



Increasing Equity and Decreasing Costs for Medicare Access and Treatment

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HEALTHCARE INEQUITY

At some point in a citizen's life, every individual requires medical care, whether it is going to an annual checkup or going to the hospital for a major procedure. When this care is needed, costs can be high, and for some, too high. Health insurance options help to relieve some of this cost so that individuals can receive the care they need without having to pay exorbitant amounts of money. To suit the needs of many individuals, there are different types of health insurance that usually fall under two overarching categories - public health insurance and private health insurance. Focusing in on the public aspect of healthcare, one public caregiver in the U.S. is the Medicare system. Since Medicare is public, it only denies claims for medically unnecessary care. Furthermore, it covers eighty percent of the medical costs, leaving only twenty percent for the participant to pay (Archer, 2012). Thus, Medicare, and public health care in general, is often essential for many to receive both insurance and medical care that would otherwise be unaffordable.

Unfortunately, a portion of U.S. citizens are uninsured, do not receive adequate care, cannot afford medical care, or experience some combination of these situations, which translates to disparities in quality care between groups. Specifically, there are differences in quality of care based on socioeconomic status (SES) with contributing factors of race, age, and gender. People living in low-SES communities dominate the portion of the population who are uninsured, under insured, or lack access to private insurance options. Lack of appropriate insurance prevents individuals from seeking medical attention in a timely fashion, or at all, and low-SES individuals therefore experience a lower quality of care. This lack of quality care leads to poorer overall health and lack of access to preventative care, which is a common trend for aging populations, people of color, and women (Shavers, 2007).

Further compounding the problems of low quality care and high costs, citizens over 65 who are on Medicare often rely on retirement benefits and have no active source of income to easily cover medical costs. The elderly also face more medical problems and have more interaction with the medical system in the U.S. Financially, the U.S. has the largest health expenditure per capita compared to 35 other countries (OECD, 2017). Although we spend the most money on healthcare, the life expectancy of those in the U.S. is just below average and the infant mortality rate is higher than average (OECD, 2017). The exorbitant expenditures without a correlating improvement in health outcomes for U.S. citizens is puzzling.

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CURRENT MEDICARE COVERAGE

The U.S. Medicare system provides low-cost/free insurance to elderly citizens who have previously paid their taxes during their time in the workforce. Medicare is split into parts that range in both the services it provides and costs.

- Medicare A, which requires no additional payment, covers hospitalizations and hospital care.
- Medicare B covers non-hospital services, which include doctor visits, preventative medicine, ambulance services, and some medical equipment.
- Medicare D assists beneficiaries with prescription drug coverage.

Medicare C, or Medicare Advantage, does not cover specific services like Medicare A, B, and D. Instead, Medicare C involves a third party company to provide additional services separate from Medicare. Those who choose to enroll in Medicare C coverage from a third party company, rather than the federal insurance program (United States Centers for Medicare and Medicaid Services, n.d.).

ACA Policies

Implemented in 2010, the Affordable Care Act (ACA) was developed to provide affordable healthcare options for millions of Americans. The ACA focuses on preventative care by providing incentives to reduce Medicare recipient readmissions to hospitals and reduce hospital-acquired conditions. The end goal is to improve physician and healthcare personnel performance.



As humans progress in age, it is more common for them to possess comorbidities. A few common comorbidities include diabetes, renal impairments, and arthritis, all which increase the chance for infection. As we age, our immune system has a greater difficulty fighting off these infections and thus a harder time treating these comorbidities in the hospital, which can potentially lead to more hospital admissions. By 2012, financial penalties were issued to hospitals with larger than average rates of readmissions within a thirty-day period for Medicare recipients. This fine correlated to 150,000 fewer patient readmissions in 2013 alone (Blumenthal, 2013).

In order to improve patient safety, the ACA implemented another aversive payment program in an effort to reduce rates of avoidable infections, such as methicillin resistant bacteria (MRSA). Additionally, Medicare funding was reduced for hospitals and medical facilities with notable amounts of patient falls and pressure ulcers. Since the implementation of the ACA in 2010, the rate of these preventable hospital acquired conditions has decreased significantly (Blumenthal, 2013) (Figure 1). Another possible solution to increase the safety of patients in the hospital setting could be to hire additional well-trained healthcare staff (nurses and nursing assistants). Increased staffing translates to greater probability of an employee to answer a patient's call quickly and be available to lend support for daily hygiene care and assistance when walking. Thus, a potential future improvement could be adding direct legislation that discusses a mandatory ratio of patients to health care employees rather than additional fines. Even with the advancements of the ACA, disparities are still present in terms of overall access to Medicare.

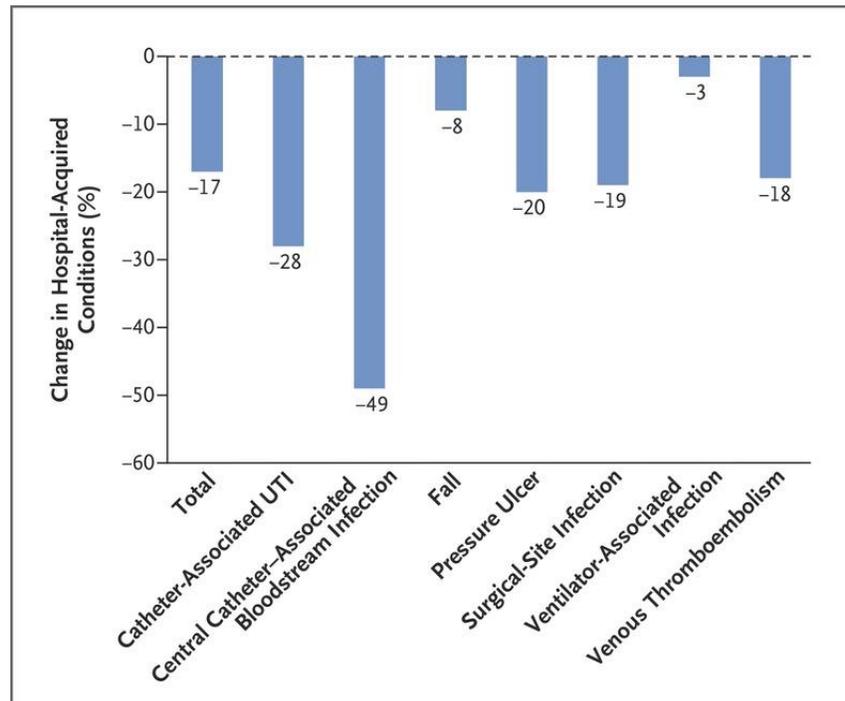


Figure 1. Percent Changes in Preventable Hospital Acquired Conditions from 2010 to 2013 for patients on Medicare (Blumenthal, 2013)

Electronic Health Records

According to the Centers for Disease Control and Prevention (CDC), there has been a steady increase in physicians using Electronic Health Records (EHRs) to store patient health data between 2007 and 2015 (Figure 2) (Jamoom, Yang, and Hing, 2016; Hsiao, Hing, and Ashman, 2014; Jamoom and Yang, 2016). Today, the majority of the health data is stored on EHRs. EHRs are patient-centered records that contain information about each patient's health in one place. EHRs provide patient data to hospitals and healthcare workers in real-time whenever and wherever they need the data to make medical decisions for and with patients. More specifically, EHRs store the patient's medical history, diagnoses, medications, immunizations, allergies, radiology images, and lab and test results. This record system increases organization and accuracy of patient information. EHRs eliminate illegible handwriting and use error proofing techniques such as allowing only a certain amount of numbers in the phone number cell when patient's fill in their personal information. The system can automate certain tasks and streamline the health provider's workflow, such as searching for a patient in a large hospital system (ONC, 2018).



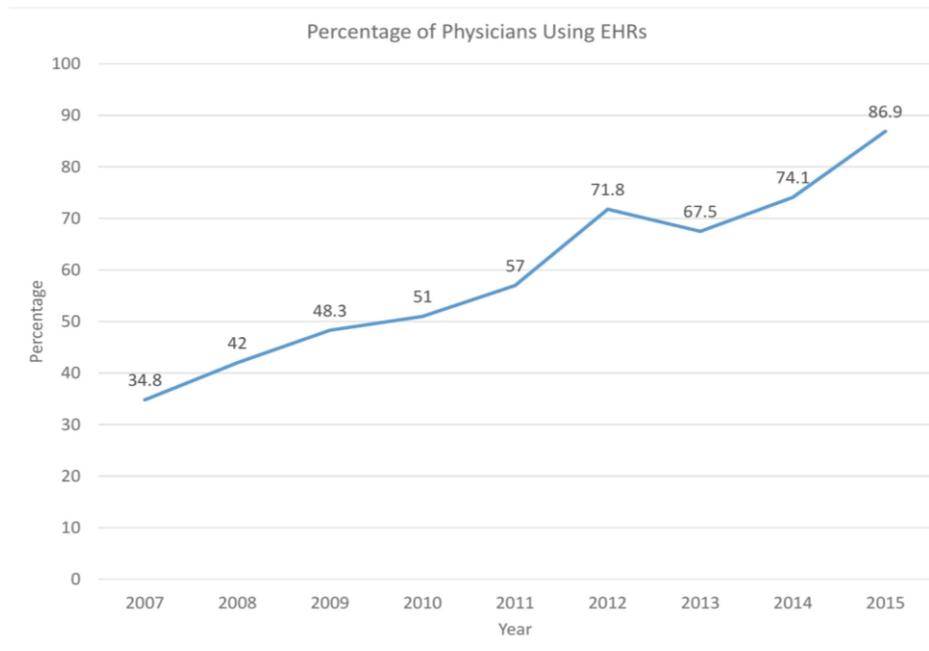


Figure 2: Percent of office-based physicians using any EMR/EHR system.

EHRs allow providers to readily share health data with each other to ensure the most accurate and up-to-date information about a patient's care is available for proper diagnoses. EHRs can prevent errors in prescriptions of drugs, specifically those that may interact in harmful ways. An EHR can also alert doctors to medications previously issued by other doctors to prevent misuse of drugs, prescribing previously ineffective treatment options, and prescribing of therapeutics that could trigger allergic reactions. These checks reduce risks and costs associated with taking ineffective or harmful medications. With EHRs, care providers can have access to all the patients test results and records at once, reducing the potential for unnecessary repeat tests and costs for the patient. Lastly, EHRs give the individual patients access to all of their personal medical information (ONC, 2017). All of these efforts support and add to the benefits seen with the ACA.

Using EHRs, the Office of Enterprise Data and Analytics, within the Centers for Medicare & Medicaid Services (CMS), have developed CMS Program Statistics, which is a data repository for healthcare statistics, Medicare coverage, and population data (CMS, 2017c). This information is sent out to the public for patients to easily see summary statistics on national health care including the costs of patient care. The CMS Program Statistics database includes three sections of information: Medicare Utilization, Medicare Providers, and Medicare Enrollment. The Medicare Utilization section has Medicare utilization and payment data for several service types such as inpatient, outpatient, and physician/supplier data (CMS, 2017c). The Medicare Providers section has tables and maps that include counts, nationally and by state, of Medicare certified institutional providers (i.e., hospitals), as well as counts of non-institutional providers (i.e., physicians and suppliers) (CMS, 2017b). Lastly, the Medicare Enrollment section has tables and maps that include counts of Medicare enrollees nationally, by state, demographic characteristics, and Medicare plans (CMS, 2017a). With all of this information out there to the public in an easy to understand format, patients can be informed about the Medicare treatment that is best for them in their area and across the country. These efforts seek to inform patients of the best medical care

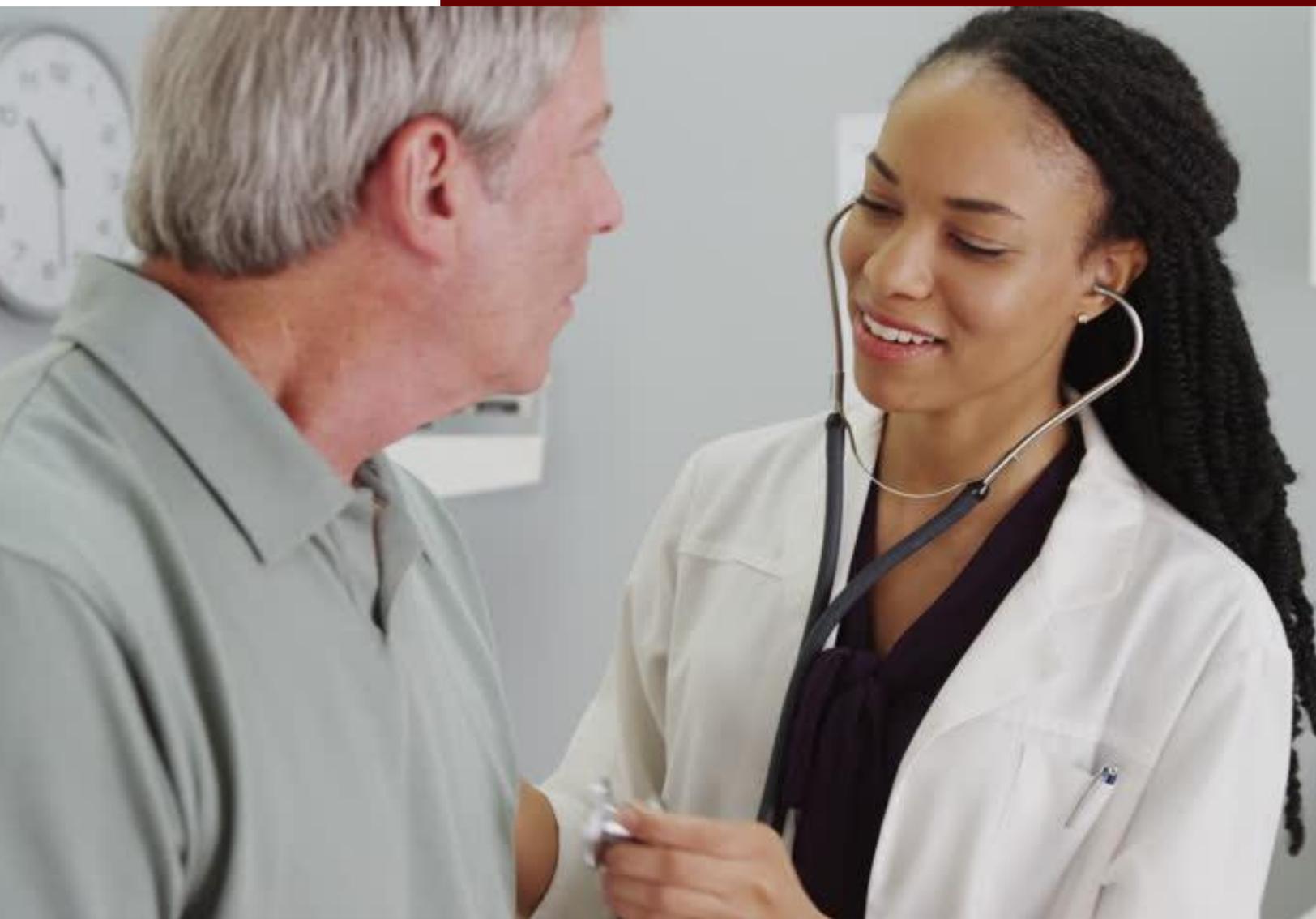
options available, but we still see inequity in access to and quality of care. With provisions in place to police the doctors and the sharing of information, the next plausible factor influencing inequity is coverage for care.

Lapses in Coverage

While Medicare covers a vast majority of the elderly population, the lower SES portion is unequally represented. This population has issues meeting the initial requirements of Medicare, most notably the tax requirements. Individuals who have not contributed 10 years' worth of Medicare taxes while in the workforce cannot receive coverage under any Medicare plans. This requirement isolates the long-term unemployed. Additionally, the structure of Medicare leaves those of lower SES with incomplete medical coverage. Part B, C, and D, which provide additional coverage outside of hospital care, require payment of copays that are unaffordable to these individuals. Currently, 4 million individuals have only Medicare part A, and 13 million individuals do not have prescription drug coverage. (National Committee to Preserve Social Security and Medicare, 2015). The result is a system in which low SES individuals default to receiving care when their condition worsens to a severe degree rather than seeking preventative medical attention and focusing on overall health. The access and equity issues that contribute to lower quality care, specifically in elderly populations, has translated to disparities between groups of individuals that are influenced by SES, proximity to appropriate and adequate care, and resources to cover medical costs.

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HEALTH DISPARITIES

Understanding health disparities is crucial to the process of improving Medicare through new policy implementation. Health disparities are caused mainly by socioeconomic status, with interacting factors such as race, age, and gender. Studies indicate that higher SES groups have greater health status improvements compared to lower SES groups. Low-SES individuals are at a higher risk of developing physical and mental problems, such as heart disease and depression, due to the gaps in healthcare services they experience. (APA, 2018)

Using the state of Virginia as an example, we can determine the relationship between SES and quality of care with statistics about Medicare beneficiaries. In Virginia, Floyd County has a median household income of \$48,005, and Loudoun County has a median household income of \$115,574. That places Floyd County in the low SES category and Loudoun County in the high SES category. The median household income of Loudoun County is more than double that of Floyd County, demonstrating the greater potential need for public health insurance in Floyd County and in poorer areas in general. This aligns with data from the United Census Bureau, which indicates that 35.45% of Floyd County residences utilized public healthcare in 2016. The age distribution of these individuals shows that 20% of the public healthcare recipients are ages 65 and older and, therefore, would fall under Medicare. In Loudoun County, the number of individuals with public insurance is only 12.13%, while those with private insurance is 86.46%. (U.S. Census Bureau, 2016) This significant difference between the beneficiaries of public versus private health insurance in these two counties contributes to the difference in the quality of care these two areas receive.

The national data suggests that low SES regions lack access to certain medications or procedures, and access to specialists and providers. This reduced access is the result of a low number of physicians practicing in lower income areas. Data suggests that practicing physicians tend to reside in higher-income areas, or areas that are in or near cities (Figure 3). In Virginia, more physicians practice in Loudoun County and other counties in the northern area, while noticeably fewer physicians work in the rural areas of southwest Virginia. Thus, patients inherently have a smaller pool of physicians to go to when medical care is needed. Furthermore, if they need a physician of a higher degree of specialization, it may be harder to find an available physician in non-metropolitan areas where a higher percentage of Medicare and public health insurance users may need those services.

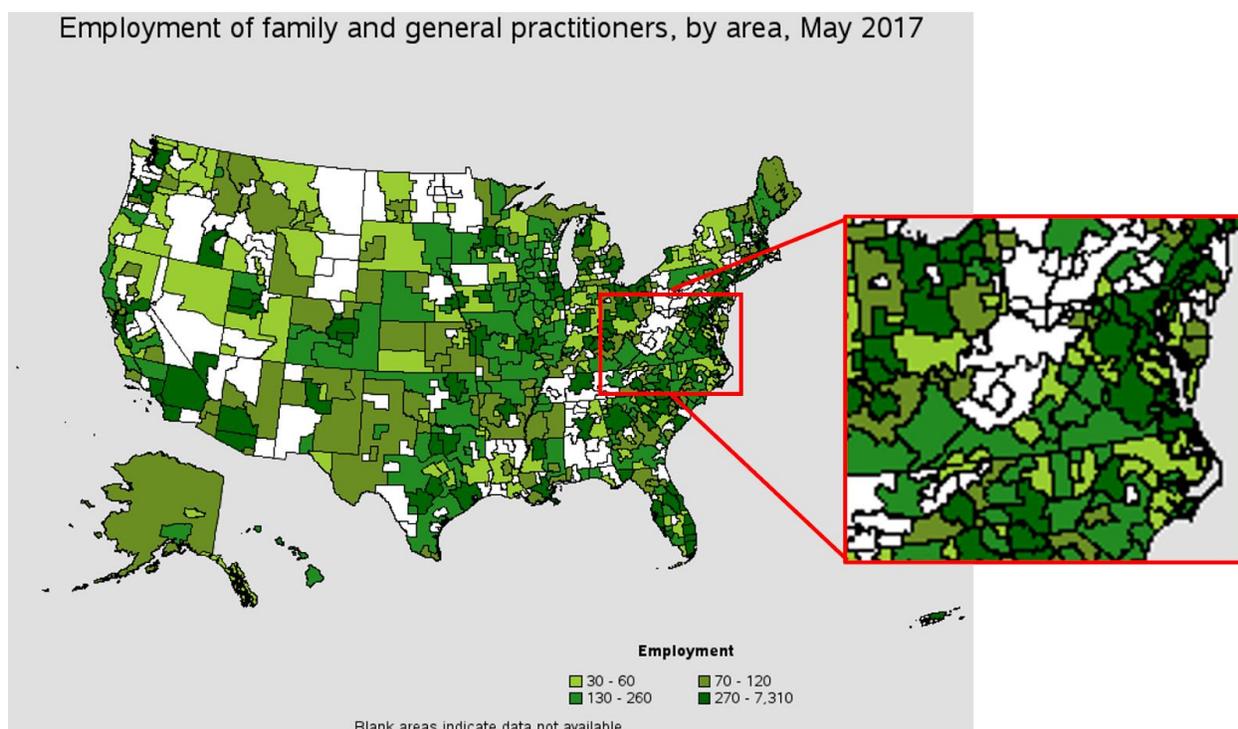


Figure 3. Employment of Practicing Physicians and Surgeons in the U.S. as of May 2017 (Left); in Virginia (Right insert) (Bureau of Labor Statistics, 2017)

The disparity in the quality of healthcare in impoverished areas extends beyond healthcare into sectors that can influence how beneficiaries benefit from public health care. These areas are affected by poorer schools with limited education and resources, which could possibly result in a lack of recognition of illnesses or reluctance to visit the doctor. There is also an insufficiency of employment opportunities and quality food (APA, 2018). Unemployment means that individuals will not have insurance through employers, may go without purchasing individual insurance, or may receive public insurance. Transportation to and from health care centers is another issue in low SES areas because there are more transportation barriers. Patients in low-income areas tend to travel distances to reach healthcare provider, may not have access to public or private transportation, or public transportation is expensive or inconvenient for them. (Syed et al., 2013)

Different races show patterns that parallel the SES stratification. Health disparities occur between race and ethnicity because certain races are more likely to be in low SES areas for various reasons (APA, 2018). Minorities, specifically Native Americans, Blacks, and Hispanics, have higher rates of poverty than Whites and Asians (Poverty USA, 2018). Health disparities between races may also be attributed to an unfamiliarity with their doctor. There can be language barriers among minorities and healthcare professionals. Essentially, inability or limited ability to speak English well could serve as a deterrent to going to the doctor. In addition, if their doctor is not perceived as culturally sensitive, a patient will be less likely to go back to the office. (University of Minnesota, 2013) Minorities also face greater discrimination compared to others. Discrimination in obtaining jobs, disparities in pay, or housing can affect someone's socioeconomic status, subsequently affecting their overall health. Studies have shown that even the perception of racism, if they believe that someone is bias against them, is shown

to negatively influence health outcomes because it qualifies as a life stressor. The perception of racism can lead to increased blood pressure, substance or alcohol abuse, or anxiety (APA, 2018). Minorities additionally face a higher risk of incarceration. Incarcerated individuals are typically minorities from low SES and lose their voting rights as a result of incarceration (Ferrer, 2018). The loss of voting rights means that they are unable to influence policies that impact them (i.e. policies on healthcare, poverty reduction) and will not be able to improve their way of living or health.

Health disparities are also prevalent between men and women. In all racial and ethnic groups, women have higher rates of poverty than men. For example, 18.7% of black men are in poverty compared to 25% of black women. Similar patterns occur with Hispanics, Native Americans, Asians, and white people: women in poverty are about 2-5% greater than the amount of men. Several theories attempt to explain this relationship (Eichner & Robbins, 2015). First, the gender wage gap: women who have the same education and occupation levels of men will also have a lower overall income than those men (APA, 2018). Women currently earn around eighty cents for every dollar that a white, male earns. This statistic is lower for black women, who make about sixty-three cents, and Latina women who make about fifty-four cents to the dollar (Cawthorne, 2005). Women are also more likely to face problems of domestic violence and abuse, which can lead to a cycle of poverty and poor health (APA, 2018). In an abusive relationship, the abuser controls the wealth and income, and women typically have little monetary control. It can be difficult to escape the relationship when they do not have much money by which to do so. Research collected by the U.S. Conference of Mayors indicated that half of the cities identified domestic violence as the main cause of homelessness (Cawthorne, 2005). Workplace discrimination because of pregnancy or harassment also contributes to low SES for women (APA, 2018). Pregnancy, planned or unplanned, can affect a woman's work schedule as they may need parental leave. Women have an increased responsibility to raise children, compared to men (APA, 2018). Employers may choose to exclude women from particular jobs because they believe they might be out of work due to pregnancy or they may not want to cover their medical costs. This interferes with a woman's opportunity to obtain income. Sexual harassment in the workplace can also influence job choice and longevity. In the majority of high paying jobs, women are underrepresented and this discomfort may keep them from gaining wealth.

Societal institutions, policies, and norms maintain the stratification of socioeconomic status resulting in disparities in health (Ferrer 2018). This, consequently, affects underrepresented groups like minorities and women. High SES individuals have more power-influencing legislature and have resources that specifically benefit them (Ferrer 2018). Availability of legislature power can influence who has access to public resources and at what cost. One can conclude that lack of representation by individuals in disparity groups contributes to the continued inequality in care.



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GLOBAL STRATEGIES TO IMPROVE HEALTH

The cancer incidence rate in the U.S. is 318 people per 100,000 people. That rate is above the average for the 35 countries within the Organisation for Economic Co-operation and Development by over 47 people (OECD, 2017). The high rate exists despite adequate amounts of radiation oncologists and physicists, advanced pathology, imaging, and surgical services available to patients with health coverage in the U.S. The high incidence rate is due to disparities in socioeconomic status, race, access to health care services, individual behaviors, social and physical environments, exposure to carcinogens, and treatment (Souza et al., 2016). When we compare health outcomes within the U.S. to those in other countries, we can start to see how programs implemented in areas with better outcomes can translate to great national health.

The Human papillomavirus (HPV) has been found to increase the risk of developing certain cancers. To counteract this health issue, a vaccine was developed and can be administered during adolescence to reduce the risk. While only 32% of the target population in the U.S. has been vaccinated with the HPV vaccine, Brazil has covered 87.3% of the target population within the first 6 months after making the vaccination free to girls between the ages of 11 and 13 (Souza et al., 2016). Making the vaccine free allowed a greater amount of the target population to access the preventative measure they needed.

Greece has the second lowest rate of cancer incidence in the 35 OECD countries. One of the reasons for this may be the traditional Greek diet, which contains protective substances such as selenium, glutathione, a balanced ratio of n-6/n-3 fatty acids, high amounts of fibers, antioxidants, and vitamins E and C (Simopoulos, 2004). The low incidence in this population suggests that a preventative measure or intervention strategy using specific dietary patterns could be used to manage patients with cancer. This would reduce the need for expensive interventions that some patients cannot afford or access.

A program in Delaware that took place between 2002 and 2009 “eliminated screening disparities, equalized incidence rates, reduced the percentage of African Americans with regional and distant disease from 79% to 40%, and nearly eliminated mortality differences” (Souza et al., 2016). They achieved this through a colorectal screening program, which used nurse navigators and care coordinators to recruit and navigate patients. Their cancer treatment program also provided universal screening and treatment in combination with existing insurance coverage.

The U.S. has the means to reduce the high incidence of cancer in the country by reducing the large disparities by race/ethnicity and socioeconomic status. Greater preventative measures in the younger population can translate to a reduction in people over the age of 65 suffering from cancer once those individuals reach the qualifying age for public coverage. Based on these cases seen in other countries, the U.S. can achieve improved health outcomes through increased access to vaccines in target populations, better care coordination, increased access to screening programs, promotion of changes in diet, and universal screening and treatment.

Greater access to care can also be achieved through palliative care. Palliative care is an approach that improves the quality of life of patients and their families facing the problems associated with life-

threatening illness through the prevention and relief of suffering (Souza et al., 2016). This type of care provides the means for early detection of life-threatening disease, treatment of pain and other problems, and relief of suffering through more affordable means. Studies have shown the use of hospital-based palliative care visits and home-based care can reduce hospital costs up to \$7,500 per patient (Souza et al., 2016).

A comparison of 10 countries of similar economic status to the U.S. suggests more patients did not meet a medical need because of cost (OECD, 2017). This might suggest that the group of individuals in the cost-associated unmet need category would be in low SES regions and groups. Interestingly, the United Kingdom is an exception to this idea. The cost-associated unmet care needs are similar between low-income adults and the rest of the population. Between 2004-2005 and 2011-2012, the National Health Service (NHS) in England successfully reduced socioeconomic health inequalities by strengthening primary care access and quality (Asaria et al., 2016). Their universal coverage plan combined with the increased emphasis on primary care has lowered the amount of patients skipping care needs due to cost to only around 7-8% for all income groups (Figure 4). This further supports the idea that a universal care system can reduce disparities.

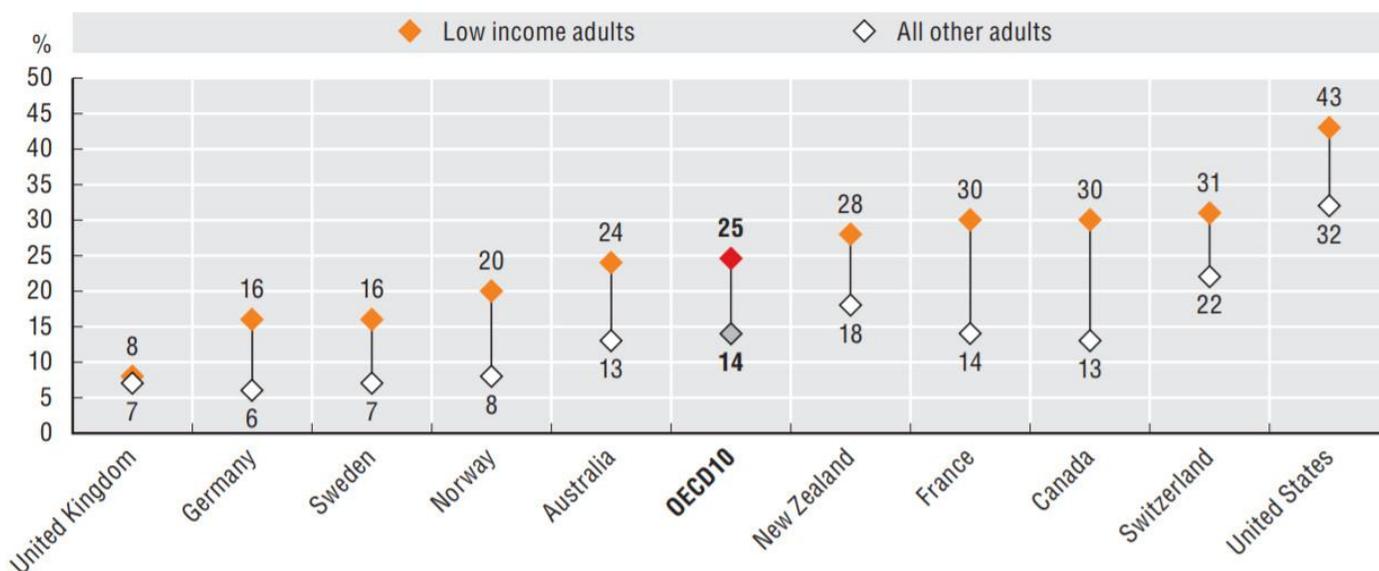


Figure 4. Unmet Care Needs due to Cost, by Income Level, 2016 (OECD, 2017)

In 2018, a study conducted by Midtbust, et al. through in-depth interviews with 20 healthcare professionals from Norwegian nursing homes. The participants suggested that increased openness and cooperation with the patients' relatives and the professional team resulted in an increase in understanding and improvements to quality of care (Midtbust et al., 2018). Adopting such an approach would require extensive education and training to ensure that facility staff understand the process for and benefits of inclusion of family members in developing care plans. Ideally, implementation of this type of care in nursing homes across the U.S. would promote the best possible care while remaining flexible to the patient's needs and sensitivities.

Greater emphasis should be placed on regular visits to primary care physicians, as was done in England, and palliative care as opposed to seeing a specialist or going to the emergency room. Measures can be taken to provide the best possible care through openness with patients and their families. More emphasis on great, flexible, and personalized care provided through palliative care will also boost scalability of this care, thus decreasing the overall cost to the healthcare system.

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FINANCING CARE

Medicare reimbursements are one cause for the increase in healthcare prices that we have seen over the last two decades. The problem comes in two stages. The first is reimbursement to hospitals for treatment of Medicare patients. Payments made to Medicare Part A providers have majorly changed twice since the creation of the Medicare system. The first change came in 1984 with the introduction of Diagnostic Related Groups (DRGs), which established a set refund amount to providers for treatment of a Medicare patient with a certain condition. These payments were adjusted according to the economic condition of the area around the hospital or practice controlled by the Center for Medicare Services (CMS)-DRG system (Carter, 2017). The next changes occurred in 2007 through the Medicare Severity (MS)-DRG, which implemented reimbursements to hospitals with greater accuracy and created a set of hospital-acquired conditions that would not be covered by Medicare (Carter, 2017). Establishing limits to coverage amounts required providers to accept the lost revenue or pass the unmet charges on to non-Medicare patients, which placed the hospital's financial deficit on non-Medicare individuals and their insurance companies.

Medicare Part B, which covers primary care and office visits, operates under a fee for service system as well, but is controlled by Relative Value Units (RVU) and accounts for the surrounding economic conditions of the practice. Medicare spending decreased after this change and linked healthcare spending to the GDP growth rate, which also severely reduced the compensation to doctors. These cuts were constantly pushed back with 'Doc Fix' acts. The low reimbursement rates given to practitioners had the same effect on healthcare costs as the system applied to Part A coverage. In 2015, RVUs transitioned to the Medicare Access and Children's Health Insurance Program Reauthorization Act (MACRA), which created two systems that divide doctors based on how many Medicare patients they treat in a given year. The first of the two is similar to the previous system with a standard compensation provided if performance standards are met and electronic health records are used. The second system has performance-based qualifications that use performance wagering to reimburse doctors. This system pits doctors with similar expertise against each other. Figure 5 shows the growth rates of the national health expenditures in billions with corresponding changes over time and some of the contributing factors. The overall trend is a constant rise in national health expenditures. Looking specifically at Medicare, the rate of increase has been relatively low. This rate of change can be compared to the percent change in national expenditures (Figure 6), which decreases over time. The most significant change occurred as a result of changes implemented by the ACA. The comparison of trends in expenditures per program and percent change over time for Medicare suggests that Medicare does not have a major influence on national expenditures.

Increasing Costs

We return to Floyd County, Virginia, and Loudoun County, Virginia, as examples of how costs have changed. On average, 30% of the total medical charges billed to Medicare by healthcare providers are unpaid independent of the locality. (American Medical Association, 2015). Thus, a difference between what is charged by doctors and what is paid to doctors by Medicare is a constant occurrence. For areas with a large proportion of individuals who utilize Medicare and other public health insurance options,

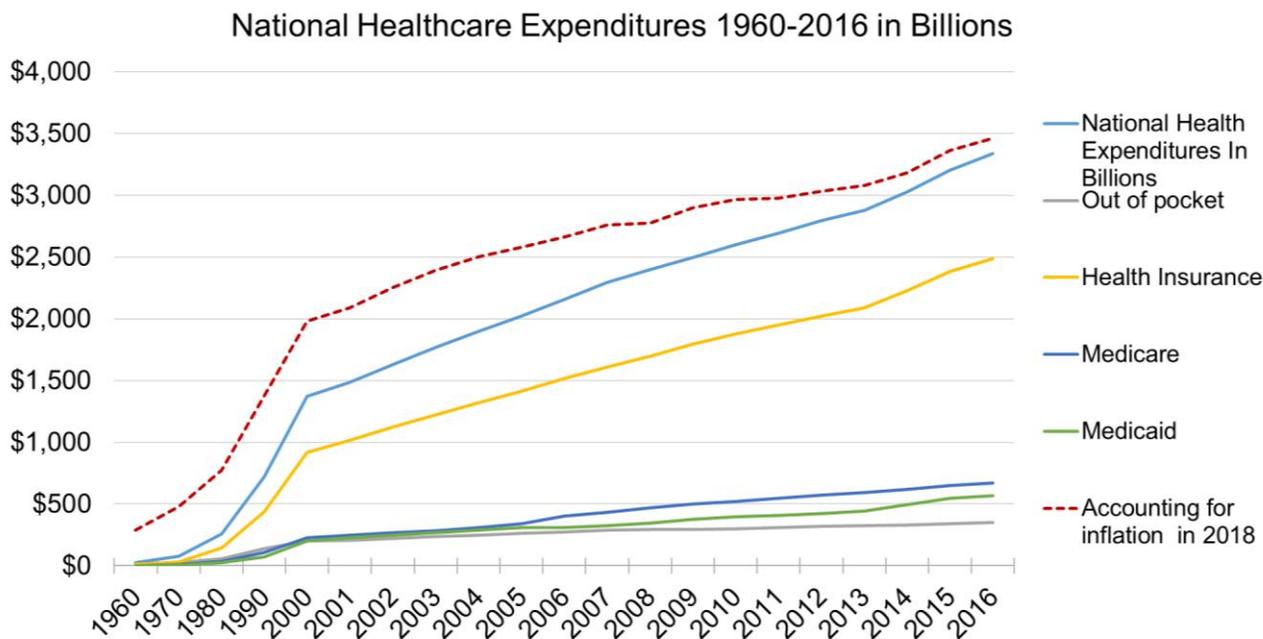


Figure 5. National healthcare expenditures in billions from 1960 to 2016. Spending for specific healthcare payment options and overall spending are shown. The period of 1960 to 2000 is in decade increments, with the remaining period after 2000 shown annually. The red dashed line shows the total national expenditure in 2018 dollars.

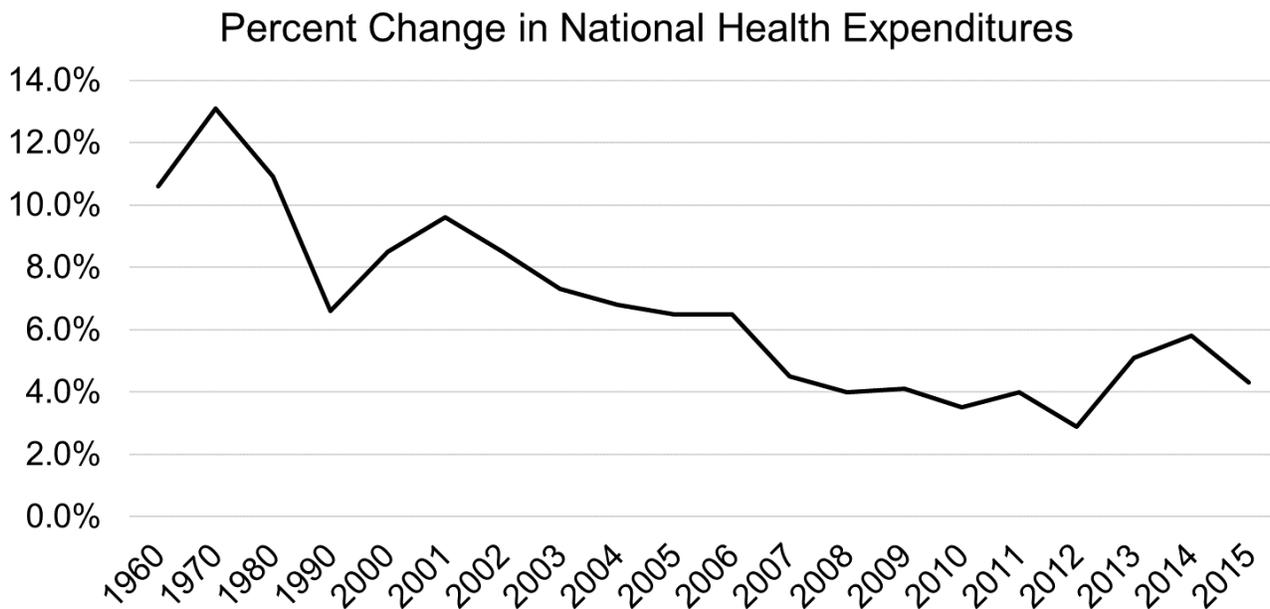


Figure 6. Rate of change for total national expenditures from 1960 to 2015. The period of 1960 to 2000 is in decade increments, with the remaining period after 2000 shown annually. Radical changes can be seen between 1970-1990 where significant changes were made to Medicare.

physicians and practices are being paid less for the medical services they provide than in regions with fewer Medicare beneficiaries (Feidt, 2013).

Other patients and insurance companies incur the unpaid costs, which increases out-of-pocket costs rather than Medicare expenditures. This is an example of how one source has increased medical spending in the U.S. by passing of cost burden between insurance companies, hospitals and the government. Insurance companies were introduced into the Medicare market in 1980 with the introduction of Medigap, and their influence expanded with the creation of Medicare Part C through the Balanced Budget Act. Medigap and Part C gave private insurance companies the ability to cover the copay for Medicare beneficiaries or offer their own coverage systems, respectively. While the policies offered are limited by federal regulation, insurance companies are still able to choose where to operate and what rates they charge for coverage. Any losses they have from Medicare must be recovered through their private market, which results in increased insurance premiums for clients on private policies, or indirectly influence hospital pricing through denied claims. Insurance companies currently have greater control over pricing and participation through recent changes to Part C through the ACA. UnitedHealthcare is one company that decided to exclude itself from participating in providing subsidized policy options for Medicare beneficiaries. It was estimated that premiums would have decreased by 5.4% with the federal subsidy option (Danfy, 2015). Companies cannot be forced to participate in certain markets with current policies, which leaves regions without Medigap and Medicare Part C options and individuals without the coverage that they need to access appropriate, quality care.

Big Data Changes How Physicians are Paid

As big data emerges from its infancy, big data is becoming necessary to help the healthcare industry. An example of this is the strategic vision for CMS. In 2015, CMS created a strategic plan that created physician quality reporting programs. These programs influence how patients and doctors make decisions by publically reporting the performance of healthcare professionals. The data collected also influences quality improvement efforts within CMS (CMS, 2015). As healthcare moves from a fee-for-service (FFS) payment system to a provider rewards system, data on quality and cost of care influences the quality of services provided by CMS to pay providers (CMS, 2015). The data collection system could be improved through procedures to collect large amounts of qualitative data from doctor-patient interactions. This data would improve the effectiveness of quality reports composed by CMS. Every word from each physician quality report would be compiled into one file containing raw data. Using big data analytical software, the computer system can compare all of the physicians in the U.S. using a predetermined scale to rank their quality simply using words from the quality reports. This approach to ranking provider quality would lead to a better way for patients to pay for their healthcare and access information on provider options.

Global Strategies for Cost Reduction

The quality of our healthcare within the U.S. is not excelling despite the fact that the highest expenditures on health are seen in this country (Figure 7). In 2017, the life expectancy at birth was at 78.8 years, which is below the OECD average of 80.6 years (OECD, 2017). The infant mortality rate was 5.8 per 1,000 live births in 2015, while the OECD median was 3.9 (OECD, 2017). Lastly, the obesity

rate among adults in the U.S. was 38.2% in 2015, which was the highest among OECD countries where the average is 19.4% (OECD, 2017). Taken together, the data suggests that the money spent on health is not going toward efforts to improve general health. Data from the 2016 OECD Health Expenditure Report shows that the problem lies within our voluntary and out-of-pocket spending (OECD, 2017).

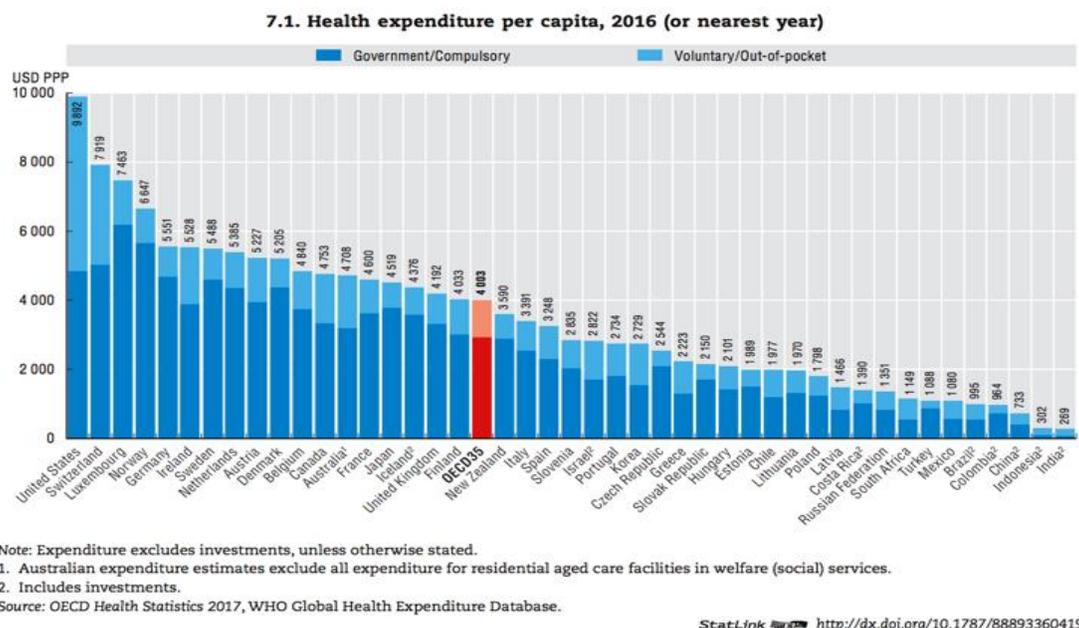


Figure 7. 2016 Health Expenditure Per Capita for 35 OECD countries. The average for all countries is included as a red bar. Expenditures are divided between federal dollars spent (government/compulsory) and citizen contributions to expenses (voluntary/out-of-pocket) (OECD, 2017)

Medicare spending accounted for 20% of our healthcare expenditures in 2016 (CMS, 2016). This rate is expected to increase as more of our population reaches retirement age and is living longer. A number of changes to Medicare have been proposed to address the increase in spending. The changes include restructuring of Medicare benefits and cost sharing, eliminating “first-dollar” Medigap coverage, further increasing Medicare premiums for beneficiaries with relatively high incomes, raising the Medicare eligibility age, and shifting Medicare from a defined benefit structure to a “premium support” system (Jacobson et al., 2017). The issue with voluntary spending rests with the increase in individuals enrolling in supplementary insurance because basic Medicare is not sufficient for their healthcare needs. In order to figure out how to reduce voluntary spending, one needs to assess the contributors to that spending and ways in which aspects of health maintenance can be publically funded.

Global Prevention Strategies

The World Health Organization (WHO) estimates that smoking causes over \$500 billion in economic damage worldwide each year (Ekpu & Brown, 2015). In addition, the cost of just tobacco-related cancers exceeds U.S. \$200 billion a year worldwide (Souza et al., 2016). As a voluntary behavior, states have approached the issue by implementing programs to deter smoking. However, a majority of the money collected in cigarette taxes and settlement money is attributed to state funding rather than the federal budget (CDC, 2012).

Conversely, the WHO estimates that increasing tobacco taxes by 50% could lead to a reduction of smokers without decreasing government revenues (Souza et al., 2016). Brazil implemented taxes on tobacco exceeding 60% of its final price. This, along with educational campaigns and other measures similar to those already done within the U.S., led to less than 12% of Brazilians as current smokers, which is a 20% decrease since 1989. The U.S. tax on tobacco exceeds 40% of its final price in most states, but 19% of Americans are still current smokers. By increasing the tax on tobacco as Brazil has, the U.S. could potentially reduce smokers without losing government revenue. Overall, this would benefit Medicare through the reduction in smokers suffering from cancer and other related health problems and the associated costs for care.

On the other hand, decreasing tobacco use may cause cigarette use to be replaced by e-cigarette use. While cigarette use decreased from 2011 to 2014, e-cigarette use, specifically among high school students, is on the rise (Buczynski, 2018). The long-term health effects of e-cigarettes is unclear and public health advocates have raised the concern that e-cigarettes may initiate youth to progress to use tobacco products in the future (Kennedy et al., 2017). Common policies to combat the use in other countries include a minimum age-of-purchase, indoor-use bans (vape-free public places), and marketing restrictions (Kennedy et al., 2017). By implementing the same policies that are used to regulate conventional cigarettes, as the WHO Tobacco Free Initiative suggests, we should see a decrease in cigarette use without increasing nicotine use from e-cigarettes (Kennedy et al., 2017).

The U.S. has a large problem with obesity and diet. Poor lifestyle choice and obesity can contribute to many chronic diseases such as diabetes, heart disease, metabolic syndromes, and cancer. An estimated 10.9 million people age 65 years and older are affected by diabetes, and over 90% of these cases are type 2 diabetes (Caspersen et al., 2012). This magnitude of the issue translates to significant medical costs. Elderly individuals collectively paid \$64.8 billion (56%) of direct diabetes medical costs in the U.S. (Caspersen et al., 2012). Public health programs are in place, but the issue persists. There is a need for modifications with targeted interventions, improved screening and surveillance, and improvements to policies to mitigate inequalities associated with care (Caspersen et al., 2012).

In a comparison of 34 countries, the U.S. ranks second for overweight population (70.1% of population 15 and over) and possesses the greatest obese population (38.2% of population 15 and over) (OECD, 2017). The United Kingdom, which is ranked sixth for percentage of population designated as obese, has implemented public health campaigns, portion control, easier access to exercise, and limited media exposure of food that is bad for health. The Netherlands possesses overweight and obesity percentages lower than the OECD average. Amsterdam specifically has managed to bring childhood obesity numbers down in underprivileged and affluent areas by promoting tap water in its schools while banning fruit juice, and refusing sponsorship to events that accept money from companies that market high-fat, high-sugar products, like Coca Cola® or McDonalds™ (Boseley, 2017). In addition, many more people in the Netherlands regularly use bicycles rather than cars compared to the U.S. While these preventative measures will affect predominantly children initially, the long-term effects would be a reduced need for obesity-associated care for these individuals when they reach Medicare age.

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FINAL RECOMMENDATIONS

Prescriptive and Predictive Analytics Improves Health Outcomes and Lowers Healthcare Costs

There are two main categories of analytics associated with big data in the healthcare industry: prescriptive analytics and predictive analytics. Prescriptive analytics provides laser-like focus to answer specific questions, while predictive analytics can be used to identify large-scale trends. Prescriptive analytics could assist with surveillance, such as using population health data to measure the number of patients who are clinically obese. Filters can be added to the data for factors like diabetes and cholesterol levels to determine where to focus treatment (Declues, 2017). Predictive analytics would be useful for dealing with socioeconomic data, which might show that people in a certain zip code are unlikely to have a car. Such information becomes useful when, for instance, a discharged patient in that zip code may have greater difficulty making follow-up appointments. Localities that consider and account for this issue have found that it is cheaper to send a taxi to pick up a patient for an appointment than it is for the patient to miss the follow-up appointment. Similar data can help organizations predict missed appointments and find a suitable way to resolve the issue (Adamson, 2017). In the end, collective small cost reductions from each successful office visit will save money.

Another example of prescriptive and predictive analytics is predictions of the trajectory of a patient's health over time. This can be done by leveraging historical medical data from patients with similar conditions. Predictive algorithms can be created using big data machine learning libraries. Machine learning takes advantage of statistical techniques to “teach” computers about human behaviors so that the computers can then predict outcomes. Patient data would allow a computer to predict and associate comorbidities, propose health outcomes based on previous treatments, and suggest the proper course of treatment to a doctor based on the predicted health trajectory (Adamson, 2017). Optum Labs, which is a U.S. research collaborative, has begun work along these lines. The group created an EHR database using health data from over 30 million patients, and used that data to create predictive analytics tools that have shown improvements to care delivery (Lebied, 2017). Their end goal is to reduce the time required for doctors to make decisions and improve treatment outcomes (Lebied, 2017). The tools further predict who might be at greater risk for certain conditions and can advise screenings, preventative care measures, and recommend emergency treatments (Lebied, 2017). Patients with complex medical histories or are suffering from multiple medical conditions can benefit the most from this reduction in time to diagnosis and sampling of multiple treatment options. The additional benefit is a reduction in costs for unnecessary tests, frequent return visits, and multiple hospitalizations.

Despite the massive undertaking of creating a big healthcare data (BHD) system, the creation of such a system would not be without its rewards. One possible benefit is that selected treatments could be more effective (Kaisler, 2013). Specifically, the information contained within the BHD system could be processed and used to determine which and for whom treatments are most effective. The predictions could contribute useful information to changes in budget allocations and technology development. Another potential benefit is improved preventative care, where it would be possible to identify individuals

that are at high risk for diseases, or to detect diseases at earlier stages (Kaisler, 2013). A BHD system could be used to better identify and track chronic conditions like diabetes. The largest possible application of BHD is the overall increase of health outcomes through targeted wellness and disease management programs (Fox, 2011). Currently those programs are built in a cookie-cutter style, where all patients with one type of disease are grouped into one pool and placed on the same program. This fails to consider unique influences on the health of each individual. Improved understanding of health conditions in an area or the variations seen within a specific disease category would improve training and education for management programs. The BHD system could be used to individually match patients with a variety of programs and passively increase the efficiency of said programs. The ultimate result of all these effects of a BHD would be to lower the cost of a public healthcare system. Better health surveillance would make prevention of illness easier and, therefore, save money by reducing the need for acute care. When a doctor is needed, treatment would be more effective. Overall, having a healthier population would help decrease the cost of our public healthcare system.

Education Can Reduce Disparities

A potential solution for reducing, or ideally eliminating, health disparities is the combination of cultural competence and patient-centered care. Creating awareness of health disparities with regard to socioeconomic status, age, race, and gender will help marginalized communities gain access to healthcare services. Awareness, education, and training for providers would also improve the quality of care given by healthcare professionals. Big picture solutions would be to create and implement more policies that would provide better education and greater funding allocations to low-income schools and communities, as well as better employment opportunities. To close the gender disparity gap for women, we need an improved balance of gender roles, elimination of pay gaps, better pay for maternity leave, and education on sexual harassment.

Public Insurance Options May Reduce Inequity and Decrease Spending

As the Affordable Care Act (ACA) becomes more prominent in the healthcare system, opponents of the ACA are advocating for a public health insurance option for all citizens under the age of 65. As of 2016, 88% of ACA enrollees lived in counties with at least three issuers (Obama, 2016). The remaining 12% are left with few insurance choices, thus those private insurance providers can charge more (Obama, 2016). Former President Barack Obama suggested that Congress implement a public plan that would be offered for all citizens and compete next to private insurances in areas with few coverage options. This public run plan would compete against private insurers in the individual healthcare market. This plan would fill the gaps in the insurance market, enabling more Americans to have a choice on healthcare coverage other than private insurance and coverage under federal assistance programs. This public plan would provide more competition in the market place leading to lower consumer insurance rates because the government would have the power to negotiate with pharmaceutical companies and hospital systems to lower rates. Globally, a few countries like Germany are also increasing competition by tightly regulating and socializing private insurers (Ridic, Gleason & Ridic, 2012).

Germany has a promising healthcare system where 90% of the population uses “sickness funds”. German sickness funds are based on an employee’s gross income and are monitored by tightly regulated, socialized private insurers. This could help reduce voluntary spending while keeping a voluntary market in the equation. Such a structure could additionally help regulate insurance companies in order to decrease spending. The problem with Germany’s healthcare system is that German doctors are paid one-third less than American doctors, because doctors receive a fee from insurers for every visit (Dorning, 2016). If we were to adopt a similar method of socialized private insurance, then we could tightly regulate the market like Germany to increase competition and allow doctors an avenue of compensation from insurers. The only remaining concern implementing the program without drastic reductions in the salaries of healthcare providers.

Equity and quality of care have proven to be complex issues to resolve. Hopefully, the recommendations provided here will contribute to the ongoing conversation surrounding the best and most cost-effective way to provide care for the elderly. The complexity increases when one considers that proper care of individuals under 65 contributes to access and quality of care for those age 65 and older. Overall, education, an adjustment in resource allocation, and implementation of big data tools are options that would best benefit the most people.

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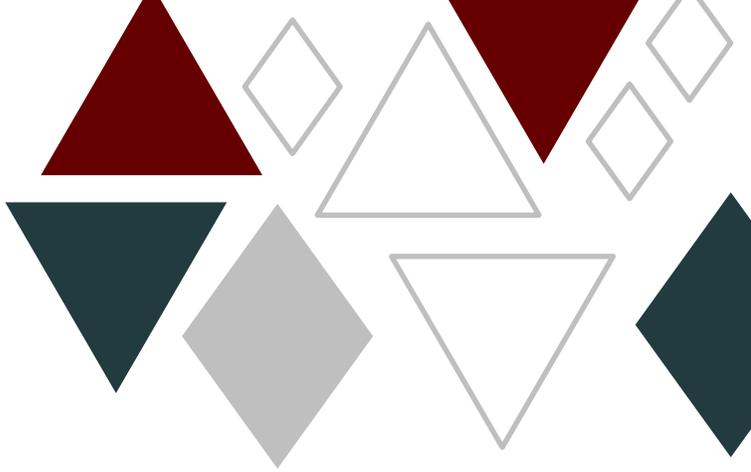
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In 1965, President Lyndon B. Johnson signed into law a bill that established Medicare. Since then, the medical needs and structure of our society have changed in many ways. But does our current medical care and payment system afford quality, affordable medical care to those who need it the most? What does data tell us is the story of our national health? Who is left behind as advancements are developed to serve our numerous health needs?