How Do the Rich Die?

Understanding the Association Between Income and Health Care Utilization at the End of Life

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ABSTRACT

By 2050, health care spending is expected to constitute 37% of GDP. Of total Medicare spending, 30% is devoted to the last year of life. Thus there is a pressing need to reduce health care costs, especially at the end of life, and there may be potential to improve quality at the same time. In this thesis, I analyze whether subgroups of the population – in this case, wealthier individuals – are more likely to receive low intensity, high quality care and avoid high intensity, poor quality health care at the end of life. If health care is a normal good, basic economic theory suggests that the wealthy will consume more health care. However due to asymmetric information in the health care system and because the wealthy more often have better access to information, are better educated, and are better able to advocate for themselves, they may avoid high intensity, poor quality care and instead choose lower intensity, less expensive, high quality care. To analyze this question, we use a dataset of Medicare patients diagnosed with poor prognosis cancer that specifies their spending and utilization in their last six months of life and we stratify by their zip code of residence to determine income. We find evidence that while residents of higher income areas spend more than those living in regions with lower income, this association disappears when controlling for the region where they received their care. We also show that decedents living in higher income zip codes are, in most cases, more likely to receive high quality, low intensity care and avoid intensive, expensive, poor quality care. By learning that residents of wealthier regions avoid poor quality, high intensity, costly care, we can understand more about potential policy mechanisms – such as better dissemination of information to patients and better doctor-patient communication – that will help the U.S. health care system provide high quality care and decrease skyrocketing health care costs.

Keywords: Medicare, income, end-of-life health care, health economics

1. INTRODUCTION

Former director of the Congressional Budget Office, Peter Orszag, warns, “The long-term fiscal balance of the United States will be determined primarily by the future growth of health care costs” (Orszag and Ellis, 2007, 1885). Health care spending in the United States currently constitutes approximately 18% of gross domestic product and the Congressional Budget Office projects that by mid-century 37% of GDP will be devoted to health care spending (Centers for Medicare and Medicaid Services, 2011; Congressional Budget Office, 2007). The U.S. currently spends $7,538 per capita on health care each year, which is $2,535 – or 51% – higher than the next highest spending country, Norway. Yet the United States does not perform better than other countries on important health outcomes (Kaiser Family Foundation, 2011). Thus this provides the opportunity for a Pareto improvement: there is a pressing need to reduce health care costs and significant opportunity to improve quality in doing so.

End-of-life health care represents a promising potential area to focus on eliminating excess spending and improving quality: almost 30% of total Medicare spending is allocated to the 5% of enrollees who die each year, and most patients receive care that does not align with their preferences (Lubitz and Reilly, 1993, p. 1093; Pritchard et al., 1998, p. 1248). In fact, Skinner and Fisher (1997) assert that as much as 30% of this spending is wasteful. The present analysis focuses on a cohort of patients diagnosed with cancer highly predictive of near-term death, thus almost all of the spending on the health care they receive is ineffective at improving their overall health or extending their lives. In assessing end-of-life spending and utilization for these cancer patients, we analyze whether subgroups of the population – in this case, wealthier individuals – receive lower-cost, lower-intensity, higher-quality care and avoid expensive, high-intensity, poor quality health care that can, in our cohort, be classified as unnecessary.

Previous research has not established clear relationships among income, spending and utilization. If health care is a normal good, basic economic theory suggests that the wealthy will consume more health care. However, because the wealthy often have better access to information, may be better educated, and may be better able to advocate for themselves, we question whether they are able to avoid poor quality, high intensity, and costly health care and opt instead for effective, low intensity, and inexpensive care. In answering these questions, we attempt to determine how best to achieve a Pareto improvement in the provision of end-of-life health care. By analyzing the associations among income and spending and utilization, we can learn more about whether policies directed at better informing patients about their health care choices and supporting them in having their preferences met would be useful to both decrease the United States' high spending and also improve quality.

This analysis addresses these questions by drawing on individual level Medicare data that details the health care utilization and spending of decedents diagnosed with poor prognosis cancer in their last six months of life. The dataset employed includes information about the regions where patients received their care and stratifies by their zip code of residence to determine income. We find that when not controlling for region, residents of higher income zip codes spend more than decedents living in lower income areas. This association disappears when controlling for region of care. We also see that wealthier decedents are generally more likely to utilize high quality, low intensity care and to avoid the alternative: intensive, expensive and poor quality care.

This paper proceeds as follows. Section 2 explains the factors that influence health care spending and details the basic economic model and hypotheses. Section 3 describes the data employed in this study. Section 4 outlines the empirical method utilized and Section 5 presents the main results. Section 6 discusses empirical extensions and interpretations, and Section 7 concludes.

2. THEORY

2.1. Types of Care

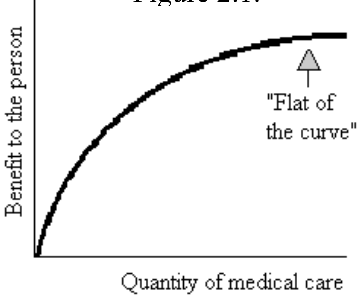
The purpose of health care is to improve health and function, while reducing pain and suffering. Accordingly, more heath care spending and utilization should lead to better health outcomes, such as lower mortality and lower disease incidence. Yet medical research has shown that not all health care produces better health and that the relative benefits of some procedures depend upon how patients value the tradeoffs involved. Wennberg et al. (2002) and Skinner et al. (2005) define three categories of care that are characterized by their efficacy in improving health.

Category I care – also referred to as effective care – encompasses evidence-based treatments with proven efficacy in treating the specific illness. Examples include eye exams for diabetics and mammograms for women over age fifty. The target utilization rate in the relevant population for these treatments is close to 100%. Category I care generally has high marginal benefit and, because there are no important tradeoffs between outcomes, greater use of effective care is expected to significantly increase the patients' health and utility.

Category II care, or preference-sensitive care, includes procedures or treatment choices that represent one of several equivalent options for treatment of a specific disease. This type of care entails tradeoffs between benefits and risks. Prostate cancer screening in men provides an example: early detection leads to at best a very small reduction in risk of death from prostate cancer, but also leads to a high likelihood of being diagnosed with the disease and experiencing the side effects of treatment, including incontinence and impotence. The choice of treatment therefore should depend on how the patient values the different possible outcomes. Maximizing utility requires choosing the treatment that aligns best with patient's values and preferences. However, physicians rarely ask a patient what matters to them when choosing between multiple care options; the physician's opinion often drives the decision about this type of care (Barry and Edgman-Levitan, 2012, p. 781).

Category III care is ineffective care. It encompasses discretionary services for which clinical trials provide no evidence of effectiveness. It is also referred to as supply-sensitive care because research has found a strong association between the supply of the resource and utilization rates. The marginal benefit of this type of health care is low or zero. Thus, consumption of this care results in "flat of the curve" medicine (illustrated in Figure 2.1) because there are low or nonexistent utility gains to consuming Category III care, combined with inevitable risks and complications (*University of South Carolina School of Public Health*, 2012). One might wonder why this care is provided at all if it is ineffective. This occurs because neither physicians' nor patients' incentives are linked to the effectiveness of the care. This is discussed further in Section 2.3.

Figure 2.1.



In sum, Category I care produces the highest benefit in terms of better health for the patient, Category II care entails tradeoffs between benefits and risks, and Category III care does not appear to improve health outcomes. Categorization of care allows us to examine differential utilization by different subgroups of Category I and Category III care.

2.2. Health Care Spending

Significant regional variations in health care spending exist. Understanding these differences and their causes and consequences may help clarify opportunities to improve quality and reduce health care costs.

Variations by geographic region are large, no matter the measure. Price-adjusted per capita annual Medicare spending varied from $15,568 in Miami, Florida – one of the highest spending regions – to $7,380 in Minneapolis, Minnesota – one of the lowest – in 2008 (Dartmouth Atlas of Health Care, 2012). Wennberg et al. (2002) explain that the typical sixty-five year old in Miami spends $50,000 more on Medicare in their lifetime than their counterpart in Minneapolis; this magnitude of difference is "equivalent to a new Lexus GS 400 with all the trimmings." Thus Fisher et al. (2003a) find that residents in regions in the highest quintile of spending in the U.S. receive 61% more Medicare resources than those in the lowest quintile. Measures of total annual spending are also highly correlated with end-of-life spending. The same regions that spend significantly more on Medicare overall also spend considerably more in the last six months of life. Much like the marked geographic differences in per capita spending, Fisher et al. (2003a) find greater than twofold geographic differences in expenditures during the last six months of life.

Much research has explored the underlying causes of geographic variations in health care spending. Evidence shows that practice pattern, supply of physicians and hospital resources, and mix of provider workforce are associated with much of the geographic variation in spending, which is explained further in Section 2.3 (Fisher et al., 2003a, p. 286). Moreover, greater provision of Category III care is strongly positively associated with spending variations, whereas there is no association between expenditures and either Category I or Category II care (Wennberg et al., 2002, p. 102).

Other factors that one might assume would explain spending differences, such as health status and patient preferences, do not account for even half of the variations. One might expect that differences in overall health may explain such drastic spending differences because healthier individuals demand less care and hence spend less. However, Zuckerman et al. (2010) and Wennberg et al. (2002) reveal that overall health differences account for less than one-third of geographic differences in per capita Medicare spending. One also may assume that spending differs because patients in different regions prefer different types of care. However, Barnato et al. (2007) suggest that patient preferences vary little across regions, and consequently do not help explain spending variations.

Evidence also suggests that higher regional spending is not associated with better outcomes or better care in general. One might expect doctors to utilize more health care with the goal of increasing survival. If this were the case, we would see that higher spending leads to lower mortality. However evidence is mixed regarding the association between spending and mortality. On some margins, studies do demonstrate mortality gains from increased spending. Romley et al. (2011) show that for patients with one of six major medical diagnoses in California, those receiving inpatient care in hospitals located in higher-spending regions experienced lower inpatient mortality than those in lower-spending regions. Barnato et al. (2010) also demonstrate that small gains in mortality are achieved by higher spending on care for Intensive Care Unit (ICU) patients in Pennsylvania and Doyle (2007) found that among heart attack patients on vacation, those who spent more on their health care had lower mortality rates. In contrast, on other margins, higher spending does not lead to lower mortality. Fisher et al. (2003b) find that among a retrospective cohort of patients with three diagnoses, higher spending is not associated with lower mortality rates. In fact, the authors showed that mortality in

Medicare patients is between 2% and 5% higher in high-spending regions.[1] These results thus show that on some margins, more health care spending is better, but on others, it is not.

In theory, higher spending would also be pursued in order to provide higher quality care, increase patient satisfaction and improve access to care. However, evidence suggests that increased spending does not buy better quality care. In fact, evidence from Baicker and Chandra (2004) and Skinner et al. (2005) supports the opposite: higher spending is associated with lower quality care. Higher spending is also not associated with increased satisfaction with the care that patients receive (Fisher et al., 1993b, p. 293). According to family members' and friends' assessments of the process and quality of end-of-life care, no measure of quality is better in high-spending regions than low-spending regions. Instead, in regions with higher spending, relatives and friends more frequently report that they were less satisfied with the quality of care received by the decedent (Teno et al., 2005, p. 1907). Additionally, Fisher et al. (2003a) find that care is slightly less accessible in areas with higher instead of lower expenditures.

When evaluating whether more health care spending is better, it is important to distinguish what health care dollars are being spent on. Much of health care spending goes to Category III care, which most often does not lead to lower mortality, instead of Category I care, despite that the latter has high marginal benefit. Thus spending on Category I care should be encouraged, while spending on Category III care should be avoided (Fisher and Skinner, 2010, p. 1897). The current evidence underscores the importance of better understanding what characteristics and behaviors lead patients to get more effective care or more supply-sensitive care. In identifying whether subgroups of

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[1] These results may occur because greater use of hospital and specialist care lead to a higher risk of medical errors or higher incidence of disease.

the population with better access to information – such as wealthier individuals – are better able to exert their influence over health care decisions, we can learn more about potential policy levers to increase dissemination of information to patients in order to both increase quality of care and lower spending. To better understand this question, we begin with a model that helps explicate the tradeoffs that face patients when choosing their health care.

2.3. The Microeconomic Model in a Health Context

The relationship between income and health care spending can be illustrated in a simple microeconomic model. In this model, individuals maximize utility as follows:

$$Max\ U\ (H, L, Z; S, X) \quad (1)$$

where H is high intensity care, L is low intensity care, Z is consumption of other goods, S represents health shocks and X are characteristics other than income (such as geographic region of residence, age, gender, race, and preferences). The utility function is maximized subject to a budget constraint with income I, and prices P_H and P_L, referring to the price of high and low intensity care, respectively.

We assume increasing utility for all three goods. For simplicity, we will disregard Z to instead focus only on the choice between consumption of high intensity and low intensity care. H and L both increase utility by improving health or quality of life, however H and L roughly correspond to Category III and Category I care, respectively, and thus affect health and quality of life differently.[2]

In our data cohort, all individuals are diagnosed with poor prognosis cancer that is highly predictive of near-term death. The cohort specifically excludes cancer patients that

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[2] There is certainly some high intensity care that is effective Category I care and some low intensity care that is ineffective Category III care, but in our model, H only refers to high intensity, ineffective care and L connotes low intensity, effective care and.

do not have such a severe cancer diagnosis. Hence we can assume S is the same for all decedents. We also assume that income is a dichotomous variable, either high, I_H, or low, I_L. With these assumptions, the demand function for the two goods we are interested in, high and low intensity care, are:

$$Q_{H_d} = f(P_H, P_L, I, X) \tag{2}$$

$$Q_{L_d} = f(P_L, P_H, I, X) \tag{3}$$

Consumers will maximize utility when the marginal rate of substitution equals the price ratio. At that point, the individual receives equal marginal utility per dollar spent on each good.

Thus, total spending on health care is:

$$Spending = H^{*} \times P_H + L^{*} \times P_L \tag{4}$$

The next several pages describes how each of the factors in the model – prices, income, and other demographic characteristics – change consumption of high and low intensity care and affect overall health care spending.

Prices and Health Insurance

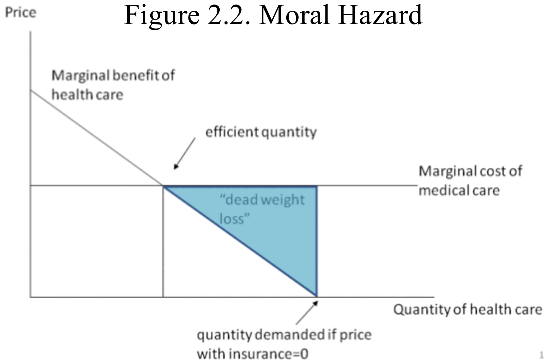
Prices affect demand and consumption of the two types of care directly through the budget constraint. High intensity care, such as intensive surgeries, costs significantly more than low intensity care, which includes basic visits to a primary care physician. Thus P_H exceeds P_L.

However, this relationship is complicated by health insurance. All individuals in our dataset are covered by Medicare, which pays for all but a 20% co-payment. Chulis et al. (1993) estimated that 12% qualify for Medicaid to cover this co-pay, another 75% buy supplemental insurance (Medigap), and only the remaining 13% do not have Medigap coverage. Because we do not have access to information about which individuals have

Medigap coverage, we assume in our model that all individuals have some kind of supplementary insurance coverage and hence face the same prices.[3]

The presence of health insurance causes patients to inaccurately assess the cost of their care. Patients only pay the prices of care with insurance, P_H^I or P_L^I, which are only a fraction of procedures' actual prices, P_H or P_L. As a result, moral hazard occurs because patients demand care until the marginal benefit is very low or zero, which is far beyond the efficient quantity, where the actual marginal cost of care equals the marginal benefit, as shown in Figure 2.2 (Newhouse, 1992, p. 5; Woolley, 2010).

Figure 2.2. Moral Hazard



Insurance not only decreases the prices that patients pay, but it also changes the relative prices of high and low intensity care that the individual sees. Medicare reimburses for hospital stays and inpatient visits, which are high intensity care, but covers very little nursing home care (Lubitz and Riley, 1993, p. 1095).[4] Nursing homes often provide low intensity care to their residents, which is palliative care that tends to improve individuals' quality of life and can reduce health care spending.[5] We model this such that H and L vary between 0 and 1. Because of the way Medicare reimburses, we posit that patients are offered $H = 1$ for free, but must pay for any $L > 0.5$. As a result, insurance subsidizes H at the expense of L. With insurance, $P_H^I \ll P_H$, whereas $P_L^I < P_L$ so that $P_H^I < P_L^I$. Thus, insurance shifts individuals' demand away from low intensity care –

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[3] The moderately poor are the most likely to not have Medigap coverage because Medicaid covers the poorest individuals and the wealthiest can afford to buy it themselves.

[4] Medicare covers short term nursing home stays, home health care, and hospice, but not at high levels and only for individuals who are unable to care for themselves, as certified by a physician.

[5] Bynum et al. (2011) demonstrate that an all-encompassing nursing home facility with the benefit of provider-patient continuity has the potential to lessen the intensity, and thus cost, of end-of-life care. Patients at such a facility had less than half as many hospital stays or emergency department visits than the average American at the end of life.

which costs less to society but costs more to the patient – and towards high intensity care – which costs more to society but costs less to the individual.

Income

Income enters the model directly via the individual's budget constraint. Because of their higher incomes, wealthy individuals have budget constraints that enable them to consume more of all goods than low-income individuals. However, evidence on the relationship between health care spending and income is inconclusive. Newhouse (1992) estimates that the income elasticity of demand for medical care in the United States is somewhere between 0.2 and 0.4. Hall and Jones (2007) propose that it is even higher, somewhere above 1.0. However, among the Medicare population, Zuckerman et al. (2010) and Sutherland et al. (2009) report a minimal association between income and expenditures. Moreover, Hogan et al. (2001) document that decedents living in zip codes with high poverty rates spend more on end-of-life care than decedents in lower poverty zip codes.

This suggests that while low-income individuals only can afford H because it is free to them, perhaps the wealthy shift away from H to L, which they desire and can afford. This is the second, indirect way that income factors into the model: through differing patient preferences between the two income groups that might alter the shares of high or low intensity care demanded.

Preferences and Asymmetric Information

In theory, the bundle of H and L that patients receive is determined by patient preferences and prices of care. However, there is little evidence that this occurs in practice. The SUPPORT study, which analyzes patient preferences, shows that preferences are unrelated to place of death. In this study, of the patients who expressed a preference to die at home, 55% died in the hospital, whereas of those who preferred to die in the hospital, only 46% did so (Pritchard et al., 1998, p. 1244). Barnato et al. (2007) corroborate this result: they find that on average nationally, 27% die in the hospital, whereas only 9% state this as a preference. Previous evidence suggests that intensity of end-of-life care is often not well aligned with the care patients would prefer: while patients prioritize L over H, they often receive more H and less L.

The divergence between patient preferences and actual care received is the result of two factors: asymmetric information and insurance. Asymmetric information in the health care market leads patients to inaccurately assess the relative benefits of H and L. Often patients overrate H and undervalue L. Insurance causes patients to see P_H^I and P_L^I, instead of P_H and P_L.

Due to their extensive training, physicians know much more than their patients about the type, costs, and quality of care that could improve patient health. Thus physicians better understand the relative values of H and L and their actual prices, P_H and P_L. Moreover, patients most often do not fully grasp the differences between L and H. Low intensity care refers to palliative care that may not improve health or decrease mortality, but significantly improves a patient's quality of life. This care may be especially important for individuals with a high probability of death for whom there is little chance of any procedures significantly extending their life.

In contrast, H refers to high intensity, Category III care, which, on average, tends to be ineffective at improving health. Although it may be associated with a small chance of improving mortality, it often negatively affects quality of life because of its significant side effects. It may seem surprising that physicians continue to provide such care, but deficient scientific evidence, perverse financial incentives, or educational gaps leave many physicians unaware of the actual effectiveness of many procedures in common use today.[6] As a result, physicians do not have accurate information about the marginal benefits of many health care procedures. Even when they do have information that a procedure has low marginal benefit, Earle et al. (2008) propose that physicians may have other rationales for recommending that procedure. For example, for a dying cancer patient with a poor prognosis, it is easier for physicians to suggest another round of chemotherapy to instill hope in their patient – even if there is almost zero chance of recovery – than to have the difficult conversation that the patient is indeed dying. Moreover, physicians are generally paid more when they provide more health care, thus may be driven by financial incentives.[7]

We use a principal–agent model to describe how physicians often choose their patients' care for them because physicians have more information about H and L than their patients. This relationship differs with income. Morrison (1998) proposes that the wealthy, also more often better-educated, prefer to make their own decisions compared to the poor, who tend to adhere to their doctor's advice more closely. Among a cohort of individuals with poor prognoses, Voogt et al. (2005) recognize that patients must communicate effectively with their doctors in order to grasp that H may no longer be effective considering their poor prognosis. Perhaps the wealthy and better educated may be more likely to do so. This is illustrated by the inexpensive, low intensity way that doctors most often choose to die – by opting for low intensity, palliative care that lets them enjoy their last months at home, instead of in a hospital – because they fully understand the limitations of the care alternatives for patients with poor prognoses

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[6] Not enough studies have been conducted to conclusively determine the benefits of many aggressive procedures targeted at specific illnesses for different populations.

[7] Doctors are paid much more for recommending that a patient undergo expensive, high intensity care than when they admit a patient to hospice, for example.

(Murray, 2012).[8] High-income individuals may be doctors – or doctors' friends – and thus may act similarly because they are more informed, efficient and productive consumers of health care. Consequently, the wealthy may choose to sacrifice some H for L because they can afford P_L^I (which is greater than P_H^I) and recognize that L matches better with their preferences.

A second problem associated with asymmetry of information is adverse selection, which is not an issue here because all individuals in our cohort have Medicare, so there is no margin of selection into insurance.[9]

Geographic Region of Residence

The geographic region in which an individual lives is vital to the type of care that they receive because medical decision-making is often strongly influenced by physician opinion and local practice patterns (Wennberg, 1988, p. 99). Supply-sensitive care and physician practice patterns account for most of the geographic variation in health care spending. High-spending Hospital Referral Regions (HRRs) have higher local supply of physicians and hospital resources.[10] Fisher et al. (2003a) and Baicker and Chandra (2004) show that use of Category III care and spending both tend to be higher in HRRs with more frequent use of the hospital, more frequent use of the ICU, and greater use of specialists. Wennberg et al. (2002) document that 41% of variation in intensity of end-of-life care is explained by supply of specialists and hospital capacity. Sirovich et al. (2008) also demonstrate that more specialists and hospital beds are associated with different

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[8] Murray (2012) explains, "Doctors don't want to die any more than anyone else. But they usually have talked about the limits of modern medicine with their families. They want to make sure that, when the time comes, no heroic measures are taken. During their last moments, they know, for instance, that they don't want someone breaking their ribs by performing cardiopulmonary resuscitation (which is what happens when CPR is done right)."

[9] See Cutler and Zeckhauser (1997) for more on adverse selection.

[10] According to the Dartmouth Atlas, "Hospital referral regions (HRRs) represent regional health care markets for tertiary medical care that generally requires the services of a major referral center. The regions were defined by determining where patients were referred for major cardiovascular surgical procedures and for neurosurgery...[The United States contains] 306 HRRs. Each HRR has at least one city where both major cardiovascular surgical procedures and neurosurgery are performed."

practice patterns among doctors: in high-spending regions, primary care physicians are more likely to see patients more frequently, recommend more tests that have an unclear value, and choose more expensive and intensive treatments than their counterparts in low-spending regions.

In sum, it seems that "regional practice norms trump patient preferences" (Skinner, 2012, p. 74). Practice intensity, variation in use of supply-sensitive care, and the mix of the provider workforce are associated with much of the geographic variation in spending and lead doctors in high-spending regions to recommend H, instead of L. Consequently, individuals in high-spending regions will be more likely to receive more H.

Other Demographics: Age, Gender, and Race and Ethnicity

Among the Medicare population, as individuals age, they tend to realize that they are near death. They may choose more palliative, low intensity care to improve the quality of their remaining life if they can afford it, instead of high intensity, life-saving treatments with detrimental side effects.

To the author's knowledge, little evidence exists about the associations among gender and health care spending and utilization. This study provides further information on whether women receive more H or L.

Evidence suggests that race and ethnicity influence an individual's preferences for care. When presented with a hypothetical scenario, more blacks and Hispanics than non-Hispanic whites indicate that they want to die in a hospital, prefer care to extend life even if it has negative side effects, and choose ventilator support to extend life (Barnato et al., 2009a, p. 697).[11] Barnato et al. (2006) show that blacks and Hispanics are also more

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[11] These results may be because over 27% of blacks believe that half or more of people who receive mechanical ventilation treatment returned to normal health, whereas only 17% of non-Hispanic whites believe this when asked by

likely than non-Hispanic whites to receive care in the Intensive Care Unit at the end of their life and are more likely to die in hospitals, both of which constitute high intensity care. Also, fewer blacks and Hispanics than whites choose palliative care that has the potential to shorten life. Therefore, blacks and Hispanics are more likely to demand more H and less L.

2.4. Applications of the Model

The choice between high intensity and low intensity care is exemplified by the choice that patients at the end of life must make between dying in a hospital, covered fully by Medicare, and dying while receiving less intense palliative care, which in some cases they must pay for out of pocket. Low-income individuals may choose the former because it is free and they do not understand that such care will not produce significant health gains and instead can harm their quality of life by making them spend their last days in the hospital instead of their home.[12] High-income patients may choose nursing home care or additional non-reimbursed in-home services because they can afford these services and they may recognize their advantages in providing higher quality and less aggressive palliative end-of-life care.

Evidence suggests that H, such as high intensity hospital care, is ineffective at increasing survival, is low quality care, and does not align with patient preferences for end of life care.[13] As a result, the National Quality Forum marks measures of aggressive care, such as chemotherapy in the last 14 days of life, ICU care in the last month of life, and dying in a hospital as poor quality care. Earle et al. (2008) suggest that provision of

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Barnato et al. (2009a). In reality, 56% of patients who receive ventilation treatment for 48 hours or more are dead after one year and almost 60% of survivors of the treatment need caregivers one year later.

[12] Fisher et al. (1994) demonstrate that the effect of hospitalizations on decreasing mortality is small or zero.

[13] Chassin et al. (1987) revealed that clinical review deemed provision of "a reasonably high percentage of procedures" studied as "medically inappropriate." Temel et al. (2010) compared cancer patients receiving palliative care with a cancer cohort receiving standard care, which included more aggressive care (defined as at least one of the following: chemotherapy within fourteen days of death, no hospice care, and admission to hospice within three days of death). They revealed that the palliative care group exhibited statistically significant higher quality of life, fewer depressive symptoms, and longer survival than those receiving high intensity end-of-life care.

chemotherapy late in life, for example, is largely ineffective and therefore of poor quality. Because cancer patients indicate preferences for home death and tend to prefer palliative care instead of high intensity care targeted at extending life, aggressive measures are of poor quality because they do not align with patient preferences (Higginson and Sen-Gupta, 2000, p. 287).[14]

While the previous paragraph indicates that poor quality arises from providing too much of the wrong care, poor quality can also occur when providing too little of the right care. Because Category I care is effective, underutilization of such care is poor quality care. One such type, nursing home care, is not covered by Medicare and was not accessible in our dataset. Consequently, we use hospice, which is covered by Medicare and is a valuable alternative with similar appeals and goals as nursing home care, to assess utilization of low intensity care. The overwhelming majority of patients tend to prefer hospice care, a high quality alternative to aggressive hospital care for individuals with poor prognosis cancer whose short-term mortality is high. Goodman et al. (2010) describes the appeal of hospice care:

> "In the course of incurable cancer, there often comes a time at which more treatment does not equal better care. Instead, comfort and quality of life become paramount... Few people want to be in a hospital in their final days; fewer still want to die in an ICU, tethered to drips and devices. Most of us would like to be at home, or in a homelike setting, surrounded by people we love and that love us. For people who want to be at home through the end of life, and for families who want to care for them, hospice is essential. Hospice programs provide medications needed to control pain and other discomfort, visits by highly skilled nurses, a team of professionals, and quick access to someone to answer questions or manage problems 24 hours a day" (Goodman et al., 2010, p. 33).

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[14] Temel et al. (2010) showed that when lung cancer patients were provided with balanced information, they often prioritized receipt of palliative care over high intensity care.

Due to the beneficial aspects hospice provides to dying patients, the National Quality Forum includes underutilization of hospice in the last month of life (enrollment in hospice within three days of death) in their definition of poor quality care.

Previous evidence is inconclusive about the relationships among income, spending, and utilization of H and L. Because P_H exceeds P_L, high intensity care translates into higher end-of-life spending. Hence, by modeling the tradeoff between poor quality, aggressive care – H – and low intensity, effective care – L – that the rich and poor face at the end of life, our analysis serves to provide insight into the relationships among income, spending, and treatment choice.

Our hypotheses are as follows. In concordance with findings by Newhouse (1992) and Hall and Jones (2007) and adhering to traditional economic theory, we hypothesize that because individuals with higher income will be able to afford more expensive, discretionary health care, they may receive more high intensity care. Thus, the wealthy may spend more on health care at the end of life than the average American.

An alternative hypothesis proposed by our model suggests that the wealthy may spend less on health care. Because they may be more efficient and productive consumers of health care who realize that much high intensity, expensive care has low marginal benefit and because they can afford the alternative – low intensity, palliative care – the wealthy may choose to receive less high intensity care and more low intensity care than their low-income counterparts. They may therefore spend less overall.

With these two opposite theoretical predictions, this becomes an empirical question: how does income relate to end-of-life spending and utilization? Due to these counteracting factors, it is possible that the relationship between income and spending will be small. Because of the importance of regional practice pattern on spending, it may be that regional spending differences outweigh the influence of income. Moreover, high-income individuals' tendency to live in regions with higher cost-of-living and more intensive practice patterns – not their greater individual utilization of high intensity care – may explain much of the relationship between income and spending.

3. DATA

3.1. Data Description

The individual-level health care data utilized in this analysis comes from a cohort created by the researchers at the Dartmouth Atlas of Health Care. From a 20-percent sample of fee-for-service Medicare beneficiaries from the Medicare Denominator files for 2003 to 2007, the cohort includes individuals who died from age 66 to 99 and were covered by Medicare Parts A and B (inpatient and outpatient insurance) in their last six months of life. The cohort includes only those who were admitted to a U.S. hospital at least once for cancer care in their last six months of life, had at least one hospital discharge or at least two clinician visits in the last six months of life, and were diagnosed with cancers associated with a high probability of near-term death (as determined by their ICD-9 cancer diagnosis codes).[15] The data thus explicitly excludes all individuals diagnosed with cancers not associated with a high risk of death. The data contains information on the median income of the Zip Code Tabulation Area (ZCTA) in which the individual lives and each decedent's Medicare spending and utilization in their last six months of life.[16]

The other individual-level characteristics available are enrollment in Medicaid, gender, race (black vs. non-black), and age of death (categorized as 65-69, 70-74, 75-79,

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[15] Cancer diagnoses were modified from those used by Iezzoni et al. (1994).

[16] Zip Code Tabulation Areas (ZCTAs) refer to the statistical geographical area created by the U.S. Census Bureau to approximate the geographic area covered by each zip code and to aid in estimating summary statistics for that area. Thus ZCTAs correspond closely to zip codes.

80-84, and 85-99). Each patient was also assigned to the Hospital Referral Region (HRR) where they received their care.

Income

Ideally, individual-level income would be available. However, Medicare does not provide this information. Therefore, we attempt to characterize the income distribution of the area in which the decedent lived. The primary income measure is ZCTA median income from 2003 estimated by Claritas.[17] A potential concern is that median income is unresponsive to changes at the tails of the income distribution (the right tail is the portion of the income distribution of interest). To address this problem, we also use a variable that measures the percent of people in a ZCTA with income of $200,000 or above. This represents the top 2.4% of the income distribution (Welniak, 2005). The correlation coefficient between median income and this measure identifying the right tail of the income distribution is 0.86, suggesting that median income adequately characterizes the right extreme of the income distribution. The Census Bureau releases these data for only some zip codes, corresponding to approximately one-fifth of the sample.[18] Thus due to the high correlation coefficient between the two income measures and the limited sample size, we only run our primary regressions with this second income measure, but will discuss alternate results as appropriate.[19]

Spending

The spending measure we employ is total spending in the last six months of the patient's life.[20] This measure is unadjusted for medical prices and consequently includes

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[17] Claritas provides yearly reports in which they estimate demographic characteristics from the decennial Census.

[18] The Census Bureau only releases this information for some zip codes most likely because of suppression issues.

[19] Two further limitations of both income measures are that income is an imperfect estimate of wealth, especially in the elderly, and Medicare only provides each patient's zip code, whereas the two income measures come from the ZCTA in which each individual lives. The geographic boundaries of zip codes and ZCTAs do not match exactly, yet the differences in most cases are small.

[20] We inflation-adjust spending to a 2005 base year because the spending data comes from years 2003 to 2007. We also inflation-adjust median income, which is estimated for 2003, to a 2005 base year.

the effects of both price and utilization. Medical prices vary across the U.S., but do so differently than overall prices. We choose not to control for price differences for two reasons. First, the way Medicare assigns prices across regions is complex and consequently, the appropriate adjustment strategy is not obvious. Secondly, controlling for regional effects will absorb much of the price differences.

Utilization and Quality

The Medicare data allows us to employ measures of both L and H. Measures of high quality, low intensity care (L) include enrollment in hospice in the last six months of life, number of days spent receiving hospice care, and total hospice spending. These are considered high quality care because of the numerous benefits of hospice.

The National Quality Forum identifies five measures of poor quality care for patients with cancer diagnoses with a high risk of near-term death (H): enrollment in hospice within three days of death ("late enrollment in hospice"), undergoing chemotherapy within two weeks of death, dying in the hospital, visiting the emergency room (ER) more than once in the final month of life, and spending time in the Intensive Care Unit (ICU) in their last month. Other utilization measures are identified as intensive, poor quality care for patients with poor prognosis cancer: the number of visits to a specialist, whether the patient underwent Cardiopulmonary Resuscitation (CPR), and whether they were hospitalized in their last month. These are poor quality measures because they do not provide hospice, are detrimental to quality of life, increase costs, or do not produce significant benefits for patients with cancer diagnoses with a high risk of near-term death.

3.2. Data Limitations

An important variable unavailable in the dataset is patient preferences. The SUPPORT study and other analyses illustrate that most patients tend to prefer less intense care at the end of life, although some do prefer higher intensity care (Pritchard et al., 1998, p. 1244).

A further limitation of this dataset is that it excludes all individuals who did not visit a hospital within their final two years of life. It is unclear how this could potentially bias the results because we do not have information on the income or spending levels of the individuals that are excluded. While this is an important limitation worth noting, Wennberg et al. (2004) suggest that this effect will be minimal.

3.3. Summary Statistics

Table 1 reports summary statistics. Columns 1 and 2 show the mean and standard deviations for the full sample. Of the 136,078 patients identified as diagnosed with poor prognosis cancer, 14% are enrolled in Medicaid, 49% are female, and approximately 10% are black. The mean of their ZCTA median income is $56,443. Spending per enrollee in the last six months of life is almost $100,000, which is much higher than spending in the last six months for non-poor prognosis cancer patients. Over half of the cohort is enrolled in hospice in their last six months and on average, patients visit specialists almost 14 times in their last six months. Approximately 2% undergo CPR and almost 7% receive chemotherapy treatment in their last two weeks. Over 30% die in a hospital and 10% visit the ER more than once in their final month of life.

Columns 3 and 4 demonstrate the summary statistics for the small sample, which includes only those individuals in ZCTAs for which the 2000 Census reported the percent with income of at least $200,000. On average, patients in this sample lived in ZCTAs where 4% of individuals have income of $200,000 or above. With a sample size of only 20% of the entire sample, many of the summary statistics, such as median income and spending per enrollee, differ from the full sample, but remain within one standard deviation. Columns 5 through 12 show summary statistics by quartiles of income and

Table 1. Summary Statistics

	Full Sample		Small Sample		By quartiles of income								Top 1%	
					(1)		(2)		(3)		(4)			
	Mean (1)	Std Dev (2)	Mean (3)	Std Dev (4)	Mean (5)	Std Dev (6)	Mean (7)	Std Dev (8)	Mean (9)	Std Dev (10)	Mean (11)	Std Dev (12)	Mean (13)	Std Dev (14)
Income														
ZCTA median income ($)	56,443	22,397	66,664	27,347	34,789	4,830	46,020	2,899	58,179	4,444	86,787	21,307	158,102	26,815
Percent with income of $200,000 or above	n/a	n/a	4.1	5.7	0.8	0.5	1.1	0.7	1.8	1.3	7.7	7.2	28.1	6.6
Spending and Utilization Measures														
Spending per enrollee ($)	97,362	108,071	119,138	127,849	93,740	103,461	91,179	107,605	95,004	104,633	109,528	119,589	121,529	138,784
Enrolled in hospice (%)	55.9	49.6	47.5	49.9	53.2	49.9	56.2	49.6	57.0	49.5	57.2	49.5	52.9	49.9
Visits to a specialist (#)	13.9	13.8	15.3	14.5	13.4	13.6	13.4	13.4	13.9	13.6	15.1	14.4	15.6	15.6
CPR, last 6 months (%)	1.8	13.3	2.0	13.9	2.0	14.2	1.7	12.9	1.6	12.7	1.9	13.5	1.1	10.5
Hospitalization in last 30 days of life (%)	64.1	48.0	64.9	47.7	64.5	47.8	63.7	48.1	64.1	48.0	64.1	48.0	64.5	47.9
NQF Indicators of Poor Quality														
Chemotherapy, last 14 days (%)	6.7	25.0	6.4	24.5	6.3	24.4	6.7	25.0	6.7	25.0	7.0	25.5	7.2	25.9
In-hospital death (%)	30.4	46.0	35.3	47.8	32.0	46.7	29.8	45.7	29.5	45.6	30.4	46.0	34.0	47.4
More than 1 ER visit in last 30 days of life (%)	10.1	30.2	10.3	30.4	10.8	31.1	9.9	29.9	10.0	30.0	9.7	29.6	10.7	30.9
Admitted to ICU, last 30 days of life (%)	25.1	43.4	21.3	40.9	25.6	43.6	24.9	43.3	24.7	43.1	25.3	43.5	25.7	43.7
Late enrollment in Hospice (%)	9.0	28.6	8.2	27.4	7.7	26.7	8.8	28.3	9.7	29.5	9.8	29.7	10.2	30.3
Individual Characteristics														
Enrolled in Medicaid (%)	14.1	34.8	12.5	33.1	24.2	42.8	14.3	35.0	10.6	30.8	7.5	26.3	4.0	19.5
Female (%)	48.7	50.0	50.9	50.0	48.3	50.0	48.2	50.0	48.8	50.0	49.5	50.0	48.8	50.0
Black (%)	9.7	29.5	6.3	24.3	20.4	40.3	8.8	28.3	5.8	23.3	3.7	18.8	1.7	12.9
Sample Size	136,078		25,905		34,014		34,029		34,020		34,015		1,360	

Notes: Data are from Dartmouth Atlas of Health Care as described in the text. Statistics refer to the last 6 months of life unless otherwise noted. The small sample includes only those living in ZCTAs where the income variable indicating the percent with income of at least $200,000 was available.

Columns 13 and 14 illustrate the mean and standard deviations for the top 1% of the income distribution. Spending and several other utilization variables, such as visits to a specialist and late enrollment in hospice, are highest for the fourth quartile and even higher for the top 1%. However, the percent undergoing CPR is highest in the first quartile and lowest among the top 1%. All quartiles have roughly the same percentage of women but the percentage of patients enrolled in Medicaid and that are black decrease as income increases.

4. EMPIRICAL METHOD

4.1. Identification Strategy

Unlike many economic studies that analyze the pure effect of income on consumption, this analysis chooses to focus on the broader effect of income and the factors associated with it. Because only ZCTA-level median income is available, an increase in the income coefficient illustrates not only the effect on spending of rising income, but also of a higher education level, an increased ability to advocate for oneself, and other factors that are highly correlated with income. By looking at the effect of income and these correlated variables, we are able to understand more about the factors associated with the people who receive high quality, low intensity care and avoid poor quality, high intensity care, which will inform us about which policies will be most effective at decreasing spending while improving quality.

4.2. Regressions

Following the model presented in Section 2, the empirical models regress either spending or utilization outcome variables Y for decedent i living in ZCTA z and receiving care in HRR r on income I, as follows:

$$Y_{izr} = \alpha_0 + \alpha_1 I_z + \boldsymbol{\chi_i \beta} + \theta_r + \varepsilon_i \qquad (5)$$

where I_z is ZCTA-level median income and $\boldsymbol{\chi_i}$ is a vector of individual characteristics that includes age of death (categorized as 65-69, 70-74, 75-79, 80-84, and 85-99), gender, race, the patient's primary cancer diagnosis and the other illnesses with which the individual is diagnosed. The coefficient of interest is α_1, which will show the effect of income and its associated factors on spending. HRR fixed effects (θ_r) are included in order to control for the more than twofold variations in spending across regions in the U.S. We choose to use Hospital Referral Regions (HRRs) as the region of choice instead of Hospital Service Areas (HSAs) or hospitals because the latter two are smaller regions and thus have smaller samples sizes and provide much less within-region variation upon which to analyze the data. Moreover, controlling for region using the HRR is the accepted convention of the relevant literature.

4.3. Advantages and Disadvantages of a Retrospective Cohort

The ideal cohort to study end-of-life health care spending would include all patients with a specific disease, no matter the severity or stage of illness, and follow their care until all patients have died. However, we are unable to conduct such a study due to time, limited financial resources, restricted access to patients, imperfect information, and other factors. Our dataset thus consists of the health care provided to decedents in the six months leading up to their death and excludes those individuals for which spending successfully saved their life. Depending on when and how these heroic efforts are most often successful, our data could overestimate or underestimate measures of spending and utilization.

Existing work suggests that these biases will be minimal for the present analysis, for the crucial reason that this dataset is limited to individuals diagnosed with poor prognosis cancer with a high probability of near-term death. There is little care that patients in this cohort could have received that would have helped extend their life.

Moreover, despite the fact that the claims data did not specify each patient's *exact* cause of death, because each was diagnosed with cancer highly predictive of short-term death, the care these patients received at the end of life reflects how patients diagnosed with severe cancer would be treated. Limiting the dataset to only cancer patients also does not limit the potential to generalize our results to the greater population, as Goodman et al. (2010) illustrates that cancer care mirrors general patterns of end-of-life care.

Retrospective end-of-life cohorts are employed in much of the research on geographic variations because they offer several distinct advantages relative to prospective cohorts. First, Skinner (2012) contends that a retrospective cohort allows for the most straightforward way to adjust for health status because all individuals in the dataset are roughly equivalent in their severity of illness.[21] Second, Earle and Ayanian (2006) argue that using a retrospective dataset to analyze end-of-life care allows for easy identification of relevant patients to include in the cohort, compared to a prospective dataset, for which it is practically difficult, and potentially impossible, to determine which patients are approaching the end of their life. Furthermore, to create a prospective cohort, patients must be uniquely defined as dying by a specific disease characteristic or event. In contrast, a retrospective cohort allows all patients who died to be studied, thus enabling me to study decedents from a multiplicity of institutions across the entire country with varying demographic characteristics that died in targeted years. Our results therefore may be more broadly applicable compared to a similar prospective study. In sum, "retrospective designs are convenient, generalizable, and efficient for evaluating and implementing performance indicators related to end-of-life care" (Earle and Ayanian, 2006, p. 839).

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[21] Accuracy in accounting for health status differences also increases when controlling for the other illnesses that the individual suffers from, as we do.

Although the selection of our dataset theoretically introduces bias into our spending measures, these measures are highly correlated with prospective measures of spending. By comparing a prospective measure created to approximate end-of-life spending and the Dartmouth Atlas retrospective measures of end-of-life spending (the same measures that we employ) Barnato et al. (2009b) find statistically significantly positive correlations between prospective and retrospective spending measures.[22] The authors conclude, "Since decedent-based measures are robust proxies for hospital treatment intensity for patients with a high probability of dying, it may be pragmatic to use decedent-based measures." Skinner et al. (2010) confirm these results.[23] Furthermore, Fisher et al. (2003a) found high correlations between end-of-life practice pattern for the chronically ill and practice pattern for other chronically ill patients, demonstrating that using end-of-life measures accurately reflects how physicians treat all chronically ill patients.

Hence, the cohort we employ not only has minimal selection bias because it only includes cancer patients with a high risk of near-term death so little of the care they receive is effective, but it also is generalizable to not only cancer patients, but all chronically ill patients.

5. RESULTS

5.1. Overall Spending

Table 2 shows the main results of the regression of total Medicare spending on ZCTA median income. The first three columns illustrate the effects of income and

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[22] This prospective end-of-life measure included only those individuals with high-predicted risk of death as calculated by analysis of their medical charts within 48 hours of admission.

[23] Skinner et al. (2010) compare a retrospective cohort of decedents with at least one chronic illness and a prospective cohort of patients admitted with Acute Myocardial Infarction. The authors find a correlation coefficient of 0.85 with a p-value of less than 0.001.

Table 2. Regressions of Total Medicare Expenditures on Median Income

Dependent Variable	Total Medicare expenditures (in 1,000's), last 6 months of life							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	HRR F.E.	HRR F.E.
ZCTA median income (in 1,000's)	0.30***		0.38***		0.40***	0.38***	0.0048	-0.0011
	(0.013)		(0.013)		(0.013)	(0.013)	(0.033)	(0.032)
Medicaid				3.01***	6.07***	4.33***	-1.65	-2.36
				(0.84)	(0.84)	(0.91)	(1.42)	(1.56)
Medicaid in Top Income Quartile						11.81***		4.80*
						(2.27)		(2.80)
Female Gender		2.33***	2.21***	2.11***	1.76***	1.75***	1.37**	1.36**
		(0.63)	(0.63)	(0.63)	(0.63)	(0.63)	(0.67)	(0.67)
Black Race		8.84***	14.14***	8.12***	12.84***	12.98***	9.93***	9.99***
		(0.96)	(0.98)	(0.98)	(0.99)	(0.99)	(1.58)	(1.57)
Age of death, 65 - 69		43.54***	44.80***	43.38***	44.51***	44.57***	48.50***	48.52***
		(1.02)	(1.01)	(1.02)	(1.02)	(1.02)	(1.85)	(1.85)
Age of death, 70 - 74		35.46***	36.45***	35.35***	36.26***	36.29***	39.63***	39.64***
		(0.92)	(0.92)	(0.93)	(0.93)	(0.92)	(1.58)	(1.58)
Age of death, 75 - 79		27.72***	28.42***	27.69***	28.38***	28.42***	31.07***	31.09***
		(0.89)	(0.89)	(0.89)	(0.89)	(0.89)	(1.25)	(1.25)
Age of death, 80 - 84		15.52***	15.94***	15.51***	15.95***	15.97***	17.45***	17.46***
		(0.91)	(0.90)	(0.91)	(0.90)	(0.90)	(1.11)	(1.10)
Constant	80.65***	27.60***	4.95***	27.46***	4.01***	4.87***	28.71***	29.03***
	(0.79)	(1.19)	(1.41)	(1.19)	(1.41)	(1.42)	(2.51)	(2.53)
Sample Size	136,078	136,078	136,078	136,078	136,078	136,078	136,040	136,040

Notes: Columns 7 and 8 include HRR fixed effects and exclude individuals living in HRRs with fewer than ten observations. Columns 2 through 8 control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered in Columns 7 and 8 to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

demographic characteristics. All variables demonstrate strong statistically significant, positive relationships with spending. The relationship between income and spending remains consistent throughout Columns 3, 5, and 6: a $1,000 increase in ZCTA income is associated with an increase in spending of between $380 and $400. In other words, with an elasticity of 0.30, a 1% increase in ZCTA income at the ninetieth percentile – equivalent to $8,400 more of income – leads to a 0.30% increase in overall Medicare spending from $97,362 to $97,654. These results are consistent with the theory that individuals living in higher income ZCTAs spend more on health care when not controlling for the region in which an individual receives their care. We hypothesize that the wealthy spend more when not controlling for region because they are more likely to live in high-spending regions that provide high-intensity care.

Regressions 4 through 6 illustrate the successive influence of Medicaid enrollment and the effect of enrollment in Medicaid while living in one of the wealthiest twenty-five percent of ZCTAs. Throughout these regressions, enrollment in Medicaid exerts a strong, statistically significant positive influence on spending. When income and Medicaid are included, for example in Column 5, those enrolled in Medicaid spend over $6,000 more than those without Medicaid coverage. The Medicaid in the top income quartile variable (which is the effect of being enrolled in Medicaid while living in one of the wealthiest twenty-five percent of ZCTAs) in Column 6 is also highly statistically significant. Decedents enrolled in Medicaid and living in a ZCTA with income in the top quartile spend almost $12,000 more than other patients. This suggests that poor individuals residing in wealthy regions tend to spend much more on end-of-life care than poor patients residing in poor areas.

Columns 7 and 8 introduce HRR fixed effects, thus controlling for the region in which an individual receives their care and accounting for differences in prices and practice pattern that vary significantly across regions. The statistically insignificant estimates reveal that, when controlling for regional differences, the income level of the ZCTA in which an individual lives is not associated with an individual's spending in their last six months of life. The fact that the association between spending and income becomes insignificant when controlling for region shows that higher income individuals are more likely to live in regions with higher spending, utilization, and prices. This is likely what drives the relationship between income and spending seen in Columns 1, 3, 5, and 6. The results from Columns 7 and 8 and the coefficient on the Medicaid in top income quartile variable from Column 6 verify that the region in which one receives his or her care outweighs the effect of income.

The association between enrollment in Medicaid and total spending also becomes insignificant when controlling for region. Only the very poor can enroll in Medicaid, thus Medicaid enrollment serves as an indicator variable for impoverished individuals, who Sutherland et al. (2009) found accounted for greater health expenditures. This may explain the positive association between Medicaid and spending in Columns 5 and 6. Upon addition of fixed effects in Column 7, Medicaid becomes insignificant, suggesting that the effect of regional differences on total spending outweighs the influence of Medicaid coverage.

Analysis of the relationship between spending and the included demographic variables shows that women, blacks, and younger cohorts spend more on end-of-life health care than their counterparts. Blacks spend almost $10,000 more in the last six months than non-blacks when controlling for regional differences, which may reflect their differing preferences for more intensive care, in accordance with Barnato et al.'s (2009a) findings. Among the Medicare population, as age increases, individuals spend less on end-of-life care, as one would predict because the elderly are more likely to

Table 3. Regressions of Total Medicare Expenditures on Percent Above Income of $200,000

Dependent Variable	Total Medicare expenditures (in 1,000's), last 6 months of life		
	(1)	(2)	(3)
	OLS	OLS	HRR F.E.
ZCTA Percent of Households with Income of at least $200,000	0.92***	0.91***	0.013
	(0.13)	(0.13)	(0.29)
Medicaid		-2.25	-1.93
		(2.35)	(3.33)
Female Gender	5.37***	5.51***	4.66**
	(1.70)	(1.70)	(1.79)
Black Race	38.03***	38.42	18.55***
	(3.15)	(3.18)	(3.74)
Age of death, 65 - 69	55.52***	55.64***	58.61***
	(2.81)	(2.81)	(5.07)
Age of death, 70 - 74	42.93***	43.02***	44.85***
	(2.45)	(2.45)	(3.60)
Age of death, 75 - 79	34.93***	34.98***	36.64***
	(2.31)	(2.31)	(2.55)
Age of death, 80 - 84	20.43***	20.47***	20.47***
	(2.30)	(2.30)	(2.50)
Constant	26.51***	26.65***	37.45***
	(3.22)	(3.23)	(6.70)
Sample Size	25,905	25,905	25,905

Notes: Column 3 includes HRR fixed effects and excludes individuals living in HRRs with fewer than ten observations. All regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation in Column 3. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

recognize that death is imminent and choose fewer aggressive and expensive measures. Gender is discussed further in Section 5.5.

5.2. Robustness Checks

An important robustness check is to verify that the use of median income is a valid indicator for the right tail of the income distribution of the ZCTA. To test this, Table 3 runs several of the same regressions from Table 2 with a second income measure:

the percent of individuals in a ZCTA with income above $200,000. Because data for this income variable is available for only a fraction of the ZCTAs, this sample size is approximately one-fifth of the overall sample. The first two columns of Table 3 correspond to Columns 3 and 5 of Table 2 and reveal similar results: there is a strong, statistically significant positive relationship between income and overall spending when not controlling for the region within which a patient receives their care.

Column 3 in Table 3 corroborates the results of Column 7 in Table 2: the effect of ZCTA income on total spending becomes insignificant when controlling for the geographic region of care. We do not run our other empirical models with this sample because of the potential bias associated with its small sample size. These regressions and the high correlation coefficient of 0.86 between these two measures show that median income is an accurate measure of not only the median income measure for a ZCTA, but also the right extreme of the ZCTA income distribution, the population – the wealthy – that we are interested in.

5.3. Hospice

Table 4 reports results for hospice utilization. This reveals whether the wealthy are more likely to get high quality care – Panel A measures – or low quality care – Panel B measures. All columns include HRR fixed effects.

Columns 1 through 3 in Panel A show statistically significant positive associations between hospice use and ZCTA median income, demonstrating that those living in higher income areas receive more hospice care than their counterparts when controlling for regional differences. An increase in ZCTA median income of $1,000 increases the probability of being enrolled in hospice by 0.07 percentage points and increases the number of hospice days by 0.039. The elasticity at the median of 0.023 in Column 2 illustrates that a 1% increase in income (equivalent to approximately $5,000)

Table 4. Regressions of Hospice Outcome Variables on Median Income

Panel A. High Quality Hospice Measures

Dependent Variable	Enrolled in Hospice, last 6 months	Hospice Days, last 6 months	Hospice Spending, last 6 months
	(1)	(2)	(3)
	Probit	Tobit	OLS
ZCTA median income (in 1,000's)	0.00069***	0.039***	3.67***
	(0.0001)	(0.010)	(1.16)
Medicaid	0.0029	3.30***	342.53***
	(0.005)	(0.49)	(48.18)
Female Gender	0.043***	4.84***	548.78***
	(0.003)	(0.29)	(30.81)
Black Race	-0.037***	-1.22*	109.46*
	(0.006)	(0.62)	(60.64)
Constant		14.69***	3034.09***
		(0.69)	(91.71)
Elasticity, median	0.047***	0.023***	0.058***
	(0.009)	(0.006)	(0.019)
Sample Size	136,040	136,040	136,040

Panel B. Poor Quality Hospice Measures

Dependent Variable	Late Enrollment in Hospice	Late Enrollment in Hospice, conditional on being enrolled in Hospice
	(4)	(5)
	Probit	Probit
ZCTA median income (in 1,000's)	0.00020***	0.00019**
	(0.00005)	(0.00007)
Medicaid	-0.012***	-0.022***
	(0.002)	(0.004)
Female Gender	-0.003*	-0.018***
	(0.002)	(0.003)
Black Race	-0.020***	-0.027***
	(0.003)	(0.005)
Elasticity, median	0.129***	0.078**
	(0.032)	(0.031)
Sample Size	136,008	76,040

Notes: All regressions include HRR fixed effects and exclude individuals living in HRRs with fewer than ten observations. Columns 1, 4, and 5 are probit regressions and marginal effects evaluated at the sample mean are shown. All regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

leads to a 0.023 percentage point increase in hospice days. These results, which support the hypothesis from our model, may be because the wealthy understand the value of hospice care above the alternative choice – more expensive and aggressive procedures that may not have the same high benefit – and are able to better align their care with their preferences.

Because those living in higher income ZCTAs receive more hospice care, they also spend more on hospice, as Column 3 in Panel A illustrates. A move from the ninetieth to ninety-fifth percentile of income, equivalent to an increase in income of $13,500 (from $84,500 to $98,000), increases spending on hospice in the last six months of life by approximately $50. Because of the high quality of life associated with receipt of hospice care, this spending is highly effective Category I care; more spending in this case is better for the patient. Not only is this high quality, effective care, but this care also leads to lower overall spending, as illustrated by Table 5, which regresses total Medicare spending on hospice spending. If hospice care merely added spending, the coefficient would be 1 because each $1 spent on hospice would contribute $1 to total spending. If hospice were to pay for itself, this coefficient would be 0, suggesting that each $1 spent on hospice is offset by $1 less spent on other health care. The coefficient of -$1.1 illustrates that hospice more than offsets its own costs. For each dollar spent on hospice, over $1 less is spent overall, which suggests that hospice actually decreases other spending by approximately $2. These results are consistent with the theory that hospice care both improves quality and reduces costs.

Although those living in higher income ZCTAs do receive higher quality care via more hospice days and spending, they also are more likely to enroll in hospice in the last three days of life – described by the National Quality Forum as poor quality end-of-life health care – as Column 4 in Panel B of Table 4 shows. An increase in ZCTA income by

Table 5. Regressions of Total Spending on Hospice Spending

Dependent Variable	Total Medicare Expenditures (in 1,000's)
	(1)
	HRR F.E.
Hospice Spending (in 1,000's)	-1.12***
	(0.075)
Medicaid	-1.32
	(1.48)
Female Gender	1.98***
	(0.67)
Black Race	9.94***
	(1.76)
Constant	32.63***
	(2.78)
Sample Size	136,040

Notes: The regression includes HRR fixed effects and excludes individuals living in HRRs with fewer than ten observations. The regression controls for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

1% at the 99th percentile, equivalent to an increase of roughly $13,300 of median income, leads to a 0.30 percentage point higher probability of late enrollment in hospice. Because individuals living in higher income ZCTAs are more likely to be enrolled in hospice, as shown in Column 1, it may be that these results are merely because those in ZCTAs with higher income get more hospice care overall. Column 5 conditions late enrollment in hospice on being enrolled in hospice and reports a statistically significant positive income coefficient, which affirms that individuals in wealthier ZCTAs are indeed more likely to be enrolled late in hospice. When only including those individuals who are enrolled in hospice, an increase in median income by 1% at the 99th percentile, equivalent to a rise of $13,300 of income, leads to a 0.16 percentage point higher probability of being enrolled in hospice within the last three days before death from the average of 55.9% to 56.06%. This represents almost more than half of the 0.30 percentage point higher probability when all individuals are included. Thus some of the statistically significant positive relationship between income and late enrollment in hospice is accounted for by the fact that individuals living in wealthier ZCTAs diagnosed with cancer are more likely to be enrolled in hospice. Yet, much of it is not, so some residents in richer ZCTAs seem to receive more low quality hospice care in the form of late enrollment while many *other* decedents in higher income ZCTAs receive more high quality care in the form of more hospice days and hospice spending. These latter results confirm the hypothesis that the wealthy in many cases realize the benefits of lower intensity and higher quality care.

5.4. Other Utilization Variables

Table 6 illustrates results analyzing whether the wealthy receive less high intensity care and less lower quality care, such as specialist visits, CPR use, chemotherapy, and in-hospital death. Previous literature suggests that these outcomes can be classified as Category III care, because for patients with poor prognosis cancer at the end of life, their use has not been shown to extend life or improve quality of life.

Column 1 in Table 6 shows that as ZCTA median income increases, individuals visit specialists more often in their last six months of life. An increase in median income from the fiftieth to the ninetieth percentile, corresponding to an increase in ZCTA income of roughly $33,000, leads to an increase in their number of visits to a specialist by 0.5. Columns 2 and 3 show that those in higher income ZCTAs are less likely to undergo CPR in their last six months of life and to be hospitalized within the last one month of life, both of which are ineffective at extending life for poor prognosis cancer patients. A $1,000 increase in median income decreases the probability of receiving CPR by 0.004 percentage points and the probability of being hospitalized in the last month of life by 0.02 percentage points. Although these numbers are small, the costs associated with these

Table 6. Regressions of Various Utilization Outcome Variables on Median Income

Dependent Variable	Specialist Visits, last 6 months	CPR, last 6 months	Hospital-ization, last 1 month	Chemo-therapy, last 14 days	In-hospital Death	More than 1 ER visit, last 1 month	Admitted to ICU, last 1 month
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	Probit	Probit	Probit	Probit	Probit	Probit
ZCTA median Income (in 1,000's)	0.014***	-0.00004**	-0.0002*	0.00007*	-0.0002**	-0.00006	-0.00009
	(0.003)	(0.00002)	(0.0001)	(0.00004)	(0.00009)	(0.00004)	(0.00009)
Medicaid	-0.72***	-0.0008	-0.021***	-0.020***	-0.022***	0.014***	-0.008**
	(0.14)	(0.0009)	(0.004)	(0.002)	(0.004)	(0.003)	(0.003)
Female Gender	-0.25***	-0.004***	-0.036***	-0.009***	-0.025***	-0.009***	-0.029***
	(0.086)	(0.0007)	(0.003)	(0.001)	(0.003)	(0.002)	(0.003)
Black Race	0.74***	0.010***	0.017***	-0.011***	0.032***	0.033***	0.022***
	(0.16)	(0.001)	(0.005)	(0.002)	(0.005)	(0.003)	(0.005)
Constant	4.10***						
	(0.26)						
Sample Size	136,040	132,941	136,040	135,904	136,040	135,994	136,029

Notes: All regressions include HRR fixed effects and exclude individuals living in HRRs with fewer than ten observations. Columns 2 through 7 are probit regressions and marginal effects evaluated at the sample mean are shown. All regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

procedures – both in money and in reducing quality of life – are large, so even small changes in their utilization may be significant.

Columns 4 through 7 in Table 6 show four utilization variables that are classified by the National Quality Forum as poor quality indicators for individuals diagnosed with poor prognosis cancer at the end of life. Column 4 indicates that a $1,000 increase in income leads to a 0.007 percentage point increase in the probability of undergoing chemotherapy in the last two weeks of life, showing that individuals in higher income ZCTAs are more likely to receive chemotherapy treatment within fourteen days of death. Chemotherapy is a very intensive treatment for cancer patients nearing death that is almost always ineffective for elderly patients with poor prognosis cancer, so this result demonstrates that individuals residing in wealthier ZCTAS in some cases do receive more expensive, low quality care. In other cases, individuals in higher income ZCTAs avoid some Category III care, such as in-hospital death, as illustrated by Column 5. An increase in median income of \$8,400, equivalent to a 1% rise at the ninetieth percentile, corresponds to a decrease in the probability of dying in the hospital by 0.05%, a significant reduction when considering the preferences for and numerous benefits of dying outside of a hospital setting. Columns 6 and 7 show negative and statistically insignificant associations between median income and the probability of visiting the emergency room more than once and the probability of admittance to the Intensive Care Unit.

Thus, decedents residing in higher income ZCTAs are more likely to avoid some key poor quality and high intensity procedures that are expensive and detrimental to quality of life, such as CPR in the last six months of life, hospitalizations in the last month of life, and in-hospital death. However, they are also more likely than individuals residing in lower income ZCTAs to receive two other high cost and low quality measures, specialist visits and chemotherapy in the last two weeks of life.

5.5. Gender

Column 1 in Table 7, which corresponds to Column 7 in Table 2, illustrates that even when including HRR fixed effects, women spend almost \$1,000 more than men on end-of-life care.[24] Column 2 in Table 7 sheds more light on the significant, positive relationship between gender and spending. When including a female – black interaction term, the female gender term becomes insignificant, showing that white men and women spend similar amounts on health care. The race coefficient shows that black men spend \$7,400 more than whites, and black women spend \$5,000 more than black men, as shown by the female – black interaction coefficient, thus black women spend \$12,400 more than white women and men. Hence, the significant positive spending difference between

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[24] To confirm that this finding is not due to women's tendency to be diagnosed with more expensive, high intensity cancers, such as breast cancer, the cancers whose burden almost entirely fall on only one gender (such as breast or prostate cancer) were removed. The coefficient subsequently increased, affirming that women spend more than men.

Table 7. Regressions of Total Medicare Expenditures on Median Income and Demographic Characteristics

Dependent Variable	Total Medicare Expenditures (in 1,000's)	
	(1)	(2)
ZCTA median income (in 1,000's)	0.0048	0.0049
	(0.033)	(0.033)
Medicaid	-1.65	-1.71
	(1.42)	(1.42)
Female Gender	9.93***	0.91
	(1.58)	(0.70)
Black Race	10.42***	7.40***
	(1.67)	(1.83)
Female x Black Interaction		4.97**
		(1.92)
Constant	28.71***	28.93***
	(2.51)	(2.53)
Sample Size	136,040	136,040

Notes: Both regressions include HRR fixed effects and exclude individuals living in HRRs with fewer than ten observations. Both regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

women and men appears to be driven by black women’s tendency to spend much more than black men.

This analysis of the influence of the interaction between gender and race on spending raises interesting questions that are beyond the scope of this paper but warrant further research. Analyzing the association among gender and race and utilization rates also would help achieve leverage on the effects of preferences and doctor-patient communication on health care spending and utilization because evidence shows that women and men communicate differently in regards to health care decision making.

6. DISCUSSION

The results of this analysis support the main predictions of our model. Without HRR fixed effects, individuals in wealthier areas spend significantly more on health care.

Yet when controlling for regional differences, the association between spending and income becomes insignificant. Decedents from wealthier ZCTAs are more likely to receive high quality, low intensity care in the following cases: they are more likely to enroll in hospice, spend more days in hospice, spend more on hospice, and are less likely to undergo CPR, are less likely to be hospitalized, and less likely to die in the hospital. However, they also receive more intense, low quality procedures: they visit more specialists, are more likely to enroll late in hospice, and are more likely to undergo chemotherapy at the end of life. There was no statistically significant association between income and ER visits or ICU stays.

To investigate whether patients residing in higher income ZCTAs are more likely to receive high or low quality care, we create three quality indexes in Table 8. The poor quality indicators approved by the National Quality Forum enabled creation of these quality indexes. The hospice quality index ranges from 0 to 2 (2 indicates the highest quality care) and an individual receives one point for being enrolled in hospice at any time in the last six months of life and one additional point for spending more than one week in hospice in the last six months of life. The poor quality index ranges from 0 to 4 (4 being the lowest quality care) where an individual receives one point for each of the following utilization measures: whether the individual underwent chemotherapy in their last 2 weeks, died in the hospital, visited the ER more than once in their final month, and spent time in the ICU in their final month. An overall quality index combines the previous two quality indexes and ranges from -4 to 2 (-4 is the lowest quality care and 2 is the highest). It was calculated by subtracting the poor quality index from the hospice quality index.

Column 1 shows that those residing in wealthier areas receive higher quality care. The elasticity of 0.12 at the 99th percentile in Column 1 illustrates that a 1% increase in

Table 8. Regressions of Quality Indexes on Median Income

Dependent Variable	Hospice Quality	Poor Quality	Overall Quality
	(1)	(2)	(3)
ZCTA median income (in 1,000's)	0.0009***	-0.0002	0.001***
	(0.0002)	(0.0002)	(0.0003)
Medicaid	0.023**	-0.038***	0.060***
	(0.009)	(0.008)	(0.014)
Female Gender	0.088***	-0.071***	0.16***
	(0.006)	(0.005)	(0.010)
Black Race	-0.043***	0.073***	-0.12***
	(0.010)	(0.010)	(0.018)
Constant	1.04***	0.47***	0.58***
	(0.014)	(0.014)	(0.025)
Sample Size	136,040	136,040	136,040

Notes: All regressions include HRR fixed effects and exclude individuals living in HRRs with fewer than ten observations. All regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are clustered to control for autocorrelation. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

income (approximately a gain of $13,000) leads to an increase in quality of care by approximately 0.12%. Column 2 shows those in wealthy ZCTAs are no less likely than their counterparts to receive poor quality care. Column 3 shows that patients living in higher income ZCTAs are also more likely to score higher on the overall quality metric. A 1% increase in income at the 75th percentile, equivalent to $6,700, is associated with an increase in overall quality by 0.34%. The statistically insignificant income coefficient in Column 2 shows that most of the overall quality gain associated with income in Column 3 comes not from receiving less poor quality care, but instead from receiving more high quality hospice care.

Table 8 also illustrates that Medicaid enrollees, women and non-blacks are more likely to receive high quality care, instead of low quality care, than non-Medicaid patients and men. The results from Table 8 illustrate that decedents living in higher income areas, Medicaid enrollees, women, and non-blacks are all more likely to receive more high quality care than their counterparts.

To analyze whether the association between total spending and income persists in the highest and lowest spending HRRs, Table 9 analyzes the effect of income on spending when examining only the ten highest or lowest spending HRRs.[25] The highest-spending HRRs are characterized by high utilization rates of Category III care, in contrast to low-spending HRRs that more often provide low intensity, inexpensive care. When using Ranking Method A and analyzing only the patients within the ten highest spending HRRs on a per decedent basis, a $1 increase in median income leads to a decrease in total spending by $0.33. In contrast, there is an insignificant relationship between total spending and income in the ten HRRs with the lowest spending when using Ranking Method A.

Because there is a potential of bias by using an outcome variable to define a sample, we also run the same regressions using Ranking Method B, which determines the ten highest and lowest HRRs using per capita end-of-life spending from a cohort of all Medicare decedents, not only cancer patients.[26] Despite the fact that many of the HRRs included differ, the results from Ranking Method B corroborate the findings from Ranking Method A. Total spending decreases by $0.16 when median income increases by

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[25] The ten highest spending HRRs using Ranking Method A, which uses the cancer cohort that was employed as the primary dataset in this analysis, are (average spending in parentheses): Newark, NJ ($237,174); Contra Costa County, CA ($232,129); Modesto, CA ($220,423); Alameda County, CA ($208,894); Los Angeles, CA ($206,870); New Brunswick, NJ ($206,462); San Luis Obispo, CA ($192,311); Philadelphia, PA ($185,623); San Francisco, CA ($185,165); and San Mateo County, CA ($182,949). The ten lowest spending HRRs as determined by Ranking Method A are (average spending in parentheses): Grand Junction, CO ($28,040); Mason City, IA ($43,500); Winchester, VA ($47,629); Greensboro, NC ($47,673); Baltimore, MD ($50,914); Yakima, WA ($51,027); Casper, WY ($51,149); Rochester, NY ($51,641); Muskegon, MI ($52,739); and Charlottesville, VA ($53,007).

[26] Ranking Method B uses average Medicare spending in each HRR in the last six months of life, as reported by the Dartmouth Atlas of Health Care, to define the ten highest and lowest spending HRRs. The ten highest spending HRRs are (average spending in parentheses): Manhattan, NY ($51,989); Bronx, NY ($47,019); Los Angeles, CA ($46,542); Miami, FL ($43,280); McAllen, TX ($42,342); Chicago, IL ($40,959); Newark, NJ ($40,709); Hackensack, NJ ($40,328); East Long Island, NY ($40,244); and Orange County, CA ($39,539). The ten lowest spending HRRs are (average spending in parentheses): Dubuque, IA ($17,529); Billings, MT ($18,640); Minot, ND ($18,970); Bismarck, ND ($19,068); Appleton, WI ($19,358); Mason City, IA ($19,428); La Crosse, WI ($19,631); Iowa City, IA ($19,816); Binghamton, NY ($20,112); and Grand Forks, ND ($20,232).

Table 9. Regressions of Total Medicare Expenditures on Median Income for Different Samples of the Ten Highest and Lowest Spending Regions

		Ranking Method A	Ranking Method B
Data Sample	10 Highest Spending HRRs	-0.33*** (0.098)	-0.16*** (0.059)
	10 Lowest Spending HRRs	-0.035 (0.042)	0.053 (0.234)

Notes: The coefficients on median income are shown. The regressions run are similar to those in Column 5 of Table 2, except for the sample. Ranking method A ranks HRRs by mean spending in the last six months of life among the cancer cohort that is the primary dataset for this analysis. Ranking Method B ranks HRRs by mean spending in the last six months of life from a cohort of all Medicare patients from the Dartmouth Atlas of Health Care. All regressions control for cancer diagnosis and the other diseases the patient is diagnosed with. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

$1 in the ten highest spending HRRs as determined by Ranking Method B, which is slightly less than half of the effect seen when using Ranking Method A. The effect of income on total spending remains insignificant among the ten lowest spending HRRs when using Ranking Method B, as we found with Ranking Method A. These results reveal that those living in the wealthiest areas in the highest spending regions of the country spend significantly less than other Americans. This suggests that those in wealthy ZCTAs choose to receive less of the high intensity care that is characteristic of high-spending regions. The small sample size in HRRs with the lowest spending and the likelihood that all residents in low-spending regions receive similarly low levels of spending and utilization may explain the statistically insignificant association between spending and income in the lowest ten spending HRRs.

7. CONCLUSION

In summary, we have seen that Medicare decedents residing in higher income regions spend more than decedents in low-income zip codes. Yet when controlling for the region within which care is provided, individuals residing in higher income regions spend on health care at the end of life much like other Americans. Residents of high income areas are also more likely to receive high quality, low intensity care, such as hospice, and avoid poor quality, high intensity care, such as dying in a hospital.

Our study suffers from several limitations worth noting. By using a retrospective cohort we potentially introduce bias; we minimize this bias by only including patients diagnosed with cancer associated with a high probability of near-term death. Moreover, median income is an imperfect measure of the zip code's income distribution. We mediate this by confirming the validity of this strategy using alternate income measures to the extent possible. Furthermore, limited time prohibited additional examination of the interactions among race and gender and spending and utilization, but future research may shed light on this complicated and potentially informative relationship.

There is something to be learned from those who do avoid poor quality care and utilize less high intensity care. Although we cannot make verifiable claims about the mechanisms for these results, we have presented several theories – such as the ability of wealthier individuals to advocate for themselves – that may explain why those living in higher-income areas are more likely to avoid high intensity, low quality care. We hope that further research will identify the qualities, behavior, and mechanisms by which residents of higher-income areas receive lower intensity, better care. These findings also may instruct us on what policy levers to utilize to provide higher quality care while lowering costs. For example, if those in wealthier districts avoid this care because they are better able to understand the choices they face, then policies to increase the provision of helpful information to patients about viable alternatives of end of life care could be warranted.

The potential of greater dissemination of information – to encourage further hospice use for example – to decrease costs is large. If the association that we found between hospice spending and total spending in Table 5 is fully causal, an increase in hospice utilization in an HRR in the 25th percentile of hospice spending to the equivalent hospice utilization of an HRR in the 75th percentile would lead to a per capita decrease in spending of $3,573, which amounts to almost half of the $7,538 that the U.S. spends per capita on health care and approximately 4% of the $97,362 that is spent per capita on patients with poor prognosis cancer in the last six months of life. To the extent that the association between hospice and overall spending is not fully causal and instead due to practice pattern differences, this is the upper bound of the effect of hospice spending on decreasing overall spending. Yet because spending in the last year of life represents 30% of total Medicare spending, the 4% reduction on the almost $100,000 per capita spending on cancer decedents represents a significant potential spending reduction. Other authors corroborate substantial financial gains for altering practice patterns: Wennberg et al. (2002) suggest that spending would fall by 29% if utilization patterns in medium- and high-spending regions mirrored those in low-spending regions.

Future analyses may reveal the strategies that are most effective in helping regions herprovide lower intensity and higher quality care and the policies that will most help patients make informed decisions, such as better doctor-patient communication, greater dissemination of information to patients about costs and benefits of care, and better coordination of care. One recent study by Temel et al. (2010) showed that increased communication with patients regarding palliative care options at the end of life increased patients' use of palliative care, thus increasing their survival while decreasing their end-of-life health care costs. By decreasing the asymmetry of information between patients and their caregivers, policies similar to the one employed by Temel et al. would ideally lead patients to prioritize high quality, low intensity care that will help improve patients’ health and quality of life, provide them with care that aligns with their preferences, and decrease overall spending. In this way, these policies could facilitate the type of Pareto improvement that motivated this analysis: provision of higher quality care at lower cost, thereby aligning care with patient preferences and addressing the increasing and potentially excessive share of the U.S. budget devoted to health care.

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