.8
UK	59,699,828	18.2	65,9	11.6	4.3	76.7	81.1

Source: Eurostat, 2007[19]

level of 10.7 liters per adult per year. Figure 3, below, shows the trends in alcohol consumption of the two countries until 2003.

According to an estimate, about 8,000 to 40,000 people per year die due to alcohol use.[27] From 1991 to 2005 the death rate for diseases directly related to alcohol use doubled in the UK from 6.9 per 100,000 population to 12.9, and the majority of the deaths occurred among males.

Physical Exercise

Physical activity and physical fitness are known to be associated with a number of health-promoting behaviors. France and the UK differ in the kinds of sports most commonly practiced by their people. The sports popular in France include basketball, football (soccer), handball, and both codes of rugby football, while in UK the most popular sport is cricket. The sports in France require more activity and alacrity, which can explain the more healthy population in France.

Education and Employment

With an increase in age Britons' participation in full-time education or training declines, and for young Britons the figure is lowest for the entire European Union.[28] 3

The male unemployment rate in the UK is close to the European average of about 25 percent, and the female rate of unemployment, at fewer than 10 percent is the best in the EU. Further, young British males work longer hours as compared to their European counterparts.

Figure 3. Alcohol Consumption in France and England, 1963–2003

Alcohol Consumption England/France 1963–2003

Source: Institute of Alcohol Studies Fact sheet, 2006[26]
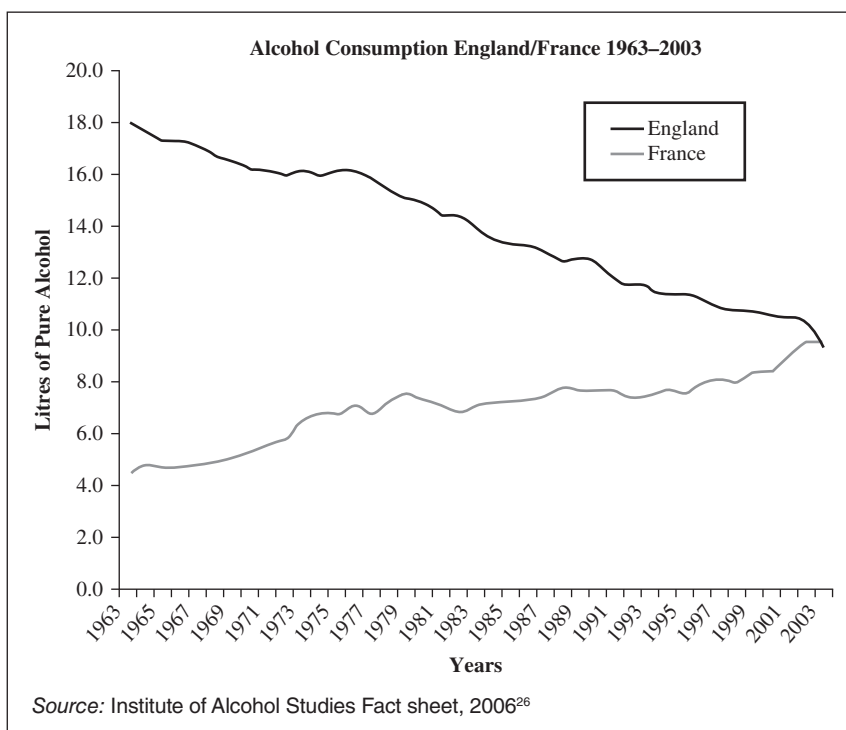
4.3. Physical Environment

The physical environment of the two countries differs greatly. The UK is a lowland terrain with some mountains in the Northwest while France is ringed with mountains. The UK has a temperate climate and temperature ranges from −4 degrees Celsius to 32 degrees Celsius. In France, the average temperature lies between 7 and 23 degrees Celsius. Similarly, in the UK the atmosphere is more humid than France. The difference is greater at night and in winter. In the UK rainfall is much higher in the winter as compared to France. Average daily sunlight is also quite low in the UK as compared to France.[29] So from the above information it is clear that the UK has more rainfall and more humidity as compared to France. And it is suggested that Pneumonia causing microorganisms favor this humid conditions.

There are considerable environmental differences between the UK and France. In December 1991, for example, London experienced a four-day air pollution episode. During the episode, deaths were 23 percent higher than expected, caused by respiratory infections. Consultations with general practitioners rose by 10 percent for upper respiratory and 4 percent for lower respiratory conditions, and hospital admissions of people older than 65 years rose by 19 percent.[30] In the UK national emission of nitrous oxide is 130,391 tons as compared to 240,608 tons in France in 2003. If we look at the emission of nitrous oxide from the energy industry, it is 8,937 tons in the UK as compared to 3,290 tons in France. Similarly if we look at the pollution by ozone, it is much lower in the UK (983) as compared to France (4,313).[31]

4.4. Health Care Facilities

In the UK, general practitioners (GPs) in groups of an average of three GPs provide primary care. In 2002, a GP had to take care of about 1,800 members of the local community. A referral is required from these GPs, who work as the gatekeepers, to consult with a specialist. In contrast to the UK, in France self-employed physicians along with salaried staff in hospitals provide primary and secondary health care, and patients have a free choice of physicians. Despite all efforts, including monetary incentives, the newly introduced gatekeeping system did not show any success.[32]

In terms of the number of hospital beds, France provides better facilities as compared to the UK. In 2002, in France there were 4.2 acute hospital beds per 1,000 population as compared to the UK, which had 3.9 beds in about 240 private acute hospitals, which is less than 5 percent of total beds. On the other hand, France has public (covering two-third of all inpatients beds) and private profit and nonprofit hospitals. Private for-profit hospitals only entertain minor injuries, whereas public and private nonprofit hospitals focus on all other treatments, including emergencies, rehabilitation, long-term care, and psychiatric treatment.[33]

In France there are about 1.6 million health care professionals who constitute 6.2 percent of the total working population. In 2001, France had 3.3 physicians and 6.9 nurses per 1,000 population as compared to 0.6 GPs per 1,000 population in the UK, which faces a shortage of skilled staff.[34]

Furthermore, both countries have some geographical disparities regarding the organizational structures of the health service providers. In the UK, for example, public

health staff may serve at central, regional, strategic health authorities, and the primary care trusts. Similarly, there are geographical disparities in France in the distribution of physicians in favor of urban as compared to rural areas. France's health system is institutionally complex, which causes tensions between the state, health insurance funds, and providers.[35]

> The French health care system was ranked at the top by the World Health Organization in 1997 with the population entirely free from chronic diseases such as cancers, AIDS, or cystic fibrosis.

Less Funding for Research in the UK

In the UK, despite the obvious severity of lung disease, only 3.8 percent of all money spent by the Medical Research Council on medical research is spent on respiratory disease.[36] As a result there is a lack of funds to support a great deal of excellent research. It seems that in the UK the current health debate is not about "evidence" but about the political decisions.

4.5. Data Quality

Data on cause-specific mortality rates greatly depends on the reliability of the certification process of deaths. There is evidence that the differences observed in chronic pneumonia between the UK and France depend less on the differences in prevalence between the two countries than on the differences in certification practices. Some of these differences are due to variations in the ways doctors certify deaths, others are due to the way certificates are coded in each country.[37] Some of the reasons are due to co-morbidity. When the cause of death is mentioned, chronic diseases like chronic

obstructive pulmonary disease (COPD) are mentioned more often than the acute one (pneumonia). Similarly, in death certificates it is difficult to identify all cases of pneumonia as the sole underlying cause of death. In a longitudinal study performed one month after hospitalization in six districts in the Oxford Regional Health Authority area, pneumonia was mentioned on 86 percent of the death certificates of patients diagnosed with it during hospitalization; only 38 percent mentioned it as the underlying cause of death.[38] The main reason for this difference is misdiagnosis of cause of death mainly on Part I of the certificate, but it is improved after the subsequent International Classification of Diseases (ICD) coding. Second, the category of respiratory diseases such as pneumonia is certainly one of the disease groups most difficult to certify.

Is there a reference to support this statement?

Biases potentially affect all causes of death, and this can be particularly serious for diseases of the respiratory system, which are subject to greater variability in certification.[39] These biases have already been recognized by some studies that outline differences in the UK and France (in the UK, the rates of chronic lung diseases are particularly high, while in France there is a high frequency of nonspecific respiratory diseases). So it will be difficult to compare specific pneumonia disease rates in Europe on the basis of data routines.[40]

Please provide full reference.

5. Conclusion

In the foregoing sections, an attempt was made to explain the differences in pneumonia mortality between the UK and France. We found that pneumonia, a disease caused by an infection of the lung tissue by bacteria

and virus, is more prevalent in the UK than France. Age-adjusted mortality rates from pneumonia were estimated at 33 deaths per 100,000 people in the UK and 9 deaths per 100,000 people in France in 2004.[41] To explain this difference, we used data from Eurostat and secondary literature from different sources. We reviewed literature which explained that some groups of people may be more susceptible to pneumonia morbidity and mortality than others, including demographic factors, health-related behaviors, physical and social environments, and access and quality of health care.

However, it was important to find out whether the differences in pneumonia mortality between the two countries were real differences or the result of data quality and comparability problems. According to a study by Eurostat, the largest variation for pneumonia mortality between France and the UK is attributed more to differences in death certification of the disease between the two countries than real differences in prevalence. The certification process has led to a reduction in the reliability percentages in France in particular.

Apart from the data problem, little differences were found with regard to the determinants of pneumonia between the two countries. With regard to demographic factors, for instance, although it was observed that the very old and the very young population are at particular risk from pneumonia, possibly due to their weakened (low) defense system, the UK and France do not differ significantly in their population composition. Smoking and alcohol consumption are probably important factors to explain differences in pneumonia mortality between the two populations.

Differences in sports behavior, education, and employment between the two countries also favor France, although the wet and humid climate of the UK provides a suitable condition for infectious agents.

More important are the differences in the health care system of the two populations in which France was found to have a better health care system than the UK. In 2002, the UK had 3.9 hospital beds per 1,000 population while that of France was 8.4 hospital beds per 1,000 inhabitants. At the same time, there were 0.6 GPs per 1,000 population in the UK, while there were 3.3 physicians per 1,000 population in France in 2002. This would mean that there is less access to secondary and tertiary care in the UK than in France. Similarly, while Pneumonia is more prevalent in the UK, it was also observed that there was less attention given to research on respiratory diseases and primary care such as childhood immunization in the UK.

Au query: This is listed as a reference but not mentioned in the text. Should there be a reference in the text?

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Competition among Turkish Hospitals and Its Effect on Hospital Efficiency and Service Quality

Nazan TORUN, Yusuf Celik, and Mustafa Z. Younis

The level of competition among hospitals in Turkey was analyzed for the years 1990 through 2006 using the Herfindahl-Hirschman Index (HHI). Multiple and simple regression analyses were run to observe the development of competition among hospitals over this period of time, to examine likely determinants of competition, and to calculate the effects of competition on efficiency and quality in individual hospitals. This study found that the level of competition among hospitals in Turkey has increased throughout the years. Also, competition has had a positive effect on the efficiency of hospitals; however, it did not have a significant positive effect on their quality. Moreover, there are important differences in the level of competition among hospitals that vary according to the geographical region, the type of ownership, and the type of hospital. This study is one of the first to evaluate the effects of health policies on competition as well as the effects of increasing competition on hospital quality and efficiency in Turkey.

Key words: *hospital competition, Hirschman Herfindahl Index, Turkey*

Introduction

During the 1990s, increased competition in health care markets became widespread. This trend occurred in developed countries as well as developing ones. Turkey implemented health care reform during this time to increase competition. Many studies have discussed whether increased competition improves quality and increases efficiency in hospital services. The purpose of this study was to determine whether the changing regulatory environment in Turkey increased competition among hospitals and, if so, whether the increased competition improved quality and increased efficiency.

Most studies on competition focus on manufacturing companies; there is less focus on the service sector including health care services.[1] Understanding the effects of competition on the service sector is increasingly important as the service sector in industrialized countries currently represents 60–70 percent of the gross domestic product. However, the health care market is very different when compared to the other service markets. There are numerous facets that distinguish the health care market including, the following: (1) competitive conditions are missing; (2) demand is uncertain; (3) offer-demand balance is unequal (offer is limited); (4) there are limitations in access to the market; (5) patients are often unaware of the services they receive; (6) the services offered are heterogeneous; (7) health care services cannot be substituted nor stocked; (8) correlation between the prices and the real costs is

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weak; and (9) there is a mixed structure in the market including nonprofit institutions.[2]

Studies on hospital competition and strategy suggest that there are several factors that affect the extent to which hospitals compete on price and nonprice.[3] These factors include the policy and regulatory environment, the share and role of the private sector, health insurance organizations and payment methods, the hospital market structure, hospitals' relationship with physicians, and consumers' sensitivity to hospital costs and demographics. This study focused on the policy and regulatory environment in Turkey and the impact that changes to this environment that took place during the 1990s and the early 2000s had on competition which, in turn, affected quality and efficiency in the services provided by hospitals.

Background

Turkey began to change its health care sector in the early 1980s to improve access to health care for all citizens. Before that time, access to health care was limited and was concentrated in certain regions of the country and in the big cities. The Turkish government implemented structural adjustment policies aimed at decreasing governmental control of the health care industry and promoting the expansion of the number of private hospitals. As a result of this regulatory change, the number of private hospitals, especially outpatient centers, started increasing. Hospital outpatient centers competed, primarily amongst themselves, for self-pay patients by focusing on patient satisfaction and quality rather than on price.

During the early 1990s, two studies were conducted by the Turkish government to determine whether the health care sector was

efficient and whether access to health care had improved. The two studies, State Planning Organization and The Second Health Sector Master Plan, were the starting point of all health sector reform discussions held in the 1990s. These discussions suggested that the health sector in Turkey needed restructuring. Public hospitals started looking at their efficiency since the number of private hospitals providing inpatient as well as outpatient services had been increasing, both because of private investment but also because of internationally financed projects. Additionally, the prevelance of nonprofessional management in most hospitals was also questioned.

These discussions led to the Health Transformation Program in 2003, which ushered in a new era in the Turkish health sector. This program changed the way health care is provided in Turkey. Under this program, the family doctor is the first level of care. They are to be the gatekeepers of the health care system and improve primary care while limiting unnecessary hospital visits. The program also aims to increase competition among hospitals in order to promote an environment of constantly increasing quality and reducing costs.[4] Thus, the evolution of the health care sector started with this program, which continues to this day.

The first major milestone in the evolution of the provision of health care started in September 2003 when active and retired civil servants and their dependants were able to use private health care facilities rather than relying solely on public hospitals. This change increased the competition among private health care facilities as they fought to attract more civil servants as well as other members of the Social Security Organization and their dependents.

The next major milestone occurred in 2004 with the development of a pay-for-performance system for health care professionals working for the Ministry of Health (MoH) hospitals. Performance is measured based on the number of patients and number of procedures provided by health professionals without considering the costs of the provided services. This change decreased the number of physicians working in private health care facilities while increasing the revenue generated by the public hospitals. Private health care facilities started viewing public health care facilities as their competitors after this system change.

In February 2005 all public hospitals, except public university hospitals, were merged under the Ministry of Health. The effect of this new regulation was to separate the part of the government that pays for the services (the Social Security Organization) from the part of the government that provides the services (the Ministry of Health). After this radical change, MoH hospitals became the major health care provider of inpatient and outpatient services. Private health care facilities as well as public university hospitals tried to attract more patients from public health insurance organizations because they were paid based on a fee-for-service payment system. Private and university hospitals needed to increase their efficiency levels and decrease costs to meet the burden of health expenditures as a result of the predetermined and packaged prices for many health interventions by public insurance companies.

In 2009, another major change occurred when MoH hospitals no longer were reimbursed on a fee-for-service basis but instead were reimbursed based on a set-fee schedule. Whether this change is positive or negative for Turkey remains to be seen. The former

body, the Social Security Institute (SSK), previously used a reimbursement system in which prices were predetermined and did not usually meet the burden of real costs of providers as a tool in decreasing the SSK's overall health expenditure. If the appropriate rate is set, MoH hospitals will have the necessary tools to compete with private hospitals that remain on a fee-for-service payment plan.

Changes to the health care system in Turkey continue to this day. As of January 2012, all social security organizations were merged into a single body called the Social Security Organization (SSO). The SSO became the single health service purchaser for all citizens of Turkey. Members of the SSO can use private hospitals, which brings a significant mobility to the Turkish health care system. As the number of private hospitals keeps increasing, competition between private and public hospitals has increased as has access to health services. The quality of the health services has improved in many towns. With a payment system based on performance, hospitals prioritize patient satisfaction and high quality of service. Moreover, through market-oriented regulations (per capita payment for hospitals and doctors and the right for patients to choose among health care alternatives), the patients/consumers have become the main determinants of the health care market and the basis of competition between health care providers. Additionally, under the SSO, there have been efforts to empower patients by giving them the right to choose physicians and providers and to report provider or organizational mistakes or improper behaviors. These developments for patients' rights enable citizens to question the quality of health services they receive and to become informed citizens on health

and individual rights while using health care services. Having a single purchaser of health care and informed citizens strongly motivates health care providers to live in an environment that is more competetive. With the transfomation of state hospitals to health businesses, hospitals will be even more subject to market conditions and its pressures.[5]

Previous Research

Increasing efficiency in the delivery of services, increasing choices among patients and their doctors, as well as minimizing costs in health service are among the purposes of competition among hospitals.[6] Studies examining the relationship between quality and competition in health services have been carried out and the effects of competition on quality have been evaluated. Although the studies do not have all the same conclusions, they mostly agree that competition improves the quality of health services.[7] Gawrisankaran and Robert estimated the effects of competition for both Medicare and HMO patients on the quality decisions of hospitals in Southern California.[8] They used the risk-adjusted hospital mortality rates for pneumonia (estimated by the authors) and acute myocardial infarction (reported by the state of California) as outcome variables. Their results are mixed. They found that an increase in the degree of competition for HMO patients was associated with a decrease in risk-adjusted hospital mortality rates. However, an increase in competition for Medicare enrollees was associated with an increase in risk-adjusted mortality rates. In conjunction with previous research, their results indicate that increasing competition for HMO patients appears to reduce prices and save lives. However, increases in competition for Medicare patients appear to reduce quality and may reduce welfare. They concluded that increasing competition had little net effect on hospital quality in their sample.

Other studies have looked at the relationship between competition and hospital efficiency. Competition increases efficiency by offering new and better products and production methods.[9] Competition is an influential strategy in controlling health care costs. Empirical studies reveal a direct relation between competition and hospital efficiency (Nai-Wen Kuo, 1998).[10] Most studies reveal that competition has a positive effect on hospital efficiency and efficiency index variables such as bed occupancy rate, number of inpatients, bed turnover rate, and length of stay (;;;; .[11]

Most research comparing cost, quality, efficiency, and competition has examined hospitals in the United States; however, some studies have examined these issues in other countries. Lien, Shin, and Jin-Tan conducted a study using Taiwanese hospitals to investigate what quality and cost factors influence whether patients perceive health care services as expensive and whether they would recommend a hospital to other patients. They concluded that the perceived value rather than the price itself is the essence of quality competition in Taiwan's health care market. However, given the unique value of health care, the validity of having patients evaluate medical performance as a quality measure needs to be further investigated.[12] Nakambal, Hanson, and McPake assessed the degree of competition for hospital services in two hospital markets in Zambia (Copperbelt and Midlands), and the effects of competition on price, quality, and efficiency. They found substantial variations among hospital types on price, cost, and quality, suggesting that

the hospital market is a segmented market with the type of hospital playing an important role.

A similar discussion may be made for Turkey. Ecevit conducted a study on hospital competition in Kayseri, Turkey, and concluded that there was a negative correlation between increasing competition level and bed occupancy.[13] However, an opposite correlation (positive) was found in our study, also in Turkey. The results of the above studies along with our findings suggest that insurance type, payment method, reimbursement rate, country characteristics, and consumer expectations have different effects in explaining the relationship between competition level and efficiency/quality indicators of competitors.

Even though the advantages of competition in terms of analyzing efficiency gains and guiding health policy makers have been documented, determining whether these same advantages hold true in the Turkish health sector has not been done. For this reason, the purpose of this study is to evaluate whether the developments in the Turkish health sector increased competition among hospitals over time. This study also examines other factors that influence the change in the level of competition and determines whether changes in competition increase efficiency as well as quality of services of Turkish hospitals.

Data Sources

This study uses data collected from hospitals annually by the Turkey Ministry of Health between 1990 and 2006. In these 16 years, there were been tremendous changes in the Turkish health care system in terms of accepted health policies and the number of hospitals. The data allow the measurement of competition on both a yearly and individual hospital basis.

Multiple and simple regression analyses were run to observe the development of competition among hospitals, to determine more likely determinants of competition, and to calculate the effects of competition on the efficiency and quality of individual hospitals.

The more frequently used methods to measure competition in a market are Structure-Conduct-Performance (SCP), M-Enterprise Concentration Ratio, and Herfindahl-Hirschman Index (HHI).[14] Among these measures HHI is currently the more commonly used index.[15] Most of the studies investigating competition among hospitals use two standard measures when gauging competition: the number of hospitals and their relative sizes. In economic theory, markets are defined as competitive when there are many small sellers and consumers have knowledge of products, sellers, and prices. Increasing the number of firms is a sign of increasing competition since individual firms do not have the capability of determining market price when there are multiple firms in the market. Thus, the simplest method to measure competition is to count the number of firms in a market. However, the disadvantage of this method is that it does not take into consideration the relative size of the competitors. HHI is the best method, taking into account both the number of firms and their relative size. In this index, the market share of all firms is calculated and all firms in the market are considered.[16] To determine whether competition changes over time, the HHI for all hospitals for the years 1990 to 2006 is determined by summing the squares of the market shares of each of the

N hospitals, where S_i is the market share, in percentage terms, of the ith hospital.

$$HHI_{(year)} : \sum_{i=l}^{N} S_i^2$$

The market share of each hospital is based on the number of outpatient centers and the number of hospitals treating inpatients per year. Squaring the market shares makes the HHI sensitive to firms with larger market shares. The HHI ranges from 0 to 1, where 1 represents a monopoly and 0 represents perfect competition.[17] Therefore, higher HHI values correspond to a less competitive market. HHI is compared over time to examine the impact of changing regulation on competition among hospitals.

In additional to time, other factors may have influenced the level of competition among hospitals. Region and type of ownership may affect the level of competition. There are more hospitals in certain regions of Turkey than others. Therefore, it is hypothesized that region will have an effect on the level of competition faced by a hospitals just as Nakambal, et al (2202)[18] found in Zambia.

Other studies have found that the type of ownership influences the level of competition faced by a hospital. Kessler and McClellan examined the consequences of hospital competition for Medicare beneficiaries' heart attack care from 1985 to 1994.[19] They also studied how relatively exogenous determinants of hospital choice such as travel distances influence the competitiveness of hospital markets and how hospital competition interacts with the influence of managed-care organizations to affect the key determinants of social welfare expenditures on treatment and patient health outcomes. Their results suggest that spillover effects

from increasingly efficient treatment of privately insured patients affect the treatment of publicly insured patients by mediating the consequences of hospital competition in a way that enhances medical productivity. In particular, managed care appears to increase efficiency by reducing the tendency of hospital competition to result in a "medical arms race" of expenditure growth. Therefore, ownership structure may also play a role in competition among hospitals.

Additionally, hospitals that specialize may face different competition. Vasilache and Prejmerean specified that teaching and research hospitals were dedicated to educating students and residents, which may be regarded both as inputs (valuable medical force prepared to deliver quality health care services), and outputs (these hospitals offer both health and training outcomes) according to their mission.[20] In order to assure a proper medical education, they need expensive, latest generation equipment and, due to their particular clinical research interests, they usually attract the most complicated and severe cases from all over the country. This leads to corresponding increases in the length of stay, and in the cost per case, making them score poorly in the efficiency tests, falling below the efficiency frontier. In a competitive market, these elements would gradually put them out of business. Devers et al. showed that the strategy frequently used by teaching hospitals in a competetitive environment has been the creation of unique services to attract patients with specific diagnoses to their facilities.[21] These so-called niche services are highly specialized and depend on the capabilities of specialists that few other hospitals have the resources to recruit and retain. Niche services can differentiate hospitals from competitors and be

aggressively marketed to smaller, specific consumer or patient segments.

For these reasons HHIs for hospitals are calculated by region, ownership, and specialization status of hospitals. Separate analyses are run to consider whether these characteristics affect competition among hospitals.

Previous research has noted the effect of competition on hospital efficiency and quality of care. Some of the studies in relevant literature have found a positive relationship between competition, efficiency, and quality[22] while some have not found support in

terms of the relationship between competition level and efficiency and quality indicators of hospitals.[23] Therefore, variables that measure efficiency, quality, and other individual characteristics of the hospitals are analyzed. The main purpose of analyses and variables used in the analyses are summarized in Figure 1. Multiple and simple regression analyses are used with natural logarithms of outpatient and inpatient HHIs since the outpatient and inpatient HHIs do not have normal distributions as indicated by the Kolmogorov-Smirnov (KS) test and Q-Q plots.

Figure 1. Regression Models and Variables

Purpose	Dependent Variable	Independent Variable
P1: Estimating competition level among hospitals by years	• Hirschman Herfindahl Index for outpatient services	• Years
	• Hirschman Herfindahl Index for inpatient services	
P2: Estimating the effect of competition level on the efficiency and quality level of hospitals	• Bed occupancy rate	• Hirschman Herfindahl Index for outpatient services
	• Length of stay	• Hirschman Herfindahl Index for inpatient services
	• Bed turnover rate	
	• Crude death rate	
P3: Estimating the more likely determinants of competition level among hospitals for outpatient and inpatient services	• Hirschman Herfindahl Index for outpatient services	• Year
	• Hirschman Herfindahl Index for inpatient services	• Ownership
		• Specialization
		• Region
		• Population of province where hospital is located
		• Number of beds per 10,000 population in province where hospital is located

Results

The results from the examination of competition levels over time are presented in Figure 2, which suggests that competition level among hospitals providing outpatient services and inpatient services has increased gradually. For instance, outpatient HHI which was 0.62 indicating a low level of competition in 1990 decreased to the level of 0.54 indicating that the competition level increased at the rate of 13.7 percent in 16 years. The increasing competition level for inpatient services in 16 years is 22.9 percent, which is higher than outpatient HHI.

From Figure 2 we notice that there is a shift from public hospitals to private hospitals. This could be related to the perception of the quality and no or an acceptable wait time in the private hospitals. Furthermore, the government policy to liberalize the economy and the improvement in the standard of living has increased the demand on private hospitals.

Previous research concluded that increasing number of firms in a market is a significant predictor of increasing competition.[24]

Figure 2. The Development of Outpatient and Inpatient HHI and Changes in Percentage by Years (Base Year: 1990)

Years	Number of hospitals		Outpatient HHI	S.D.	Change (%)	Inpatient HHI	S.D.	Change (%)
	State Hospitals	Private Hospitals						
1990	615	69	0.62	0.29	-	0.60	0.32	-
1991	637	64	0.61	0.28	2.0	0.57	0.31	4.6
1992	653	75	0.62	0.28	1.2	0.58	0.31	3.1
1993	668	81	0.60	0.28	3.5	0.56	0.30	5.5
1994	685	85	0.59	0.28	4.8	0.56	0.30	6.7
1995	702	100	0.60	0.29	3.9	0.56	0.30	6.3
1996	720	119	0.58	0.28	7.0	0.54	0.30	8.7
1997	737	134	0.57	0.28	9.2	0.53	0.30	11.3
1998	766	162	0.56	0.28	10.9	0.52	0.29	12.5
1999	783	187	0.55	0.29	11.7	0.52	0.31	12.2
2000	787	191	0.56	0.28	9.4	0.53	0.30	11.7
2001	808	201	0.56	0.28	10.7	0.52	0.31	13.2
2002*	769	233	0.55	0.28	12.0	-	-	-
2003	788	252	0.53	0.27	15.5	0.49	0.30	18.2
2004*	811	250	0.60	0.80	3.9	-	-	-
2005	789	277	0.56	0.28	9.4	0.48	0.28	20.1
2006	786	307	0.54	0.27	13.7	0.46	0.28	23.0

*Inpatient HHI could not be calculated since number of hospitals was not published in these years.

The results of this study indicate that competition levels have increased in Turkey over time. Figure 2 shows that the number of both public and private hospitals has also increased over time. For instance, the number of public hospitals has increased to 786 hospitals in 2006, a 28 percent increase since 1990. The number of private hospitals has grown at an even larger rate. Compared to the number of private hospitals in 1990 (69 private hospitals), private hospitals all around Turkey have increased at the rate of 350 percent and reached 307 hospitals in 2006—just 16 years. These figures can be interpreted themselves as a significant determinant in the increasing competition level among hospitals in Turkey.

To determine whether time is statistically significant to the level of competition, two simple regression analyses are run. One regression compares the competition for outpatient services over time and the other one examines the competition for inpatient services. According to the findings in Figure 3, both outpatient and inpatient competition levels increased significantly over time. The statistically significant negative coefficients in Figure 3 suggest an increase in competition among hospitals in Turkey with each

passing year with regards to both outpatient and inpatient services. These results may be because of changing policies in Turkey. Starting in 1990 health care policies in Turkey have changed with the goal of increasing the number of private hospitals and facilities to increase accessibility to health service and to improve quality via increasing competition. However, the R^2 statistics also suggest that the year variable itself is a weak determinant in explaining increasing competition level and that the effects of other likely predictors of competition level should be analyzed.

The results of the next regression analyses examining the effect of outpatient and inpatient HHIs on efficiency and quality level of hospitals are presented in Figure 4. Two simple regression analyses (Model A and B) are run to estimate the effect of HHI on each efficiency and quality indicator. Model A estimates the effect of outpatient HHI on each indicator while Model B examines the effect of inpatient HHI. Both regression equations (Model A and B) produced statistically significant results for bed occupancy rate, length of stay, and crude death rate of hospitals. According to the results, increasing competition for outpatients (decreasing HHI)

Figure 3. The HHI Value of Outpatient and Inpatient Numbers by Years

Variables	Outpatient HHI		Inpatient HHI	
	Unstandardized Beta	t	Unstandardized Beta	t
Constant	32.086 (*6.816*)¥	4.71**	44.512 (*8.451*)¥	5.27**
Year	−0.012 (*0.003*)¥	−3.46**	−0.018 (*0.004*)¥	−4.27**
R	0.094		0.124	
R²	0.009		0.015	
F	11.971**		18.275**	

¥:Standard error of unstandardized beta; **: p < 0.000

Figure 4. The Effects of Outpatient and Inpatient HHI on the Efficiency and Quality Level Indicators

	Coefficients		Goodness of fit indices of models		
	Unstandardized Beta	T	R	R²	F
Bed Occupancy Rate					
Model A					
Constant	*82.453 (5.166)¥*	*15.960***	*0.147*	*0.021*	*29.368***
Outpatient HHI	*−3.284 (0.606)¥*	*−5.419***			
Model B					
Constant	*82.168 (4.679)¥*	*17.562***	*0.172*	*0.030*	*35.866***
Inpatient HHI	*−3.329 (0.556)*	*−5.989***			
Length of Stay					
Model A					
Constant	*30.922 (2.292)¥*	*13.489***	*0.282*	*0.079*	*115.169***
Outpatient HHI	*−2.886 (0.269)¥*	*−10.732***			
Model B					
Constant	*27.713 (2.162)¥*	*12.820***	*0.277*	*0.077*	*97.375***
Inpatient HHI	*−2.535 (0.257)¥*	*−9.868***			
Bed Turnover Rate					
Model A					
Constant	*49.426 (5.917)¥*	*10.846***	*0.078*	*0.006*	*7.174**
Inpatient HHI	*−1.725 (0.644)¥*	*−2.678***			
Model B					
Constant	*58.795 (5.421)¥*	*10.846***	*0.078*	*0.006*	*7.174**
Inpatient HHI	*−1.725 (0.644)¥*	*−2.678***			
Crude Death Rate					
Model A					
Constant	*4.986 (0.274)¥*	*18.202 ***	*0.364*	*132*	*179.288***
Outpatient HHI	*−0.430 (0.032)¥*	*−13.390***			
Model B					
Constant	*4.223 (0.234)¥*	*18.042 ***	*0.341*	*0.116*	*154.110***
Inpatient HHI	*−0.345 (0.028)¥*	*−12.414***			

*: $p < 0.05$; **: $p < 0.005$; ¥: Standard error of unstandardized beta

increased bed occupancy rate, length of stay, and crude death rate while decreasing inpatient HHI (increased competition) increases bed occupancy rate, length of stay, bed turnover rate, and crude death rate significantly. The results for bed occupancy rate and turnover rate indicate that the increasing competition level has positive effects on efficiency indica-

tors. However, the findings for length of stay and crude death rate need further explanation. If increased competition leads to increased efficiency, it is expected that increasing competition should decrease length of stay, which means that hospitals use their scarce resources more efficiently by keeping their patients for a shorter period of time. Additionally, if increased competition leads to better quality, it is expected that increasing competition should decrease the crude death rate, which is a proxy for quality care in hospitals. However, the results do not support this. A possible explanation is that competition may be increasing faster among big hospitals in bigger cities that may accept patients whose conditions are more severe. Therefore, increasing competition may have negative effects on length of stay and crude death rate. Another possible explanation for the effects of increasing competition being negatively related to length of stay may be the fact that more hospitals want to keep their patients longer because hospital reimbursement is fee-for-service. The Ministry of Health changed the fee-for-service payment system in 2009, which is outside of the scope of this study. Therefore, increasing the length of stay increases revenues under the fee-for-service payment system that was in place over the time period examined. Both university and private hospitals were under the fee-for-service payment system during the years examined and still remain under that system. The results show that outpatient HHI had no significant effect on the bed turnover rate of hospitals but it does for inpatient. These results indicate that bed turnover may not be a sufficient proxy for efficiency in an outpatient setting.

The results in Figure 4 suggesting that time is a significant factor in increasing competition among hospitals in Turkey war-

rant further investigation. Since 1990, competition among hospitals in Turkey has been increasing. However, other developments in the Turkish health sector may impact competition. Regression analyses are used to examine whether factors other than time influence levels of competition. These factors include the population of a province, the region in which a hospital is located, the number of beds per ten thousand populations in the province, the ownership structure of the hospital, and the specialization of the hospital. The effects of these variables for outpatient and inpatient HHI are estimated and the results are given in Figure 5.

The results in Figure 5 indicate that the population of a province, the number of beds per ten thousand population, ownership, specialization of the hospital, and the region where the hospital is located are statistically significant determinants of competition level among hospitals in terms of outpatient and inpatient HHI. The results also reconfirm that hospitals are getting more competitive over time. A larger population and more beds in a province are found to be significant determinants of competition for outpatient and inpatient providers. This is expected since hospitals operating in an environment with a large population and number of beds need to be more competitive.

The results indicate that general hospitals are more competitive than specialized hospitals. This finding is valid for both outpatient and inpatient and when the small number of specialized hospitals and beds are taken into account.

A dummy variable is used for different regions in Turkey because different regions have different characteristics in terms of economic, social, and cultural differences along with differences in technology and the number of hospitals. The Marmara Region

Figure 5. The Determinants of Outpatient and Inpatient HHI

Variables	Equation for Outpatient HHI			Equation for Inpatient HHI		
	Unstandardized Beta	Standardized Beta	T	Unstandardized Beta	Standardized Beta	t
Constant	244.688 (7.272)ᵛ		33.646**	158.200 (6.995)ᵛ		22.616**
Year	−0.116 (0.004)ᵛ	−0.237	−31.825**	−0.074 (0.004)ᵛ	−0.135	−21.138**
Log of province population	−1.831 (0.053)ᵛ	−0.426	−34.501**	−1.474 (0.050)ᵛ	−0.312	−29.571**
Number of beds per 10,000	−0.026 (0.002)ᵛ	−0.106	−10.939**	−0.020 (0.002)ᵛ	−0.074	−9.010**
Ownership						
Minister of Health	Reference		Reference			
Private hospitals	−1.735 (0.045)ᵛ	−0.340	−38.672**	−3.237 (0.0043)ᵛ	−0.577	−75.982**
University hospitals	0.200 (0.069)ᵛ	0.022	2.904**	−0.481 (0.066)ᵛ	−0.049	−7.328**
Specialization						
Specialized hospitals	Reference		Reference			
General hospitals	0.682 (0.042)ᵛ	0.126	16.245**	1.474 (0.040)ᵛ	0.244	36.628**
Regions						
Marmara	Reference					
Mediterranean Sea	0.249 (0.068)ᵛ	0.032	3.673**	0.103 (0.065)ᵛ	0.012	1.599
East Anatolia	0.085 (0.087)ᵛ	0.009	0.982	0.176 (0.083)ᵛ	0.017	2.130*
Aegean Sea	0.266 (0.065)ᵛ	0.034	4.089**	0.191 (0.062)ᵛ	0.022	3.075**
South-East Anatolia	0.415 (0.087)ᵛ	0.040	4.775**	0.308 (0.083)ᵛ	0.027	3.707**
Central Anatolia	0.097 (0.058)ᵛ	0.016	1.681	0.016 (0.055)ᵛ	0.002	0.295
Black Sea	0.203 (0.076)ᵛ	0.027	2.686**	0.101 (0.072)ᵛ	0.012	1.394
Goodness of fit indices	$R= 0.797$; $R^2= 0.635$; $F=999.638$**			$R=0.828$; $R^2=0.685$; $F=1462,505$**		

*: $p < 0.05$; **: ; $p < 0.005$; ᵛ:Standard error of unstandardized beta

is used as the basis and then compared with other regions in Turkey. The main characteristics of the Marmara Region are the highest levels of development, highest per capita income, and the largest number of hospitals that are well equipped in terms of health care workers and technology in all of Turkey. Large numbers of patients whose conditions are severe have to go to the hospitals located in the Marmara Region from other regions though this is slowly changing. The hospitals located in the Marmara Region of Turkey have to compete more to get outpatients compared to hospitals located in the regions of South-East, Mediterranean Sea, Central Anatolia, and East Anatolia. The hospitals in the Marmara Region also have to compete more for inpatients compared to those hospitals of the Aegean Sea, East Anatolia, and South-East Anatolia regions. The results presented in Figure 5 show that the region of Turkey in which the hospital operates has a significant effect on the level of competition it faces.

The results also show that the ownership structure influences competition. Statistically significant results show that private hospitals compete more to get outpatients and inpatients compared to hospitals of the Ministry of Health. However, competition levels among university hospitals for outpatients is lower while competition levels among university hospitals are higher for inpatients compared to MoH hospitals. There are several plausible explanations for this. University hospitals may prefer outpatients since the cost of outpatients is low and there is no barrier to access to university hospitals for outpatients except that patients may have to travel farther and pay more themselves. There is pressure also to decrease the cost of inpatient treatments and self-pay prices and

to decrease the remuneration used by Social Security Organizations. University hospitals usually claim that the fees predetermined by the SSO are low. University hospitals may have accepted fewer inpatients due to either the high cost of inpatient treatment or the desire to have high quality by accepting fewer patients in their limited number of beds. Ministry of Health hospitals have become more competitive over time. Health policies implemented in last decade, such as separating the financing of health services from the provision of health services and paying for performance for health care workers in MoH hospitals has been forcing these hospitals to become more competitive.

It is also important to keep in mind while interpreting the results in Figure 5, that competition level is calculated by using HHI. This method is based on the market share of hospitals and the market share is affected by the number and capacity of hospitals. It is important to note that competition levels are the highest in Istanbul, Ankara, and Izmir which are the biggest cities in Turkey and many private and university hospitals are located in these cities.

Conclusion

There are several implications of this study. The first implication is that the region in which the hospital operates influences the level of competition it faces. The calculated numbers for inpatient and outpatient HHIs reveal that the health care market in Turkey has the characteristics of an oligopoly market in some regions while other regions have more competition. Those hospitals located in certain regions (Marmara, Aegean Sea, and Mediterranean Sea) that are private or are university hospitals have the characteristics

of a competitive market structure because calculated outpatient and inpatient HHIs for these hospitals have a score of less than 0.1. Hospitals located in the eastern part and the Black Sea regions, as well as those in small cities have almost monopolistic characteristics. These results suggest that environmental characteristics, such as region and area population, play a very important role in shaping the competition level of hospitals in Turkey. The fact that these findings are consistent with the findings of a study on competition among hospitals for HMO business suggests the pattern of competition among hospitals for HMO business may have varied by region, population, and other market characteristics (2002).[25]

Another implication is that public hospitals are less competitive than private hospitals, and general hospitals are less competitive than specialized hospitals. Almost 72 percent of the hospitals in Turkey belong to the Ministry of Health and many of these hospitals are general hospitals that accept all types of diseases. Ministry of Health hospitals and general hospitals have operated in a less competitive environment for years because there was no serious attempt to make hospitals competitive. Private or specialized hospitals, on the other hand, have had to compete for patients for years. These hospitals package treatment for particular diagnoses or patient sub-populations in an effort to differentiate themselves from their competitors. Like the academic medical centers, these specialized or private hospitals advertise services to consumers through traditional media and the Internet in an effort to establish brand loyalty and attract more patients to their highest paying services. The public hospitals have not competed on this level but that is slowly changing.

Another important implication of this study is the effect of increased competition on hospitals' management. According to Ugurluoğlu (2007), a majority of hospital managers in Turkey thought that there would be beneficial consequences to increased competition in a hospital environment so they tried to institute strategies to gain advantages.[26] Hospitals facing more competition, such as those in more developed regions and in cities, have been known to fix prices. Private hospitals have been known to advertise their services in a manner contrary to current health laws. They do this, even at the risk of being fined, to attract patients who are rich and able to pay their health care expenditures out of pocket. Hospitals facing strong competition have an alternative to these types of illegal behavior: go to other less developed regions and cities that have not had the increase in competition that they face in certain regions and major cities. The government will provide them with incentives to do so. It remains to be seen if this will happen.

Competition is usually recommended by authorities as a potential solution for increasing health expenditures. As in other countries, the competition strategies of hospitals in Turkey are limited to mainly patients, physicians, and health insurance companies. Price, which is the main determinant of competition strategy in other industries, is not adequate to ensure competition in the health sector. In the health sector patients can be insensitive to price since their health expenditures are often covered by health insurance companies. Additionally, price competition is limited in the health sector because of government involvement in setting prices for government reimbursement and setting limits on pricing strategies for nongovernment reimbursements. Since hospitals are not free to compete on price, they often compete with quality. Many hospitals, including

some MoH hospitals try to increase their perceived quality by such cosmetic tactics as investing more in their physical appearance, patient satisfaction, and decreasing wait times in outpatient departments.

The major conclusion of this study is that changes in government regulation have increased competition among hospitals in Turkey and have improved access to healthcare. Unfortunately, the benefits of increased competition have not been felt equally in all regions of Turkey. There is much further to go.

The Implications for the Future

As this study shows, competition in the health sector has many benefits. Competition has been shown to decrease prices and increase quality in the hospital industry. Another result of this study shows that increasing the competition level among hospitals in Turkey has had a positive effect on improving efficiency. Because of these benefits, health economists and policy makers should play a more active role in putting processes in place that will increase competition among hospitals. However, it seems clear that classic competition strategies based on price do not work effectively in the health care market. For this reason, health care managers should find more creative competition strategies to attract consumers such as competing on quality. In order to compete on quality, a better understanding of health care quality is the key for new and creative competition strategies. Patient and staff satisfaction surveys are a good place to start in a better understanding of quality issues.

Understanding and strengthening the relationship between increased competition and increased productivity is also necessary. The implementation of electronic patient files and standardizing treatment for more resource-consuming diseases might be a starting point in increasing productivity. Also, a better understanding of the relationship between productivity and managed care is an important topic for further analysis.

This article, among others, makes clear the benefits of competition among hospitals. Therefore, it may be necessary to create new laws and regulations for the Turkish health care system to use competition more effectively to increase health care efficiency and quality.

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A Decomposition Analysis of Medical Expenditure Growth among Injured Workers

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The factors driving the rapid increase in US medical spending are a concern for both policymakers and payers. This article analyzes variation in spending growth rates for a large sample of persons with workplace injuries. We analyze trends by type and age of injury, and by type of provider. Medical spending growth ranged from 2 percent to 12 percent for different injuries, and 3 percent to 16 percent across different types of providers. We decomposed spending growth into price, volume, and service intensity growth rates. Service intensity accounts for 20 percent of overall expenditure growth, but is a particularly large and variable contributor to spending growth in inpatient services, ranging from 35 percent to 73 ercent of total spending growth among the four most prevalent injuries we studied. Efforts to forecast spending, and to design policies that manage spending growth, should account for heterogeneous trends across patients and providers.
Key words: *spending growth, inflation, decomposition analysis, workplace injuries*

Introduction

On a per-capita basis, health care spending in the United States grew at an average annual inflation-adjusted rate of 4.7 percent from 1960 to 2011, outpacing the rate of GDP growth by more than two percentage points (Centers for Medicare and Medicaid Services, 2011).[1] Policy discussions about medical expenditure growth tend to focus on this national average. But this single number masks heterogeneity in the trajectory of health care spending for subsets of the US population, as well as the underlying drivers of spending trends, which are of interest to health care service providers, health insurers, and policymakers alike.

Understanding the components of medical spending growth is important for two reasons. First, it can improve health care spending forecasts. Second, it can be used to isolate the source of high rates of spending growth by categories of injury and disease, as well as trends in the input prices, volume, and intensity of services. Depending on what is driving spending trends, policymakers and health insurers could target interventions

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to monitor expenditures for particular sub-groups of providers, patients, or technologies, while not focusing on those subgroups where spending is growing relatively slowly.

Our article addresses these concerns by quantifying variation in spending growth rates for different groups of patients and providers in a large sample of injured US workers. Injuries account for a substantial proportion of total medical spending in the US, responsible for about 1 in every 10 dollars spent on health care.[2] Each year, about 4 million workplace injuries—a subset of all injuries—are reported in the US, which in 2010 resulted in $12.9 billion of hospital spending.[3] Although injuries are a unique and important setting, our primary objective is to quantify the extent of spending growth variation, and the sources of this variation, across patients and providers. This approach addresses a limitation of prior analyses, which measured overall trends, thereby "averaging over" heterogeneity between subgroups. In contrast to these earlier analyses, we show what types of injuries have the most rapid rates of spending growth, what categories of providers are responsible for most of these increases, and potentially, how much these growth rates could be controlled with policy interventions.

Some research has investigated the extent to which rates of spending growth differ by medical condition, age group, and provider type. Most of these studies use a high level of aggregation and do not consider the way trends differ across the joint distribution of patient and provider types. A few studies find important differences in spending trends for different populations and types of medical services. Thorpe, et al., found that 15 prevalent conditions were associated with 56 percent of US medical spending growth between

1987 and 2000.[4] They found that for some conditions (for example, heart disease), the availability of new therapies caused spending to accelerate, while for other conditions (for example, mental illness), increases in the number of treated patients accounted for most spending growth.Merea, et al., found that spending growth averaged 4.1 percent per year from 1963–2000 for the non-elderly, and 5.8 percent for seniors, but that expenditure increases slowed among seniors in the late 1990s.[5] They attribute this slowdown to the implementation of Medicare's inpatient hospital prospective payment system and reforms introduced by the 1997 Balanced Budget Act. Another study found that spending growth for prescription drugs among the nonelderly outpaced growth for hospital services by slightly more than two percentage points in the 2000s.[6] Finally, an analysis of spending trends among Medicare beneficiaries found that spending grew fastest among less disabled, and likely less costly, beneficiaries from 1992 to 2000.[7]

Economists have sought to disaggregate the contribution of price inflation, utilization, and innovations in diagnosis and treatment capabilities to spending trends. This literature falls into two main categories: studies that directly measure changes in the composition of cases and medical services over time, and those that decompose spending into price, quantity and service intensity categories. Kominski and Bradley employed the "direct" approach, in which they measured the independent effects of changes in a hospital's case mix and cost per case using Diagnosis-Related Group (DRG) level Medicare data.[8] They estimated the contribution of advances in medical technology to both case mix (for example, through diagnosing capabilities) and the resources used

to treat a case. Their analysis found that the effect of technology on both case mix and on costs per case accounted for 37 percent of spending growth per Medicare admission from 1984 to 1987.

Decomposition analysis is the most commonly used technique for examining contributors to medical spending trends, and is employed by the Congressional Budget Office and the Centers for Medicare & Medicaid Services (CMS). This approach considers spending changes to be the product of changes for three components: price, quantity, and service intensity. Service intensity growth is considered to reflect the application of new technologies or other methods in the delivery of care. For example, a change in service intensity could represent the substitution of a new, on-patent drug for a generic drug, or the substitution of an MRI for an x-ray. This is a component of spending growth that may be modifiable through policy interventions. Using the example of an MRI, such an intervention would discourage use of more expensive imaging technology in the early stages of diagnosing a new injury.

Using the decomposition approach, Newhouse concluded that "the principal cause of increased costs appears to be the increased capabilities of medicine".[9] Based on a sample of private insurance claims, Bundorf, *et al.*, found that the highest rates of inflation-adjusted spending growth occurred in outpatient professional services and prescription drugs.[10] Moreover, they found that virtually all spending growth on outpatient services was attributable to nonprice effects (including the adoption of new technologies). Service intensity and volume was responsible for 72 percent of the growth in pharmaceutical spending. Some studies have tried to further decompose the residual into population changes, to reflect trends such as aging and the growing prevalence of obesity. However, empirical work has found that the short-term contribution of aging and obesity to spending growth is low.[11]

New Contribution

Relatively little is still known about how the underlying components of spending growth differ for a broad range of health conditions and providers. This research decomposes spending growth rates for patients with prevalent injuries in a large sample of injured workers into price, quantity, and service intensity components. The analysis is done for subsets of the data defined by injury type, injury age, and provider type. Consistent with most studies in this area, the decomposition approach that we use indirectly measures changes in service intensity. We use a decomposition approach because it is methodologically consistent with earlier analyses and because our dataset provides limited information on comorbidities not related to the worker's injury, which we would need to include in an approach that directly controls for case mix.

To our knowledge, this is the first decomposition-based analysis of medical spending growth to look at trends by medical condition and provider to be conducted using a sample of employed workers. Although our analysis focuses on the trends for one large workers' compensation insurer, our intention is to illustrate the extent of the variation in health spending trends in different segments of the adult population. Use of workers' compensation claims offers us the advantage of observing all medical spending associated with a workplace injury over a

long time horizon. In the private group health market, the frequent turnover of people among health insurers would substantially complicate a similar analysis of long-term spending trends among nonelderly adults.
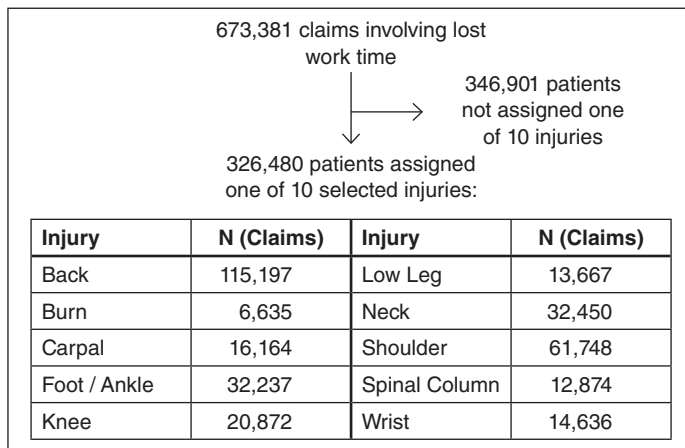
Study Methods and Data

We analyzed medical bills paid by a large, national workers' compensation insurer. We included all individuals who: (1) lost work time due to a workplace injury, (2) resided in the US, and (3) received services between January 1, 2000 and December 31, 2010. The sample consisted of 673,381 workplace injuries (defined as claims). A person may have more than one claim during the study period. Each claim corresponds to a single injury episode.[12] The sample covers a broad cross-section of industries and includes people in all 50 states.

We identified a primary injury for each claim, using a methodology developed by Heins, *et al.*[13] Briefly, this methodology identified an injury based on the frequency of diagnosis (ICD-9) codes associated with a claim's medical bills. We excluded drugs and lab tests from the observations that could con-

tribute diagnosis codes, since diagnosis codes accompanying these bills tend to be assigned for administrative purposes, and may not accurately document medical conditions.[14] Identification of the primary injury was based on the relative frequency of diagnosis codes specific to a particular injury or anatomical region (see the Appendix for the diagnosis codes used to identify injuries). We selected nine of the ten most prevalent injuries for subpopulation analyses, comprising 326,480 claims (48.4 percent of our sample size, and a similar proportion of spending). Figure 1 shows the composition of the sample by type of injury. We omit burns from injury-specific decomposition analyses because of the infrequent occurrence of claims and uneven levels of expenditures associated with this injury.

We identify seven provider types, within which we analyze spending trends. These provider categories are: (1) inpatient hospitals, (2) outpatient hospitals, (3) doctor's office visits, (4) home care, (5) generic prescription drugs, (6) brand-name prescription drugs, and (7) all other services. We use National Drug Codes to distinguish between brand-name drugs and their generic counterparts. We use

Figure 1. Sample of Claims Included in Study

673,381 claims involving lost work time

346,901 patients not assigned one of 10 injuries

326,480 patients assigned one of 10 selected injuries:

Injury	N (Claims)	Injury	N (Claims)
Back	115,197	Low Leg	13,667
Burn	6,635	Neck	32,450
Carpal	16,164	Shoulder	61,748
Foot / Ankle	32,237	Spinal Column	12,874
Knee	20,872	Wrist	14,636

publicly-available price indices to measure inflation for each provider type (Table 1).[15,16] These indices measure changes in the cost of a fixed basket of goods (Laspeyres index), in which the weight of each component of the market basket is determined for a base year and held fixed thereafter. For pharmaceuticals, we use the producer price index, as opposed to the consumer price index, since we are interested in measuring changes in input prices that the insurer faces. In workers' compensation, the insurer pays fully for medical costs associated with a workplace injury; there is no balance billing.

We conduct four sets of analyses. First, we compute an average annual per-capita spending growth rate in the entire sample. Second, we calculate separate growth rates by provider type. Third, we compute spending growth rates by injury age and provider type. Fourth, we stratify the third analysis by injury type, for the nine most prevalent injuries identified above. In each analysis, we decompose the per-capita growth rate into

three components: price, volume, and service intensity. We measure volume by counting the number of invoices, and spending as the final amount paid by the insurer for each invoice. To compute per-capita volume and spending, we divide spending and volume totals by the total number of unique claims with medical spending for the corresponding provider and year. Service intensity growth is then calculated based on the identity:

Annual Per Capita Service Intensity Growth (%) = (Total Per Capita Spending Growth (%) + 1)/[(Price Growth (%) + 1) × (Volume Growth (%) + 1)] − 1

In the injury-specific analyses, we compute ten-year average growth rates by provider type, and construct a weighted average of provider-specific rates to compute injury-average growth rates. Weights are the proportion of total spending represented by a provider for the injury group.[17] We analyzed all final paid claims in our sample.

To compare spending trajectories for new and older injuries, we calculated spending

Table 1. Price Indices Used as Measures of Inflation, by Provider Type

Provider Type	Reference Price Index	Base Year
Inpatient Hospitals	CMS Prospective Payment System Hospital Input Price Index	2006
Outpatient Hospitals	CMS Prospective Payment System Hospital Input Price Index	2006
Doctor's Offices	CMS Medicare Economic Index	2006
Patient's Home	CMS Prospective Payment System Home Health Input Price Index	2003
Generic Drugs	BLS Producer Price Index, Pharmaceuticals for human use, prescription	2001
Brand Drugs	BLS Producer Price Index, Pharmaceuticals for human use, prescription	2001
Other Services	BLS Producer Price Index, Pharmaceuticals for human use, prescription	2001

Note: Base Year refers to the year for which expenditure weights are calculated for components of the market basket. Since complete PPI pharmaceutical data was not available prior to 2003, we assume an annual rate of inflation of 5 percent through 2002.

growth rates among bills incurred in the first year of a claim, and annual growth rates for bills incurred when claims were at least 12 months old. We determine the age of a claim based on the number of days that have elapsed since the initial encounter with medical provider following injury. This approach annualizes spending to the date on which providers first responded to the injured worker's claim. We align this data to price indices based on the calendar year in which the index medical encounter occurred.

Based on our definition of a claim less than one year old, all claims have medical spending in year one. However, not all claims have spending in later years. Since we did not have a census of open claims at different points in time, we treat claims with no spending in a given later year as inactive, instead of as open but with no expenditures. This approach provides an upper bound on the growth rates for older claims, since we exclude claims that would otherwise lower the average. Analyses were conducted in SAS version 9.3 and Microsoft Excel 2007.

Results

Overall and Provider-Specific Trends

Volume and price increases each accounted for approximately 40 percent of the overall annual per-capita rate of spending growth in the entire sample of claims, while service intensity growth accounted for about 20 percent of the rate. (Hereafter, we refer to the average annual per-capita growth rate as a "growth rate" or "rate.") The spending growth rate was lowest for home care (2.8 percent), outpatient hospitals (7.8 percent) and doctor's offices (7.9 percent), and was highest for inpatient hospitals (10.1 percent) and pharmaceuticals (averaging nearly

16 percent for both brand-name and generic drugs) (Column 1 of Table 2).

As shown in Table 2, differences in spending growth between service categories are mostly attributable to variations in volume and service intensity. This is due, in part, to the fact that our measures of annual price inflation are relatively consistent across service categories, ranging from 3.0 percent for home care to 5.9 percent for pharmaceuticals, leaving most variation in spending trends attributable to volume and intensity components. Volume growth was negative for home care (−1.2 percent), low for inpatient hospitals (0.9 percent), and highest for pharmaceuticals (7.5 percent for generic drugs and 6.7 percent for brand-name drugs). Service intensity growth ranged from −0.6 percent for doctor's office visits to 5.3 percent for inpatient hospitals and 5.6 percent for home care. On a percentage basis, service intensity accounted for 52 percent of spending growth for inpatient hospitals, 33 percent for outpatient hospitals, −8 percent for doctor's offices, 15 percent for brand drugs, and 13 percent for generic drugs.

For most services, there is an inverse relationship between volume and service intensity growth. Specifically, when volume growth is lower, as with home care and inpatient hospitals, the service intensity growth rate is generally higher. This is partially a consequence of the identity that we used to relate overall per-capita spending growth to volume, prices, and service intensity for the decomposition analysis. However, it also may also reflect a shift toward more intensive service by some types of providers.

Spending Trends by Injury Age and Provider Type

Spending for workers' compensation claims can occur over multiple years, since

Table 2. Summary of Annual Spending Growth Rates, by Provider Type, Decomposed into Volume, Price and Service Intensity Growth and By Time since Injury

	All Spending for all Years	Spending in First Year of Claim[†]	Spending in Second Year of Claim and Thereafter[‡]
Inpatient Hospitals	19.4%	21.3%	16.3%
Per Capita Spending Growth	10.1	10.1	10.1
Per Capita Volume Growth	0.9	0.5	0.8
Price Growth	3.6	3.6	3.6
Service Intensity Growth	5.3	5.6	5.4
Outpatient Hospitals	20.9%	24.7%	14.7%
Per Capita Spending Growth	7.8	8.0	3.7
Per Capita Volume Growth	1.4	1.3	−1.1
Price Growth	3.6	3.6	3.6
Service Intensity Growth	2.6	2.9	1.4
Doctor's Offices	48.0%	48.5%	47.2%
Per Capita Spending Growth	7.9	8.2	2.8
Per Capita Volume Growth	5.4	6.1	0.6
Price Growth	3.0	3.0	3.0
Service Intensity Growth	−0.6	−1.0	−0.7
Home Care	0.2%	0.2%	0.4%
Per Capita Spending Growth	2.8	7.6	8.8
Per Capita Volume Growth	−1.2	0.7	−3.9
Price Growth	3.0	3.0	3.0
Service Intensity Growth	5.6	6.2	14.3
Generic Drugs	4.1%	1.8%	7.8%
Per Capita Spending Growth	15.9	11.1	11.0
Per Capita Volume Growth	7.5	5.1	3.5
Price Growth	5.9	5.9	5.9
Service Intensity Growth	2.0	−0.2	1.9
Brand Drugs	5.4%	1.6%	11.8%
Per Capita Spending Growth	15.5	10.3	8.2
Per Capita Volume Growth	6.7	3.0	0.4
Price Growth	5.9	5.9	5.9
Service Intensity Growth	2.3	1.0	2.0

Note: Other services not shown in the table.

[†] The first year of a claim is defined as 365 days from the first invoice date associated with a claim.

[‡] The second year of a claim and thereafter is defined as all invoices occurring at least 366 days from the first invoice date associated with the claim.

a patient may not recover from an injury within one year. On average, 62 percent of total medical spending occurred in the first year but varied considerably by type of injury.

For all claims less than one year old, overall per capita spending grew by 8.6 percent per year (Column 2 of Table 2). Overall and within provider types, spending trends in these new claims largely followed the trajectories observed over all years of claims (Column 1 of Table 2). This is not surprising given the large proportion of total spending that is associated with new claims. Exceptions to the overall pattern were pharmaceuticals, where growth was 5 to 6 percentage points lower in the first year of a claim, and home care, where spending growth was nearly 5 percentage points higher in new claims. The contribution of service intensity to these growth rates was similar to that among all claims, but was 10 percent among brand-name drugs and negative for generic drugs during the first year of claims.

Annual spending growth among claims at least one year old slowed to an average rate of 5.3 percent (Column 3 of Table 2). Growth rates were highest for inpatient hospitals and generic pharmaceuticals, and lowest for doctor's offices and outpatient hospitals. With the exception of doctor's offices and brand-name drugs, volume either contributed negatively or negligibly to spending growth in each provider type. As a result, most spending growth in old claims is attributable to service intensity and prices. On a percentage basis, service intensity contributed –25 percent of total spending growth for doctor's offices, 38 percent for outpatient hospitals, and 55 percent for inpatient hospitals. Service intensity contributed to slightly less than 20 percent of growth on pharmaceutical spending after the first year—considerably higher than its estimated contribution among newer claims.

Spending Trends by Injury

Spending growth varied widely across injuries (Table 3). In new claims, spending

Table 3. Decomposition of Annual Spending Growth Rates, by Injury

	Spending in First Year of Claim[†]	Spending in Second Year of Claim and Thereafter[‡]
Back (Number of claims: 115,197)	**$2,074**	**$3,615**
Per Capita Spending Growth	8.1	6.8
Per Capita Volume Growth	4.0	0.1
Price Growth	3.4	3.9
Service Intensity Growth	0.7	3.2
Carpal Tunnel (N = 16,164)	**$2,134**	**$2,230**
Per Capita Spending Growth	6.8	1.2
Per Capita Volume Growth	2.3	–0.9
Price Growth	3.4	3.5
Service Intensity Growth	1.4	–0.3

	Spending in First Year of Claim[†]	Spending in Second Year of Claim and Thereafter[‡]
Foot/Ankle (N = 32,237)	**$1,719**	**$2,591**
Per Capita Spending Growth	11.5	11.4
Per Capita Volume Growth	5.0	4.0
Price Growth	3.4	3.6
Service Intensity Growth	2.8	5.4
Knee (N = 20,872)	**$2,777**	**$2,879**
Per Capita Spending Growth	6.3	8.1
Per Capita Volume Growth	3.3	3.1
Price Growth	3.4	3.6
Service Intensity Growth	0.5	1.4
Low Leg (N = 13,667)	**$2,561**	**$3,108**
Per Capita Spending Growth	9.0	6.7
Per Capita Volume Growth	4.4	2.1
Price Growth	3.4	3.7
Service Intensity Growth	1.8	1.5
Neck (N = 32,450)	**$2,543**	**$3,338**
Per Capita Spending Growth	8.2	6.2
Per Capita Volume Growth	4.0	0.2
Price Growth	3.4	3.8
Service Intensity Growth	1.1	2.7
Shoulder (N = 61,748)	**$3,082**	**$3,319**
Per Capita Spending Growth	9.0	5.0
Per Capita Volume Growth	4.1	1.0
Price Growth	3.4	3.6
Service Intensity Growth	2.0	0.9
Spinal Column (N = 12,874)	**$3,662**	**$4,083**
Per Capita Spending Growth	9.0	5.6
Per Capita Volume Growth	4.2	−0.1
Price Growth	3.4	3.9
Service Intensity Growth	1.6	2.1
Wrist (N = 14,636)	**$1,863**	**$2,461**
Per Capita Spending Growth	9.6	5.0
Per Capita Volume Growth	4.8	0.5
Price Growth	3.4	3.5
Service Intensity Growth	1.5	2.2

Aggregate growth rates, decomposed into prices, volume and service intensity, are weighted averages of the corresponding rates by provider type. The weights are calculated as the proportion of total spending in the injury analysis sample that is represented by the provider. The average per-capita medical spending per injury is displayed in the gray header cells. One injury category, burns, is excluded from the results we present because of the infrequent and expensive nature of these claims, which provided less stable estimates.

[†] The first year of a claim is defined as 365 days from the first invoice date associated with a claim.

[‡] The second year of a claim and thereafter is defined as all invoices occurring at least 366 days from the first invoice date associated with the claim.

growth was lowest for knee injuries, averaging 6.3 percent, and highest for foot and ankle injuries, averaging 11.5 percent. As before, price inflation is relatively consistent across injuries; the decomposition analysis therefore attributes most variation in spending growth to volume and service intensity. On a percentage basis, volume growth accounted for between 34 percent (carpal tunnel injuries) and 53 percent (knee injuries) of spending increases in claims less than 12 months old. Service intensity accounted for between 8 percent (back) and 25 percent (foot and ankle injuries) of spending increases in these new claims. We observed lower service intensity growth when volume growth was relatively high (knee and back injuries), and somewhat higher service intensity growth when volume growth was relatively low (foot and ankle injuries).

For all of the injuries we analyzed, volume growth declined in older claims (those at least 12 months old), such that prices and service intensity account for a greater share of spending growth. The contribution of service intensity to total spending growth was greatest for back and foot and ankle injuries (47 percent) and lowest for carpal tunnel injuries (–13 percent). This could suggest areas in which care was not delivered properly in the initial year and additional follow-up care was therefore necessary. Volume growth was negative for spinal and carpal tunnel injuries, and positive but low for back, neck, and wrist injuries. Volume growth was highest for knee and foot and ankle injuries.
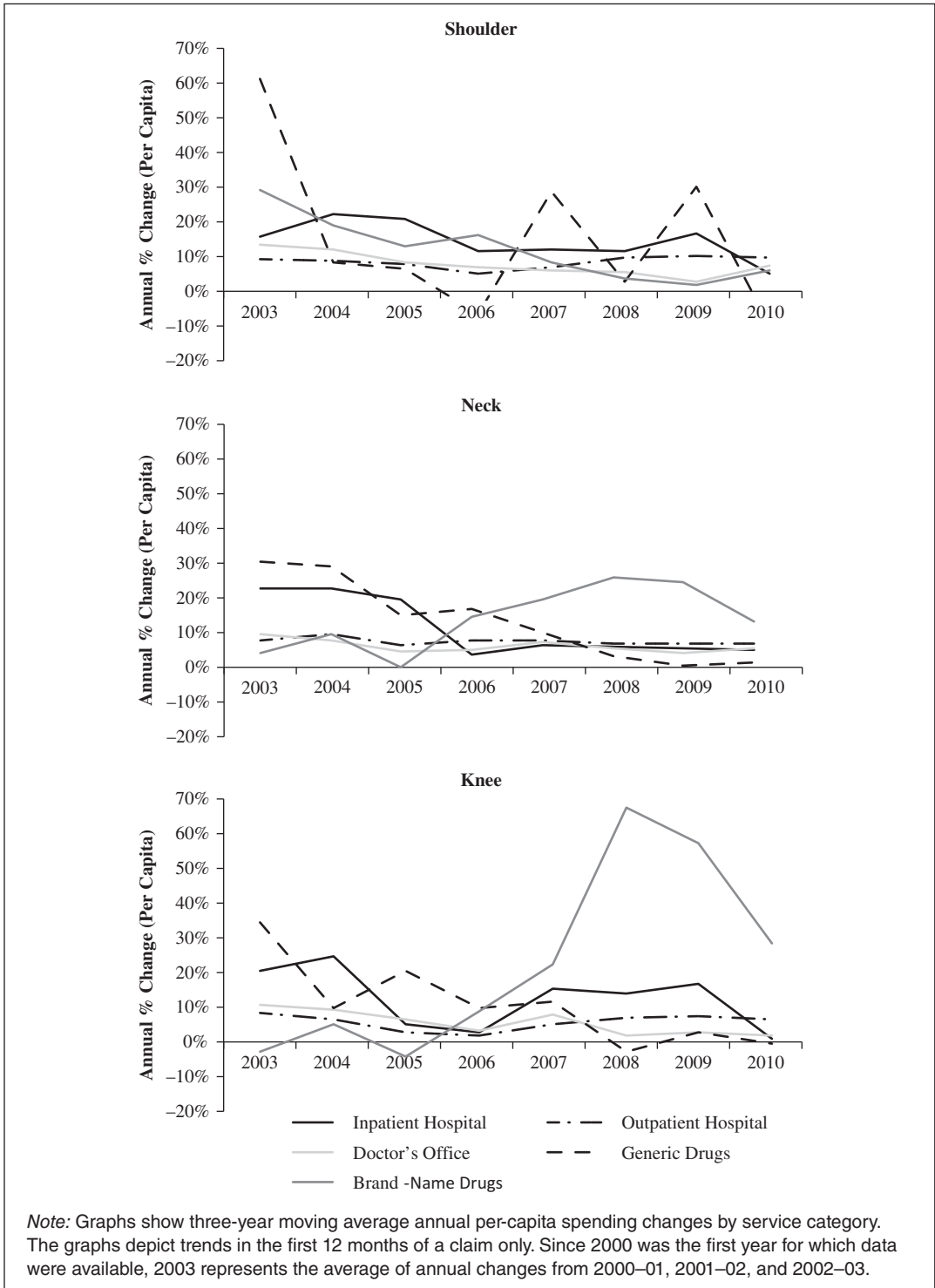
Figure 2 plots three-year moving averages of annual per-capita spending growth rates by provider type for the four most prevalent injuries in our sample: back, shoulder, neck, and knee injuries. For clarity of presentation, we show only the annual spending trend for bills in claims less than one year old, but discuss trends for the older claims in the text. From 2000–2010, inpatient hospital spending increased between 10.1 percent (back) and 12.7 percent (knee) annually in the first year of claims, and ranged from 5.4 percent (knee) to 8.6 percent (shoulder) for outpatient hospital services for new claims. Among older claims, annual spending growth on inpatient hospitals was higher, ranging from
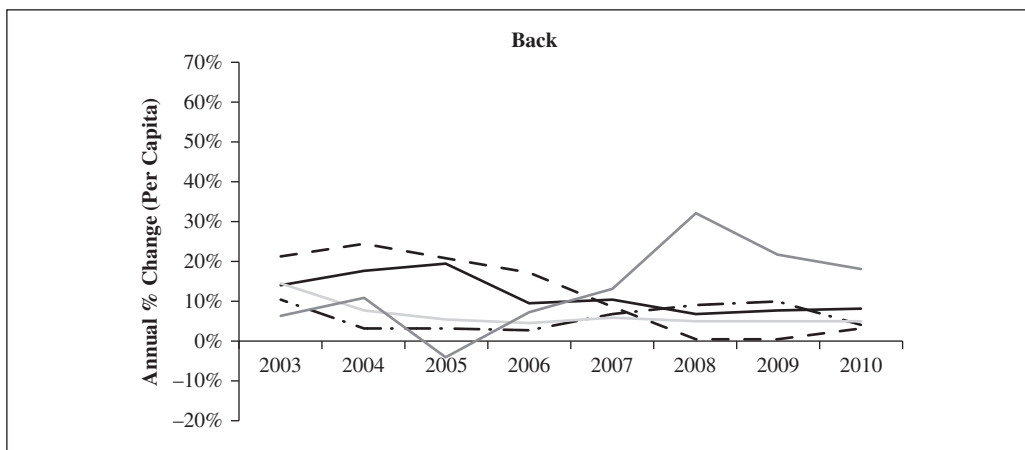
Figure 2. Three-Year Moving Average of Spending Trends by Injury and Provider Type, Claims less than 12 Months Old

Figure 2. Three-Year Moving Average of Spending Trends by Injury and Provider Type, Claims less than 12 Months Old *(Continued)*

Note: Graphs show three-year moving average annual per-capita spending changes by service category. The graphs depict trends in the first 12 months of a claim only. Since 2000 was the first year for which data were available, 2003 represents the average of annual changes from 2000–01, 2001–02, and 2002–03.

11.5 percent (shoulder) to 19.2 percent (neck). For outpatient hospitals, it ranged from 3.7 percent (shoulder) to 4.8 percent (neck). Growth in service intensity played an important role in spending trends, ranging from 60 percent (shoulder) to 73 percent (back) of inpatient spending growth, and 29 percent (back) to 60 percent (neck) of outpatient spending growth in claims less than one year old. Among claims at least 12 months old, service intensity accounted for about 70 percent of inpatient spending growth for back, shoulder and neck cases, but was only 35 percent of growth among older knee injuries. For outpatient services provided in older claims, service intensity contributed between 20 percent (knee) and 76 percent (neck) of the growth rate. Again, this suggests areas in which additional scrutiny would be warranted to properly treat the injury in the first year.

A final observation of note is the inter-year trend in spending for pharmaceuticals. Figure 2 depicts dramatic increases in spending for brand-name pharmaceuticals for back, neck and knee injuries in the first year of claims. The decomposition analysis indicated that, in years for which the spike in spending growth was most pronounced, increases in the volume of prescriptions given per patient contributed 40 percent to 50 percent of this spending growth. We find similar trends among older claims (not shown in the figure). The use of brand-name pharmaceuticals for treatment of an injury in the first year, and subsequent years, is an area in which health insurers may be able to steer patients to lower-cost, generic options.

Discussion

We observed considerable variation in spending growth rates by provider and injury

group. Spending growth tended to be high for the different population subsets we analyzed, averaging, for example, 10.1 percent per year for inpatient hospital services and 7.8 percent for doctor's office visits across all injuries; and 8.1 percent and 9.0 percent in the first year of back and shoulder claims, respectively. After adjusting for inflation, these estimates exceed the long-run real average medical spending growth rate of 4.7 percent in the US. However, given the unique characteristics of workers' compensation insurance, which fully covers medical expenditures associated with the treatment of workplace injuries, this figure is plausible.[18] Our findings about the relative contribution of price, volume, and service intensity to overall average spending growth are also generally consistent with prior research, which has found that technology is a substantial contributor to medical spending growth, ranging from 25 percent to 75 percent of the growth rate, depending on the data analyzed and how technology is defined.[19]

The new contribution of this article is the extent to which growth rates, and the contribution of service intensity to these rates, vary across patients and providers. As we disaggregated the insurer's population by injury type, we found considerable heterogeneity in the average rate of spending growth, highlighting that broad averages mask variability in spending trends between providers and patient populations. Knowing the extent of this variation is critical for developing better forecasts of spending by subpopulation and identifying appropriate areas to dampen spending growth rates.

Rates of spending growth varied widely by injury and injury age, ranging from 2.0 percent to 11.5 percent. We found that spending trends for injury groups were strongly

influenced by spending on inpatient hospitals, which increased at a faster rate than doctor's office and outpatient expenditures. We uncover even more variation in growth rates when examining trends by provider type within groups of patients with similar injuries. For example, among newer neck injuries, inpatient hospital spending grew at an average annual rate of 10.3 percent, while the comparable rate for older neck injuries was 19.2 percent. Differences in growth rates of these magnitudes carry dramatic financial implications: For example, at a 10.3 percent growth rate, spending doubles every 7 years, while at a 19.2 percent growth rate, spending doubles in 3.9 years.

Spending was accelerating fastest for pharmaceuticals, driven primarily by prices and volume, and for inpatient hospitals, due in large part to increasing service intensity. Spending trends in these categories may warrant further review. For inpatient services, the compounded effect of spending growth on already high-cost services has an outsized influence on overall levels of spending. Pharmaceuticals, on the other hand, account for a growing share of US medical spending. Their increased use to treat the prevalent injuries in our sample of injured workers mirrors their growing use as therapies for other common chronic diseases. Whether a growing trend of drug use is favorable depends on the effect of pharmaceuticals on quality of life and the need for more expensive medical care. Such an evaluation is beyond the scope of this article, but should be taken into consideration when evaluating the implications of greater pharmaceutical use.

Patterns of service intensity growth also highlight where insurers, clinicians and policymakers could focus attention on practice patterns to lower health care spending. Some injuries, for example, have large rates of service intensity growth after the first year. This could reflect the fact that these long-term injuries require more complex care. However, it may also reflect the fact that appropriate care was not provided in the earlier stages of a patient's recovery, or that unnecessary care is being provided, perhaps because of inappropriate utilization review. Review of practice guidelines and their correlation with spending trends may identify reasons for the increases in the later years. Given that 38 percent of the spending is in these out years, the potential for slowing rates of spending growth is substantial.

If an insurer is a relatively small purchaser of medical services relative to the entire market, the insurer has a limited ability to reduce prices and therefore—as is the case in workers' compensation insurance—the main policy levers it has available to restrain spending growth are the quantities, intensity, and the composition of services given to patients. The substitution towards higher-technology services in the hospital and increased use of brand-name drugs play an important role in spending growth among patients with shoulder, back, and neck injuries. In these populations, a health insurer may want to develop utilization review procedures to control spending and to better evaluate the benefits of care on patients. However, it may not be wise to set policy on spending growth rates alone. The use of newer technologies may accelerate a patient's recovery and return to work, thereby lowering total spending over the duration of the claim.

Our findings are subject to several limitations. We use an identity to decompose spending growth rates into volume, price and service intensity changes. Imprecise

measurement of the price or volume components will necessarily distort our measure of service intensity growth. To this point, we used proxy measures of price inflation, which may not be representative of changes in the prices of services actually purchased by the insurer. Moreover, the price indices are constructed as fixed-weight Laspeyres market baskets, which are based for the composition of resources used in a reference year. Fixed-weight market baskets may overstate true inflation, if purchasers are able to substitute away from goods rising in price over time, which will bias our estimates of service intensity downwards.[20]

Our estimates of per capita spending and volume rely on the calculation of the number of patients receiving medical services at a given time, ideally measured by the number of active claims. The insurer did not have a census of open claims for all years in our sample. Construction of such a count was complicated by the fact that some workers periodically stopped and resumed coverage for lost work time, and because some workers had multiple injuries, and therefore multiple claims. For simplicity, we counted the number of unique claims present for a given provider type and calendar year. In cases in which a given claim is associated with sporadic service use over time, our approach likely undercounted the number of active claims and overstated per-capita spending. Thus, we regard our estimates of spending growth among older injuries as an upper bound on the true rate.

We are limited by the quality of data provided by the insurer, and changes over time in the way data is reported and collected. For example, we found a discrete jump in the average length of stay for inpatient services

in 2005, but in general statistically insignificant changes in the mean length of stay both before and after 2005. We did not observe statistically different average lengths of inpatient hospitalizations in most years. Given this data, we were unable to "back out" from estimates of inpatient service intensity length of stay.

Lastly, our injury-specific analyses rely on our designation of a primary injury for each claim. We identify a primary injury based on the preponderance of a set of diagnosis codes related to a common injury. We did not classify claims for which diagnosis codes either did not provide a clear indication of the injury or indicated an injury outside of the ten we analyzed. This method may not include in our injury categories claims with complex clinical histories. To the extent this occurs, our injury-specific subpopulations could be healthier or less severely injured than the "true" set of injury-specific claims.

Conclusion

Our analysis of medical spending for workers' compensation claims found substantial variation in spending growth. The ranges was from 2 percent annually to as much as 16 percent and varied by types of providers and types of injury. Accelerating inpatient hospital spending, which our analysis linked to increasing service intensity, explains higher spending growth rates observed for some injury groups. We observe high rates of spending increases on brand-name pharmaceuticals in common injuries, which are driven heavily by growth in the number of prescriptions per patient. We also observe high rates of service intensity growth after the first 12 months from a patient's injury. This finding underscores the

need to evaluate whether inappropriate care, delivered in both the early and later stages of recovery, accounts for these expenditure increases. Policymakers and health insurers should consider the variation in spending trends when forecasting medical expenditures for subsets of the US population, and consider areas in which spending is growing the fastest, when developing policies to slow expenditure growth.

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15. Bureau of Labor Statistics Producer Price Index for "Pharmaceuticals for human use, Prescription," Series ID: WPUSI07003. Accessed on August 3, 2011 via *http://data.bls.gov/timeseries/WPUSI07003*.
16. Medicare Market Basket Data, accessed on August 3, 2011 via http://www.cms.gov/MedicareProgramRatesStats/04_MarketBasketData.asp.
17. We computed ten-year average growth rates as the average of annual changes in

spending. This is approximately the same, but not equivalent to, a compound annual growth grate.

18. Full coverage of medical expenses under workers' compensation insurance eliminates patients' price sensitivity, making them more

willing to use newer, and more expensive, procedures.

19. Chernew and Newhouse, *supra,* n.7.

20. Moulton, KA, "An Overview of Experimental US Consumer Price Indices," *Journal of Business and Economic Statistics*, 17(2), 141–151 (1999).