

# Dangers in Diagnosis

**Addressing Medical Diagnostic Errors with an Equity Lens on  
Women and Minorities**

Ashley Staggers

In conjunction with the University of Virginia and the AHRQ



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### ***Personal Statement***

***\*Trigger Warning: the following content includes references to suicide\****

*For my APP, I chose to address the prevalence of medical diagnostic errors for all individuals, with special attention to the diagnostic error disparities that additionally occur for both women and minorities. I chose this topic due to my own personal trials and tribulations that have occurred within the medical system. My pain began when I was 14, however I was severely discounted and dismissed by doctors. I was told it was anxiety and sent home to continue to deal with my pain on my own. As such when I was 17, I planned to take my life because the pain was too unbearable to continue to handle alone. The day I was going to follow through on my plan, was the first day I woke up without pain in 3 years. The pain began again the next day, but that break saved my life. Last year, I entered into a series of months where I couldn't digest food, I was in constant pain, and some days I was immobile. After fighting to be seen again, and a lucky surgery appointment, it was discovered that I was weeks away from a pulmonary embolism and the conclusion of my life. I was diagnosed with Antiphospholipid Antibody Syndrome, and later diagnosed with fibromyalgia. But the diagnoses were bittersweet as I could identify two moments where I almost lost my life. I was lucky; many others are not. This APP is my way to bring justice to lives lost by a negligent system.*

### **Disclaimer**

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgements and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency

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## *Glossary and Acronyms*

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### **Acronyms**

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**AHRQ:** Agency for Healthcare Research and Quality

**EHRs:** Electronic Health Record

**HHS:** Department of Health and Human Services

**IHSDN (or IHN or IDSs):** Integrated Health Service Delivery Networks (often times shortened to Integrated Health Networks (IHNs) or Integrated Delivery Services (IDSs))

**NIH:** National Institute of Health

**PAEHRs:** Patient Accessible Electronic Health Records

**PCPs:** Primary Care Physicians

### **Glossary**

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**Capitation Payments:**

A type of healthcare payment system where periodic fixed amounts of money, per-patient payments for each individual enrolled in a capitation insurance plan, where physicians are paid in advance for the delivery of healthcare services.

**EGS (Emergency General Surgery):**

Any patient (inpatient or emergency department) requiring an emergency surgical evaluation (operative or non-operative) for diseases within the realm of general surgery as defined by the American Board of Surgery

**Fee for Service:**

A type of healthcare payment system where a doctor or other health care provider is paid a fee for each particular service rendered

**Healthcare Fragmentation:**

Care fragmentation is defined as the dispersion of an individual's health care across systems and providers and is ubiquitous in the U.S. healthcare system

**Synthesis:**

The combination of ideas to form a theory; in relation to healthcare, to form a diagnosis

## Executive Summary

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In the following report, I will examine medical diagnostic errors for the population of the United States, with an equity lens on its greater existence in marginalized communities for Department of Health and Human Services, Agency for Healthcare Research and Quality (AHRQ). I will begin by addressing the magnitude of the problem and detailing the four major causes of diagnostic error for the population as a whole. I will then highlight equity considerations, before delving into evidence of interventions that have the potential to address diagnostic error, including: Values-Based Healthcare Reimbursement Models, Integrated Health Service Delivery Networks, and Patient Accessibility to Electronic Health Records. These interventions will inform the three hospital-level alternatives I choose to examine as possible recommendations to my client, AHRQ:

- (1) Transitioning to Capitation Payment Models
- (2) Integrating Health Networks; and
- (3) Making EHRs, Patient Accessible

I will examine these alternatives against criteria analyzing their costs, the scope of these alternatives' effects, the viability of the implementation of each alternative, and their equity potential.

The report concludes by recommending that the AHRQ, and HHS (the Department of Health and Human Services) as a whole, should pursue a transition to capitation payment models due to its low average cost, wide scope of effects, high viability, and moderate equity potential. I will then conclude by detailing the two avenues for implementation that HHS can pursue, including implementing this transition through regulations or incentives.



## Problem Statement

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In the United States, 12 million people are affected every year by medical diagnostic errors (Fierce Healthcare, 2019). Additionally, an estimated 40,000 to 80,000 of this group dies annually from complications resulting from these errors (Fierce Healthcare, 2019). As race, gender, and socioeconomic status remain key determinants of the quality of healthcare a person receives as well as the health outcomes experienced, a growing body of research is demonstrating that these disparities play a big part in diagnostic errors (Williams et al, 2018). **As a result, too many women and minorities experience medical diagnostic errors, and subsequently experience poor healthcare and health outcomes, including death.**

## Background on Disparities and Problem Context

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Medical errors are the third leading cause of death in the United States, after heart disease and cancer (CNBC, 2018). In fact, a recent John Hopkins study claims that more than 250,000 people in the United States die every year from these medical errors; other reports claim this number to be as high as 440,000. Diagnostic error specifically, is the number one cause of serious medical errors (Hopkins Medicine, 2016). Diagnostic Error is defined as “any mistake or failure in the diagnostic process leading to a misdiagnosis, a missed diagnosis, or a delayed diagnosis” (Schiff et al., 2009). Diagnostic errors contribute to as many as 70% of medical errors and are the most common claims in malpractice lawsuits, with around \$38.8 billion reported to have been paid out to plaintiffs in these cases between 1986 and 2010 (Royce et al., 2019). Postmortem examinations spanning several decades consistently show that diagnostic error contributes to around 10% of patient deaths (Shojania et al., 2003). Additionally, 10% of diagnostic errors result in permanent and severe harm to living patients. Researchers estimate that the number of patients dead or permanently suffering from preventable diagnostic error in the U.S. annually ranges from 80,000 to 160,000 people (John Hopkins Medicine, 2013). Furthermore, gender and race are shown to play a huge factor in these medical errors, as women and minorities are 20 to 30 percent more likely to be misdiagnosed (Fierce Healthcare, 2019). Thus, diagnostic error must be understood through an equity lens.

## Client Overview

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In looking to address diagnostic error, my client became the U.S. Department of Health and Human Services’ Agency for Healthcare Research and Quality (AHRQ). AHRQ is focused on producing evidence-based research to make healthcare safer, higher quality, accessible, equitable, and affordable. However, as my client is a part of the HHS hub, they made it clear that my APP does not have to focus on alternatives in research specifically. I can recommend what I feel will work, and my APP will simply be sent to whatever subdepartment can implement the changes I am recommending. My only constraint is that my alternatives must be able to be implemented at the federal level.

AHRQ’s interest relies in their understanding that diagnostic error is a huge quality and safety issue that is deeply prominent within the healthcare community. Additionally, as I am approaching this problem through an equity lens for women and minorities, I am also addressing disparities in diagnosis that affect a large population of U.S. individuals. Reformation of the system is long overdue and given the copious amounts of research highlighting the problem, my client is ready for policy solutions.

## Broadening the Scope for Better Analysis

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Evidence addressing diagnostic disparities for only marginalized groups would not be a complete analysis of the problem, as diagnostic errors occur for everyone, and are merely exacerbated by these marginalized identities. As such, it's best to address diagnostic error as a whole for all populations, while looking through an equity lens when discussing criteria for the best recommended intervention. Thus, in the following sections, the four most common causes of diagnostic error for all individuals will be explained.

### Diagnostic Error Cause 1: Intrahospital and Interhospital Fragmentation of Care

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One of the main causes of diagnostic error involves the fragmentation of care both within and across hospitals. Medical professionals have long pointed out the continued fragmentation of healthcare for patients attempting to receive a diagnosis, or follow-up care. Fragmentation loosely means that instead of a patient going to one main doctor for their healthcare needs, they often end up needing to visit various specialists for different analyses, testing, and treatments (Pim, 2018). However, this decentralized analysis means that individuals have no single medical professional holding a full picture of their health; specialists merely continue to order and read tests according to their personal perspective of the problem and as a result, may miss significant symptoms or test results. Thus, the chance for diagnostic error greatly increases (King et al., 2013).

This fragmented communication occurs on both an interhospital and intrahospital level and can lead to delays in medical diagnosis and treatment (King et al., 2013). Interhospital communication involves sharing information, such as medical records, among sites and institutions (e.g., between facilities) (Regis College, 2018). Whereas intrahospital communications involves sharing information among personnel within the same hospital (e.g., between staff and patients) (Regis College, 2018). These transitions of information and care are a vulnerable point in which vital details that could impact patients' diagnoses are being omitted or misunderstood (Laudermilch et al., 2010). Specifically, up to 54% of process failures in the clinical setting (where medical care is omitted, performed incorrectly, or incomplete) are cited as a result of communication failures and delays (Symons et al., 2013).

In a study designed to directly assess written communication failures conducted in the University of Wisconsin's Emergency Department, patients with one of six EGS (emergency general surgery) diagnoses, which account for a majority of morbidity, mortality, and cost associated with EGS diagnoses, were included to determine information loss (Harl et al., 2017). These six EGS diagnoses were: appendicitis, cholecystitis, diverticulitis, bowel obstruction, perforated viscus, and mesenteric ischemia. Of the 129 patients who met the inclusion criteria, 42.5% of their documents were missing medical histories and physicals (Harl et al., 2017). Diagnoses were missing in 9.7% and reasons for transfers were missing in 18.6% (Harl et al., 2017). Among the 70 receiving tomographies, final reads were missing in 70.0% and among the 27 receiving ultrasounds and x-rays, final reads were missing in 80.0% of the patients' documentation (Harl et al., 2017).

Broadly, according to research examined by Fierce Healthcare, this poor communication between hospitals and specialists contributed to 7,149 of 23,000 cases of medical malpractice (roughly 30%) filed between 2009 and 2013 (Budryk, 2016). Fatally, this percentage also includes 1,744 patient deaths and over \$1.7 billion in malpractice costs (Candello Database). Additionally, a study performed by the Center for Health Information and Decision Systems, found that this insufficient communication drives up healthcare costs by also preventing institutions from accessing patients' medical files which creates a need for duplicate tests and second opinions that are essentially unnecessary, totaling \$12 billion in wasted finances annually (CHIDS, 2009).



## Diagnostic Error Causes 2 and 3: Doctor Overconfidence Errors and Synthesis Errors leading to Subsequent Lack of Testing, Lack of Followed Guidelines, and Premature Diagnostic Closure

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The next two main causes of diagnostic error are combined as they lead to the same lack of testing, lack of followed guidelines, and premature diagnoses; these causes are doctor overconfidence and synthesis errors.

According to the overconfidence hypothesis (OH), physician overconfidence in diagnosis is a major factor contributing to diagnostic error in medicine (Cassam, 2017). As a result of their overconfidence in correctly diagnosing existing symptoms, “physicians might not request the additional resources (ie. further diagnostic testing and computerized resources) to facilitate diagnosis when they most need it” (Meyer et al., 2013). Research has proven that physicians have admitted to having many questions of possible importance at the point of care, but they do not pursue these inquiries (Osheroff and Bankowitz, 1993; Gorman and Helfand, 1995; Covell et al., 1985). Even when information and resources are automated and easily accessible at the point of care with a computer, a tiny fraction of these resources are actually used (Meyer et al., 2013). Furthermore, even when an indication that relevant information was available flashed on the physician screens, physicians rarely reviewed it (Meyer et al., 2013).

Autopsy data is considered the ‘gold standard’ in terms of providing the most definitive data on the accuracy of a diagnosis, as it is assumed to have a 100% sensitivity for finding causes of death and 100% specificity for excluding them (Graber, 2013; Goldman, 2018). Concrete and definite evidence of overconfidence in medical practice has been demonstrated multiple times, using autopsy findings as the gold standard. Podbregar and his colleagues studied 126 patients who died in the ICU and underwent autopsy (Podbregar et al., 2001). Physicians were asked to provide the clinical diagnosis associated with the autopsy and also their level of uncertainty (complete certainty, minor uncertainty, and major uncertainty). The rates at which the autopsy showed significant discrepancies between the clinical and postmortem diagnosis were essentially identical across all 3 levels of uncertainty. In all 3 groups, physicians were wrong on average 40% of the time (Podbregar et al., 2001). Similar findings were reported in other adjacent studies: the level of physician confidence showed no correlation with their ability to predict the accuracy of their clinical diagnosis (Landefeld et al., 1988). Other studies even found that sometimes the confidence level of the worst performers was actually higher than that of the top performers (Potchen, 2006).

When physicians are asked whether they have made a diagnostic error in the past year, typically only 1% admit to having made one (Berner and Graber, 2008). In a study, where 53 family physicians were asked to recall memorable errors, participants were able to recall very few. However, 60% of these physicians had committed diagnostic errors in the past and in 47% of the cases, the patient died following the error (Ely et al., 1995).

Other effects of overconfidence that have led to diagnostic errors include widespread non-compliance with clinical guidelines and “the general tendency on the part of physicians to disregard, or fail to use, decision-support resources” (Berner and Graber, 2008). Clinical guidelines output from computerized decision-support systems, often in the form of guidelines, alerts, and reminders. A comprehensive review of medical practice in the U.S. found that the care physicians provided, deviated from the recommended best practices detailed in clinical guidelines, 50% of the time (McGlynn et al., 2003). It's important to note that for many conditions, consensus on the best treatments and the recommended goals exists; despite this, these national clinical guidelines have a high rate of noncompliance (Cabana et al., 1999; Eccles and Grimshaw, 2004). These compliance rates are not minimal. In one study, although 95% of physicians were aware of lipid treatment guidelines, for the treatment of high cholesterol, they only followed these guidelines 18% of the time (Pearson et al., 2000).

Lastly, although cognitive errors often lead to a premature closure of a diagnosis (ie. assuming the diagnosis is correct without pursuing inquiries or other possible diagnoses further) and a dismissal of clinical guidelines, more commonly cognitive errors reflect problems gathering data such as failing to elicit complete and accurate information from the patient, failure to recognize the significance of data, or

most commonly a failure to synthesize or “put it all together” (Graber et al., 2005). Therefore, while a dismissal of clinical guidelines can influence diagnostic error, diagnostic error can influence which clinical guidelines are followed. As these treatment guidelines are also dependent on accurate diagnoses, if the clinician cannot correctly synthesize symptoms and recognize the diagnosis, the guideline may not be invoked (Tierney et al., 2005).

#### Diagnostic Error Cause 4: Rushed Appointments and Interrupted Patient Communication

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Finally, the last major cited cause of diagnostic errors involves rushed appointments which lead to subsequent interrupted patient communication. Research shows that, on average, doctors only spend between 10 to 15 minutes with each of their patients during appointments (Tai-Seale, 2007). This time frame is largely attributed to the volume-based reimbursement model physicians are paid by, titled Fee-for-Service (FFS) payments (Rabin, 2014). Ultimately, that means physicians’ time is literally money as they are paid per visit, and insurance companies or government agencies (ie. Medicaid) are billed for every test, procedure, and treatment rendered whenever a patient visits the doctor, has a consultation, or is hospitalized (Bizmatic, 2018). Thus, it’s more economically beneficial for physicians to see as many patients as they can (Rabin, 2014). FFS payments are the dominant reimbursement model in the U.S., as it strongly encourages and financially rewards the quantity of care provided, regardless of its quality or necessity (Mayes, 2011). Unfortunately, physicians and other health providers have been noted to respond rationally to these existing financial incentives. In other words, they maximize activities and services that pay them, and minimize those activities and services for which they are not paid (Mayes, 2011). As such, there appears to be a general consensus that Fee-for-Service (FFS) payments are a practice that leads to overprovision, inefficiency, and uncontrollable health expenditures (Ikegami, 2015).

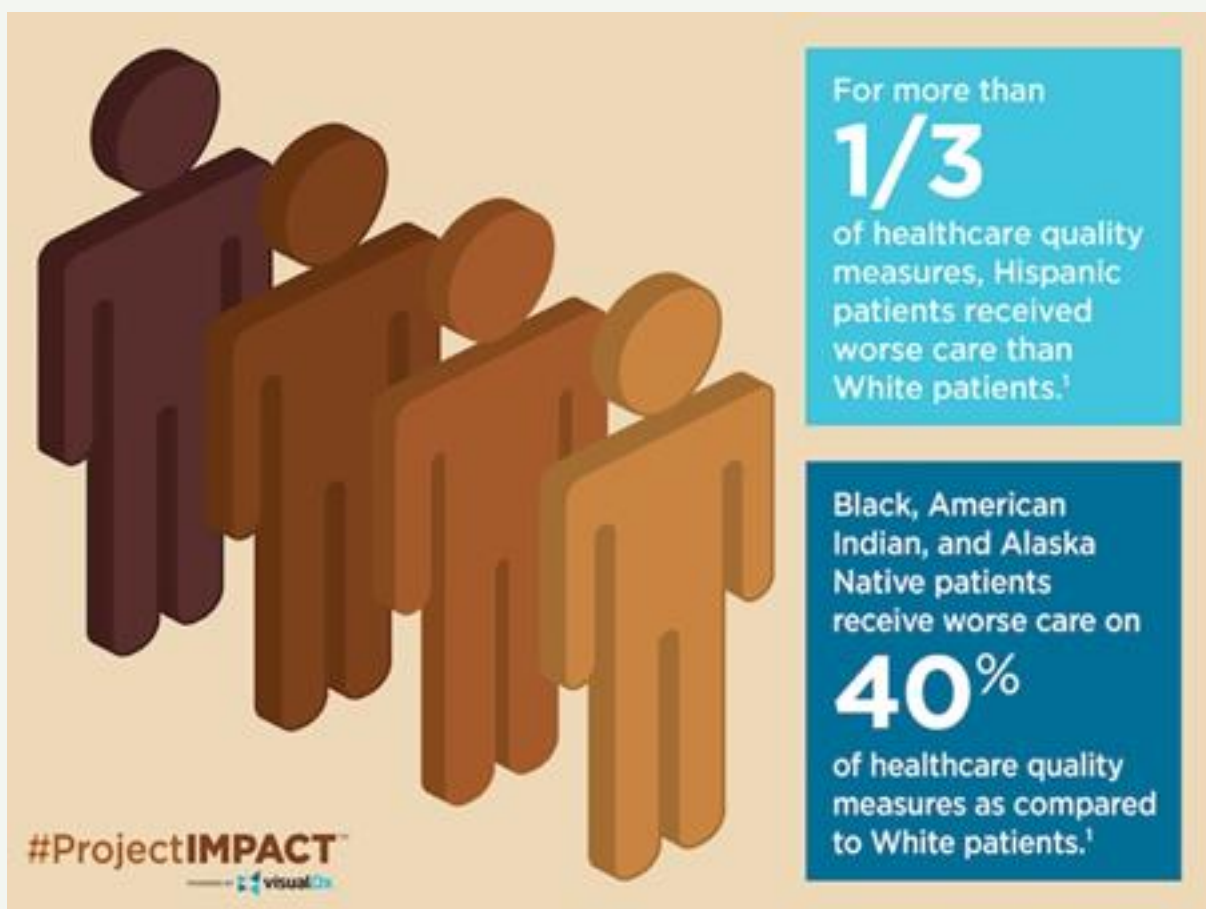
These rushed and inefficient appointments have a dire effect on patient communication and patient involvement in the diagnostic process, as doctors will often not give patients time to openly explain their symptoms. In a study published by the Journal of General Internal Medicine, research found that only 36% of patients are given the opportunity, through open-ended questions, to speak up about why they came in for their appointment (Ospina et al., 2018). This percentage was even slimmer for patients who went in for specialized care, where only 20% of specialty care doctors asked their patients what was wrong (Ospina et al., 2018).

Furthermore, even when doctors did ask patients for the reasoning behind their visit, they did not listen to their patient for long. The study revealed that most patients were only able to speak for an average of 11 seconds before they were interrupted by their clinician (Ospina et al., 2018). There is variation among the average number of seconds physicians allow their patients to speak (i.e. other studies note that physicians were able to listen to patients’ stories for a median of only 18 to 23 seconds before interrupting in some manner, and family practitioners are said to let the patient speak an average of 19 seconds), however, the theme of interruption remained common (Phillips and Ospina, 2017; Noakes, 2018). These results are unfortunate given this communication and involvement has been shown to be important in accurate diagnosis and patient care, and failure to elicit the patients’ agenda is associated with a 24% reduction in the physician’s understanding of the main reasons for the consultation (Dyche and Swiderski, 2004; Balogh et al., 2015). Additionally, research has shown that when left uninterrupted, patients only need on average 30 seconds to communicate their issues to a primary care doctor, and 92 seconds to communicate their issues to specialist doctors (Ospina et al., 2018).

Further concerning, in a poll conducted by *Medscape*, which included responses from more than 1,000 nurses and advanced practice registered nurses (APRNs) as well as 172 physicians, it was found that the vast majority of respondents were very confident in their listening skills (Medscape, 2018). According to the poll, 89% of nurses and APRNs and 87% of physicians rated their listening skills as high (Medscape, 2018). Therefore, doctors don’t even recognize their inability to listen in order to correct these issues and better inform the diagnostic process.

## Equity Implications

These problems to the general population are exacerbated by the bias, lack of education, and lack of research for women and minorities (Appendix A; Appendix B). Bias causes patient communication to further suffer as doctors believe women are simply being overemotional, and believe different races feel different levels of pain (Dusenbery, 2018; The Joint Commission; Appendix A; Appendix B). Thus, the synthesis of information is affected, and doctor overconfidence protects these faulty diagnoses. Ultimately, women and minorities experience these errors more and even when they are referred to a specialist, their documentation often does not hold the proper information or reason for referral (Balogh et al., 2015). Additionally, individuals who stand at the intersection of these two identities, face the brunt of these consequences (Chinn et al., 2021). While white women are fighting sexism within the medical community, and ethnically minority men are fighting racism within the medical community, ethnically minority women must fight both (Smith, 2015). Therefore, this problem holds greater consequences (and subsequently, addressing it will yield greater benefits) for ethnically-minority women (Chinn et al., 2021). Thus, in addressing medical errors for all, we must pay special attention to how these demographics specifically will benefit from the proposed alternatives.



\*Image retrieved from New England Journal of Medicine, Project Impact:  
<https://libraryhub.nejm.org/article-hub/2021/04/visualdxs-project-impact-addresses-racism-and-implicit-bias-in-medicine/>

## Existing Evidence and Literature

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To best examine which alternatives could directly decrease the presence of diagnostic error, I turned to existing evidence and literature surrounding previous interventions designed to increase healthcare quality. The evidence points to values-based capitation reimbursement models, integrated health services delivery networks, and patient accessible electronic health care records. For evidence, I reviewed case studies, medical reports, previously conducted literature reviews, randomized control trials, and systematic reviews. Each of the sources reviewed experienced their own forms of limitations, as such the research and limitations of the sources will be highlighted within the sections.

## Values-Based Healthcare Reimbursement

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Current Fee-for-Service (FFS) payment plans are volume-based healthcare reimbursements; where finances are dependent on the number of tests, procedures, consultations, or hospitalizations a physician can schedule (Ikegami, 2015). As discussed before, this form of reimbursement is detrimental to the quality of healthcare a patient receives (Ikegami, 2015). Therefore, there has been a recent push for the integration of values-based reimbursement within the healthcare sphere. Values-based reimbursement is defined as healthcare reimbursement based on the quality of care provided and patient improvements, rather than payment for every individual test and procedure (Saleh and Shaffer, 2016). Beginning in 2008 with the Patients & Providers Act (MIPPA), the federal government began introducing various values-based models (Meola, 2021). The newest and most prominent version of this type of reimbursement is the capitation payment reimbursement model.

As defined in the glossary, capitation payments are “periodic, per-patient payments (usually monthly) for each individual enrolled in a capitation insurance plan, where physicians are paid in advance for the delivery of healthcare services” (Alguire, n.d.). Therefore, a provider can be paid per month, per patient, despite how many times the patient comes in for treatment or how many services are needed (Fearnley, 2016). As an example, if a physician has 30 patients under their care (this is a gross underestimate of the average), and only needs to see 5 of them during that month, the physician will still be paid as if they saw all 30 patients for that month. This model is helpful as not everyone needs to see the doctor every month, and the physician is not tempted to overbook appointments for payment; as such, physicians can spend more time with patients who need it and thus, capitation payments target the rushed appointments that became a major cause of diagnostic error. Most capitation payment plans for primary care services include:

- Preventive, diagnostic, and treatment services
- Injections, immunizations, and medications administered in the office
- Outpatient laboratory tests done either within the hospital or at a designated laboratory
- Health education and counseling services performed within the office
- And routine vision and hearing screening (Alguire, n.d.)

Additionally, it is pretty common for physicians to also receive an additional capitation payment for diagnostic test referrals and subspecialty care (Fearnley, 2016). While this puts the primary care provider at greater financial risk if the overall cost of referrals, medical screenings, and medical tests exceed the capitation payment, the potential financial rewards are also greater if diagnostic referrals and subspecialty services are controlled (Fearnley, 2016).

In August of 2020, the UnitedHealth Group published research where they studied the effects of capitation payments against the effects of FFS payment models on the quality of care a patient received. The study found that primary care physicians (PCPs) paid through capitation reimbursements hit key healthcare quality metrics (defined by the National Committee for Quality Assurance’s Healthcare Effectiveness Data and Information Set; HEDIS) at higher rates than those paid through FFS reimbursement models (UnitedHealth Group, 2020). The metrics studied were related to preventative care



and chronic conditions across 5 million patients and tens of thousands of primary care physician practices (UnitedHealth Group, 2020). Given that preventative care requires early diagnosis to detect and prevent serious diseases and medical problems, and chronic conditions are the hardest to diagnose, both of these metrics can be inferred as acceptable predictors for improvements in diagnosis (Cigna, 2020).

Furthermore, as one of the previously highlighted main causes of diagnostic error was doctor overconfidence and premature closure of diagnosis, additional screening can also be inferred to improve diagnosis (Cassam, 2017). Throughout the analysis, it was found that 80% of patients treated by PCPs under capitation payment models were screened for breast cancer, versus 74% of patients treated by FFS providers (UnitedHealth Group, 2020). Additionally, 82% of patients were screened for colorectal cancer compared to 74% of FFS patients (UnitedHealth Group, 2020). Thus, although we would assume that FFS providers would be more incentivized to invoke diagnostic testing given they are paid per test, it was actually capitation providers. Furthermore, the analysis showed that capitation payments were associated with a 9-percentage point increase in higher controlled blood sugar levels (89% vs. 80%), a 10-percentage point increase in eye exams (84% vs. 74%), a 10-percentage point increase of functional status assessments (96% vs. 86%), and a 5-percentage point increase of medication reviews (97% vs. 92%) (UnitedHealth Group, 2020).

Additional studies have backed up the UnitedHealth Group research with one discovering that capitation funding was significantly associated with higher rates of effective, safe, and responsive care (L'Esperance et al., 2019). Another study found that while FFS models resulted in more primary care visits, patients were less satisfied with access and care by their physician compared to patients with capitated payment providers (Gosden et al., 2000).

Although there are promising studies of capitation models, it's important to note that only a little less than 6 percent of provider payments in the U.S. in 2018 were considered capitation payment reimbursement models, according to the Health Care Payment Learning & Action Network (LaPointe, 2020). Consequently, there are very few models of where there is adoption of capitation and therefore there is a significant lack of research regarding the effects of this model. However, of the research that does exist, it is clear that capitation models far out-benefit patients in comparison to current FFS models.

## Integrated Health Service Delivery Networks (IHSDNs)

For the purpose of this analysis and literature comprehension, it's important to note that IHSDNs are often shortened to Integrated Health Networks (IHNs) or Integrated Healthcare Delivery Services (IDSs). The WHO defines integrated healthcare service delivery as “the management and delivery of health services so that clients receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system” (Lenka and George, 2012). In other words, IHNs are organizations or groups of healthcare producers that align local healthcare facilities and manage them with one governing board (Oosdyk, 2004). Examples of these integrated networks include Kaiser Permanente, Highmark Health, Cleveland Clinic, and Mayo Clinic (Lenka and George, 2012).

While integrated healthcare systems have not been directly studied in accordance with their impact on diagnosis directly, they have been studied in accordance with healthcare quality received. Additionally, since fragmentation of healthcare was previously noted to be a main cause of diagnostic error, effects of integration can be inferred to have an effect on diagnosis (King et al., 2013). The effects of IHSNDs are evident in case studies throughout the country; the most recent study relevant to this analysis comes from Intermountain Healthcare. Intermountain Healthcare is a fully integrated IDN based in Idaho, Nevada, and Utah that delivers more than half of all health care in the region through a network of 180 primary care clinics, 24 hospitals, and a health insurance plan (Reiss-Brennan et al., 2016). Intermountain Healthcare is an important case to study as they still use FFS reimbursement (Reiss-Brennan et al., 2016). Thereby, the effects of integration assessed through this study are not upwardly biased due to changes in reimbursement models as they may be for many other systems. The study of Intermountain Healthcare found consistent high-quality care and outcomes, as well as lower healthcare costs, associated with their clinical and operational integration (Reiss-Brennan et al., 2016). Additionally,



the study found that Intermountain Healthcare's maximum cost per-person per-year to the system as a whole, dropped from \$115.09 annually to \$22.19 after implementing integrated care in primary care (Reiss-Brennan et al., 2016).

While Intermountain is an interesting case given its payment reimbursement model. It's not the only study to procure these findings. In a literature review published by the American Journal of Managed Care (AJMC) the researchers began with a total of 168 peer-reviewed articles, eventually cutting the research to 21 articles reviewing quality of care associated with health system integration based on data methods and eligibility (Hwang et al., 2013). Of these 21 peer-reviewed articles, 20 showed a significant correlation between increased integration in healthcare delivery and increased quality of care (Hwang et al., 2013). Six of the peer-reviewed articles also assessed whether there was a reduction in the utilization of services (thus accounting for repeated or unnecessary tests often performed by unintegrated systems) and of these, four showed decreases in the utilization of services with increases in integration (Hwang et al., 2013). The AJMC was not the only journal to have these findings as many other studies have confirmed IHSNDs correlation with healthcare quality and efficiency of healthcare services (Montenegro et al., 2011; Wan et al., 2002; Yogman et al., 2018). One study (focusing on youth specifically) even found that there was a 66% probability that randomly selected youth would have a better outcome following integrated care than those who received usual forms of health care (Kolko, 2015). Furthermore, a study performed by the Sustaining Healthcare Across Integrated Primary Care Efforts (SHAPE) found that healthcare efficiency through the use of integrated services increased so much that somewhere between \$26 billion and \$48 billion is estimated to be saved following effective integration of healthcare services across the United States (SHAPE, 2020).

It is important to note however that important efficiency and implementation are necessary for IHSNDs to work well. Physicians need to be effectively integrated at all levels of the system as well as be able to play leadership roles in the design, implementation, and operation of an integrated health system for integration to yield the best effects (Appleby et al., 1999; Burns, 1999; Coddington et al., 2001; Hawkins, 1998). This is important as physicians who experience a perceived loss of power, prestige, income or change in practice style experience physician discontent, resentment, and resistance to change due to having to share decision-making responsibility; thus, affecting implementation and subsequently quality of care (Anderson, 1998; Appleby et al., 1999; Budetti et al., 2002; Coddington et al., 2001; Hawkins, 1998).

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### Patient Accessible Electronic Health Records (PAEHRs)

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Electronic Health Records (EHRs) are computerized medical information systems that collect, store, and display patient information; they are meant for physicians to record and access clinical information about individual patients (Ajami and Bagheri-Tadi, 2013). In 2017, it was reported that around 95 % of hospitals use EHRs for their patients (Parasrampur and Henry, 2019). Given the widespread use of EHRs in hospitals, it is concerning that EHRs were found to be frequently incomplete when compared to patient reports of information with an average of 24% of records missing information (Staroselsky et al., 2006). Additionally, EHRs were found to frequently have omitted or misidentified health procedures and lab reports with an average of 30% of EHRs omitting this information (Staroselsky et al., 2006). This is a problem, as the omitted information causes delays in diagnosis and problems with specialist referrals. One solution to this issue is to open patient access to their EHRs, or PAEHRs, where patients would be able to review the information that doctors are placing on their records (Jilka et al., 2015).

In a systematic review based on articles written between 1990 and 2005, researchers focused on populations where the dependent variable was *the effects on medical practice* and the independent variable was *patients having access to their medical records* (Ferreira et al., 2007). The study focused on adult patients and therefore excluded studies that gave parents access to pediatric records (Ferreira et al., 2007). From the 167 articles obtained, 14 met the acceptable population and methodology criteria. These

studies ultimately revealed that patient access to their EHRs enhanced communication between the patients and the doctors, helped doctors better understand the condition of the patient, improved patients' education on their own conditions, lead to more patient participation in their health treatment, and also improved the correctness and completeness of the patient records (Ferreira et al., 2007).

The limitations of this research must be highlighted as it is important to note that while the research does not explicitly state diagnosis, it does mention enhanced communication and understanding of patient condition on the physician side; thereby, improved diagnosis can be inferred (Ferreira et al., 2007). This enhanced communication directly targets one of the main causes of diagnostic error previously reported (interrupted patient communication and rushed appointments) as patients are still verifying that their symptoms and information is being considered (Ospina et al., 2018). Furthermore, while the study did highlight concerns about patients being able to change the information on their EHRs when they deemed there to be an omission of information, this is easily resolvable as open access to patient records does not need to mean open editing and additions can be structured in a way where they must be monitored and approved (Ferreira et al., 2007).

It is also important to understand that this systematic review was conducted a while ago; however, other studies and systematic reviews have come to light supporting the findings that PAEHRs have increased the capture of patient information, increased patient adherence to medication, improved patient outcomes, enhanced knowledge, and even decreased mortality in patients with diabetes (Tapuria et al., 2021; Rathert et al., 2017; Neves et al., 2020). Furthermore, one study even noted that PAEHRs have an extremely low risk of bias since patients are involved with the information recorded (Neves et al., 2020). Thus implying direct equity effects for women and minorities with PAEHRs.

## Disclaimer

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I have chosen to exclude medical education as evidence to examine as state medical boards are in charge of regulating health care professionals in the United States, due to the 10th Amendment of the United States Constitution authorizing the states to establish laws and regulations protecting the health, safety, and general welfare of their citizens (Federation of State Medical Boards). Thus, it is the responsibility of the individual states to regulate the practice of medicine, and federal institutions would need to remain out of it. As such, any alternative I could provide or examine, would not be able to be implemented at the federal level. Additionally, I have chosen to exclude implicit bias as evidence to examine as the general consensus in unconscious bias training is that it is not effective, therefore analysis would merely take up space with the end result deciding that bias training is useless (Atewologun et al., 2018).

## Hospital-Level Proposed Alternatives

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Given the existing evidence and literature considerations, the alternatives I chose to examine at the hospital-level include transitioning to capitation payment models, integrating current healthcare facilities, and making electronic health records more patient accessible.

### Alternative 1: Transition to Capitation Payment Models

Currently, both healthcare specialists and primary care physicians (PCPs) are reimbursed through Fee-for-Service (FFS) payment models. As previously mentioned, rushed patient communication is one of the four major causes of diagnostic errors. A transition into capitation models, as highlighted by the literature, reduces the likelihood of doctors providing unnecessary services to patients simply to procure more money. Additionally, the transition restrains doctors from rushing patients through their appointments simply because they get paid by the quantity of patients they see, rather than the quality of the services they are providing. Likewise, transitioning to capitation payment models has been linked to decreased diagnostic errors, as well as increased healthcare outcomes, decreased primary care visits, and improved patient satisfaction (UnitedHealth Group, 2020; Cigna, 2020; Cassam, 2017).

### Alternative 2: Integrate Healthcare Facilities

The literature also placed emphasis on the fragmentation of care and information, as well as doctor synthesis errors, as two major causes of diagnostic error. Integrated Health Networks are systems which allow for patient information and patient testing to flow among specialists, thus addressing the fragmentation of care. This can help to produce a proper diagnostic synthesis as specialists now have access to the full biography of patient information. Complete information regarding a patient, helps make sure that physicians and specialists do not miss important symptoms or test results that could aid their diagnostic conclusion. As such, complete information helps the diagnostic process and lowers the chances of diagnostic error. In addition to decreasing healthcare costs and integration's deduced effect on decreasing diagnostic error, the literature also explained how integration increased quality of care and health outcomes in patients.

### Alternative 3: Make Electronic Health Records, Patient Accessible

Finally, as evidenced by the literature, Patient Accessible Electronic Health Records (PAEHRs) have been associated with decreased diagnostic error by enhancing patient-doctor communication, improving patient education and physician understanding, and increasing the correctness and completeness of patient records. Therefore, another alternative would be to pursue electronic health records becoming accessible to patients for viewing, so patients can follow what is being recorded by their doctors and sent to specialists. This alternative does not mean that health records need to be open to patient editing of their health records, just that a transparency of all information recorded must exist. Furthermore, this alternative addresses the rushed patient communication that becomes a major cause for diagnostic error, as information is provided to the provider through the EHRs before the start of the appointment.

### *Disclaimer*

As AHRQ is a research facility, I did conduct a literature review examining improving diagnostic research as an alternative to improve diagnostic error; however, the proposed alternative to follow did not align with the hospital-level criteria set in place in the following sections. Thus, improving research was evaluated as evidence and an alternative in the appendix (Appendix D).

## Client Values

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The Department of Health and Human Services (HHS) and the National Institute of Health (NIH) have been forming committees and dedicating funding toward understanding and pursuing ways to reduce diagnostic error for the last couple of years. Additionally, both HHS and the NIH have released research surrounding diagnostic disparities for women and minorities. Both departments have explicitly made it known on several occasions that they are looking to uncover the most effective way to address these issues. Therefore, the criteria below will discuss looking at the scope of effectiveness, the implementation viability, and equity of each alternative. Furthermore, each alternative will also be evaluated by a cost criterion that will address both the average cost of the alternative, as well as the costs saved following implementation.

## Criteria For Evaluation

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### Cost

The criterion for cost will cover the costs of pursuing an alternative, as well as the costs saved following the implementation. Cost will therefore be evaluated on the following sub-criteria:

- (1) The average median cost of implementing the alternative, as most costs are set at a range. Ideally, the recommended alternative will have the lowest average cost of implementation
- (2) The average time it takes to implement the alternative; as time is a form of opportunity cost. Ideally, the recommended alternative will take the shortest amount of time to implement
- (3) The average reduction in costs incurred by healthcare providers following implementation. Cost reductions for healthcare are typically given in ranges, therefore the median average will be used for evaluation. Ideally, the recommended alternative will save healthcare providers the most money and therefore should have the highest reduction in cost.
- (4) The variability of the reduction in costs. As the reductions for healthcare are given in ranges, I will evaluate how large the range is. The variability will be rated either as low (0-5% range), medium (5-15% range), or high (greater than 15%).
- (5) The strength of the evidence of cost reduction. This sub-criteria will look at confidence intervals, statistical significance, and the amount of studies evaluated, to determine the strength of the evidence.

### Scope of Effects

The criterion for the scope of effects will evaluate how well each alternative addresses the problem of diagnostic error. As diagnostic error is only identified through the correction of a misdiagnosis, or autopsy upon death, direct effects will be unable to be studied. However, effects on diagnosis can be inferred by examining common predictors of lower diagnostic error. As such, this alternative will examine the quality-of-care patients are receiving, patient satisfaction, risk of mortality, increases in screenings, etc. The more predictors alternatives affect, the more effective they are likely to be at reducing diagnostic error. This criterion will therefore be evaluated on the following sub-criteria:

- (1) Is there a wide range of effects? The scope of effects will be rated as either small (1-2 effects), moderate (3-5 effects), or wide (greater than 5 effects). Ideally, the recommended alternative will have the widest scope of effects.
- (2) The strength of the evidence of the effects. This sub-criteria will look at confidence intervals, statistical significance, and the amount of studies evaluated, to determine the strength of the evidence.

## Viability

The criterion for viability will evaluate whether there is still an implementation gap to be filled by physicians, as well as whether the implementation will be effective based on provider opinion and its importance. This criterion will therefore be evaluated on the following sub-criteria:

- (1) What percent of hospitals already implement this alternative? Ideally, the recommended alternative will be implemented in the least amount of hospitals so that it has the opportunity to create the most change upon implementation.
- (2) What are the general physician opinions surrounding this alternative? Physician opinion will be rated as generally positive, neutral, or generally negative. Ideally, the recommended alternative will have generally positive physician opinions surrounding the implementation of the proposed alternative.
- (3) Whether the physicians' opinions will affect effective implementation of the alternative. Ideally, the recommended alternative will not be reliant on physician attitudes because effectiveness would not be prone to fluctuation based on attitude.

## Equity Potential

The criterion for equity will evaluate the degree to which the alternative is beneficial for marginalized groups and will help close the diagnostic gap. This alternative will be evaluated on a scale from weak to strong where:

- Weak: Evidence does not support the diagnostic gap closing
- Moderate: Evidence shows support for and against closing the diagnostic gap
- Strong: Evidence shows support for closing the diagnostic gap

Ideally the recommended alternative will show strong evidence in support for closing the diagnostic gap.



## Analysis

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The following section details the analysis of the three alternatives to help decrease diagnostic error, against the given criteria:

- Alternative 1: Transition to Capitation Payment Models
- Alternative 2: Integrate Health Networks
- Alternative 3: Patient Accessible Electronic Health Records

### ALTERNATIVE 1: Transition to Capitation Payment Models

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#### Cost

##### Implementation Monetary and Time Cost:

In order to change the structure of the reimbursement models, healthcare providers and health insurance companies have to negotiate insurance contract rates, which requires an average of 4-6 months (Kurani et al., 2021; Credentialing.com). This process normally costs between \$8,000 and \$12,000 for those negotiating (PPS, n.d.). Therefore, the average median costs I will be using for evaluation are **\$10,000 and 5 months**.

##### Reduction in Cost to Providers Per Patient:

Capitation payments should cause a reduction in costs to providers as physicians would be ordering fewer unnecessary screenings and tests, as they would no longer be paid per service provided. In order to evaluate the average annual cost of reduction from transitioning to capitation payment reimbursement models, I will be examining over 30 studies highlighting the percentage reductions in costs for hospitals post-capitation implementation.

In 2017, *Health Affairs* evaluated Maryland's all-payer global capitation model, and found that the model reduced hospital costs by \$429 million overall (over 2% reduction) (MDH, 2018). A 2018 *Atlas* study comparing fee-for-service Medicare models to the Medicare Advantage capitated-integrated model also found that Medicare Advantage brought the total cost of care per member down by \$4,450 annually, which equates to 9% lower total costs of care (Nelson, 2021; Crane, 2018).

Between 2004 and 2005, Landon et al. (2011) evaluated 2,211 primary care physicians (PCPs) working in hospitals, physician groups, and private practices under the capitation model, who delivered services to over 250,000 people. With this capitated model, healthcare providers saw a 3.9% reduction in costs annually, compared to PCPs paid through fee-for-service models. Furthermore, the Lewin Group has three studies surrounding capitated payment models including: a 2006 study on capitated MCOs (Medicaid Managed Care Organizations), a 2006 on capitated hospitals in West Virginia, and a 2009 meta-analysis highlighting 24 studies commissioned by state and federal governments, researchers, and private foundations on capitated MMCs (Medicaid Managed Care Models). The 2006 study of MCOs noted savings through the use of capitation models ranging between 2% and 19% (Lewin Group, 2006). In West Virginia, the study found an estimated savings of 4.1% (Lewin Group, 2006). Lastly, with the MMCs, the meta-analysis saw cost reductions ranging from 1% to 20% for patients; one Ohio study in particular (an outlier excluded from the range) saw a reduction of 27% under capitated MCMMs (Lewin Group, 2009).

Given that the range of cost reduction goes from 1% to 20% for all the highlighted studies, the median average cost I will be using for evaluation will be a **10.5% reduction** in costs for healthcare providers annually.

## Variability in Cost Reduction and Strength of Evidence:

Given the **19-percentage point range** of cost reduction from the highlighted studies, capitated payment models show a **high variability in cost reduction**. However, since the evidence of cost reduction is from over 30 studies, the strength of the evidence is **very strong**

### Scope of Effects

From 2006 to 2016, the *Canadian Journal of Diabetes* conducted a longitudinal study looking at the aspects of diabetes care. The study followed the trends of many family physicians in Ontario changing from fee-for-service reimbursement to capitation reimbursement. The study found that physicians paid with capitated plans were **more likely to provide diagnostic and preventative testing**; they were more likely to provide glycated hemoglobin testing by 2.75%, lipid assessment by 2.76%, nephropathy screening by 1.08%, and statin prescription by 1.08% (Bamimore et al., 2021). Patients with physicians under capitation payment plans also had a **lower estimated risk of mortality by 0.0124% per physician per year** (Bamimore et al., 2021). All of these numbers were found to be statistically significant at the 95% confidence interval. The study has limited generalizability, as it only covered diabetes and was conducted in Ontario. However, the evidence of a greater use of diagnostic testing indicates that patients were being diagnosed at greater levels under capitated physicians, essentially helping them live longer.

A meta-analysis study conducted within the United States, highlighting 11,648 studies found that specialists paid with capitation payments **accepted sicker patients and saw patients with chronic conditions for more follow up visits** than fee-for-service specialists (Quinn et al., 2021). This difference was marginally significant at the 90% confidence interval. Additionally, The New England Journal of Medicine found that patients with physicians under capitated models **received more diagnostic testing for colorectal cancer**; patients were 29% more likely to receive fecal occult blood tests (at a confidence interval of 99%), and 7.3% more likely to receive endoscopies (at a 95% confidence interval) (Berwick, 1996; Greenfield, 1995). The journal also found that patients with physicians under capitated models received **7%-19% more follow-up visits** for pelvic inflammatory disease and vaginitis, as well as **1%-26% more diagnostic testing** (both at the 95% confidence interval) (Berwick, 1996; Greenfield, 1995). Both these studies show statistically significant changes in the rate of follow up visits and diagnostic testing; therefore, we can assume that with capitated payments, physicians are able to see a larger quantity of patients who are in critical conditions and diagnose them more efficiently.

Finally, a quasi-experimental, non-randomized study by the American Public Health Association found that patients with physicians under capitated models **received significantly more screening tests** than patients with FFS physicians (Retchin & Brown, 1990).<sup>1</sup> (All of these ratios were found to be statistically significant at a 95% confidence interval and we can assume that greater diagnostic screening tests will result in greater chances of diagnosis.

Capitated payment models saw **7 statistically significant effects**: more diagnostic and preventative testing for diabetes, as well as a lower estimated risk of mortality for patients with diabetes, more diagnostic testing for colorectal cancer, more follow up visits and diagnostic testing for pelvic inflammatory disease as well as vaginitis, and more screening tests overall including screening for breast cancer with a mammography, and eyes diseases with a tonometry. This alternative is **very strong** based on the criteria because there is a wide scope of effects. As all of these results were significant, the strength of the evidence was on average **very strong**.

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<sup>1</sup> More specifically, including tonometry (Odds Ratio = 8.4), mammography (OR = 2.7), pelvic examinations (OR = 5.3), rectal examination (OR = 2.9), and fecal occult blood tests (OR = 3.3); Odds Ratio = probability of an event/probability of a nonevent

## Viability

It's often reported that the proportion of value-based reimbursements (including capitation payment models) from the commercial sector to physicians and hospitals increased from 10.9% in 2012, to 53.0% in 2017 (Lapointe, 2019). However, an overwhelming majority of those were built on a fee-for-service foundation, and in 2018 it was reported that fee-for-service reimbursements actually accounted for 70% of the overall healthcare revenue (Hunter et al., 2021). **Only 6% of total commercial dollars, as of 2017, came from a value-based payments models** (Lapointe, 2019). Therefore, there is much room for improvement as 94% of physicians are not reimbursed with value-based payment models, nonetheless capitation payment models.

Physician attitudes toward the idea of capitation payments are **generally low**. A written survey was given to 200 physicians and among the physicians who do not participate in capitation reimbursements 100% believed that there would be a conflict of interest in capitated payments, and 77% (23 physicians) believed participation plans that reduce physician income in proportion to medical expenditures is unacceptable (Wynia et al., 1997). Among those who did participate in capitated payment contracts, 95% (41 physicians) believed these plans posed a conflict of interest, and 72% (31 physicians) believed participation plans that reduce physician income in proportion to medical expenditures were unacceptable (Wynia et al., 1997). It is important to note that neither of these numbers were statistically significant ( $p=0.4$  and  $p=0.66$ , respectively) and this study was conducted in 1997; however, these attitudes still reflect a portion of physicians within our healthcare system.

Although physician opinions should be taken into consideration, they **do not affect the initial implementation** of this alternative, as their attitudes will not change how capitated the plans are, without provider and insurance approval.

## Equity Potential

Capitation reimbursement would allow physicians to spend a majority of their time with the patients they determine to be in critical need, which would benefit patients, and help accelerate a complete diagnosis for individuals with chronic conditions who normally take longer to diagnose. However, capitation does not account for physician bias in time allotment. As physician bias tends to believe that minorities exacerbate illnesses for access to pain medication, and don't feel pain at the same level white people do, capitation could lead to less care for racial and ethnic minorities (Dusenbery, 2018; The Joint Commission; Appendix B). One study found physicians under capitation were more likely to commit their time towards white patients rather than black patients (Care et al., 2003). Additionally, as physicians tend to believe women exacerbate illnesses due to hysteria, capitation could lead to less care and time for women (Dusenbery, 2018).

However, although with standardized capitation systems women and minorities could be left behind, capitation systems can be designed to promote equity. There has been recent talk of risk-assessment capitation payment models that are set up with varying levels of reimbursement based on demographics including age, gender, race, and socioeconomic status. These levels mean monthly payments for women, minorities, older individuals, and low socioeconomic individuals are higher than capitation payments for middle-class white men (Care et al., 2003; Alegria et al., 2016). *DC Health* stipulated that with the implementation of risk-based capitation payment models, physicians will treat the most lucrative patients first, and once that market is exhausted, treat others, as well (Care et al., 2003). Therefore, capitation systems can be designed to be more equitable and target individuals who need physician attention more, or who are more commonly left behind.

While current standardized capitation models may struggle to close the diagnostic gap, capitation has the potential to become a more equitable system through risk-based models. Therefore, capitation payment models will be rated as having **moderate equity potential**.

## ALTERNATIVE 2: Integrate Healthcare Facilities

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### Cost

#### Implementation Monetary and Time Cost:

The evidence for implementation costs of integration for healthcare specifically are hard to pinpoint, especially as the expenses for integration vary for every acquisition (i.e. new certifications, new service networks for seamless communication, transition of roles and positions of power, etc.). However, integration costs for most business and healthcare acquisitions have been reported to be at a very wide range from \$4 million at the lower end, to \$3.8 billion at the higher end (Salsberg, 2019). As U.S. healthcare is one of the most expensive systems in the world with an annual expenditure of \$4.1 trillion, it's not unreasonable to assume that integration costs will be relatively high (Hartman et al., 2022). Furthermore, the average timeframe for the completion of an integration is between six months to 3 years (Gallant, 2021). Therefore, the average median costs I will be using for evaluation will be **\$1.9 billion** and **21 months**.

#### Reduction in Cost to Providers Per Patient:

Integrated care should cause a reduction in costs since physician information would be shared amongst specialists, and thus duplicated tests and unnecessary tests caused by a lack of complete information should decrease. In order to evaluate the average rate of the reduction of the annual cost from a transition into integrated health networks, I will be examining studies highlighting the percentage reductions in costs for hospitals post-implementation

According to the Kaiser Family Foundation, the average annual cost of health insurance in the USA is \$7,470 for an individual (Holden, 2021). Cigna is a healthcare and insurance company based in Bloomfield, Connecticut that began creating and offering integrated plans to their members. Following Cigna's integrations, they saw an average savings of \$227 annually for every member who was a part of their plan (Minemyer, 2021). Given the average cost annually for an individual in the U.S. and the average savings Cigna produced, the average reduction in costs was around 3.04%. However, when reevaluated through the 2018 Millman Research Report on a wider sample, it was noted that Cigna's reduction range per individual actually goes up to 10% annually (Melek et al., 2018).

Millman Research completed their own meta-analysis looking at 22 different studies involving integrated health models and subsequent reductions in costs to providers annually. The study found that the "typical cost savings estimates range from 5% to 10% of total healthcare costs," for patients receiving care through integrated systems (Melek et al., 2018).

Lastly, Intermountain Healthcare is a fully integrated system that completed a longitudinal study of the patients receiving care via their integrated team versus traditional practices. Intermountain Healthcare studied patient outcomes, healthcare utilization, and cost differences. The study noted that on average there was a 3% reduction in total healthcare costs annually (Reiss-Brennan et al., 2016). It must be noted that this study has a potential bias in which the organization conducting the study is an integrated healthcare network; however, it is currently unclear whether this bias affected the results.

Given that the range of cost reduction goes from 3% to 10% for the highlighted studies, the median average cost I will be using the median **6.5% reduction** as my estimate in costs for healthcare providers annually.

#### Variability in Cost Reduction and Strength of Evidence:

Given the **7-percentage point range** of cost reduction from the highlighted studies, integrated networks show a **medium variability in cost reduction**. However, as the evidence of cost reduction is from over 20 studies, the strength of the evidence is **very strong**.

## Scope of Effects

Integrated healthcare networks show efficiency through decreases in hospital utilization, as services are not being duplicated and diagnoses are received faster. Between January 2010 and December 2013, A study evaluated 113,452 patients with diabetes and hypertension within integrated and traditional healthcare to determine the difference in health practices and outcomes for the groups. The study found that patients within integrated networks had statistically significantly lower rates of healthcare utilization in the emergency department (on average **5.4 fewer uses of the ER per year**), which is indicative of better healthcare received for the patients (Boroyan, 2016; Reiss-Brennan et al., 2016). The study also found that rates of traditional hospital admissions were statistically significantly lower (on average **1.1 admissions less**) and statistically significantly lower rates of primary care physician encounters (which includes phone calls; on average **17.6 fewer encounters**), which is also indicative of patients receiving better healthcare as they need to use their networks less (Boroyan, 2016; Reiss-Brennan et al., 2016). All of these criteria were evaluated at a 95% confidence interval. Given the confidence interval and the statistically significant result, this study has relatively strong evidence.

At Intermountain Healthcare (as previously stated, an FFS integrated system), patients can receive integrated healthcare for both physical and mental illnesses. Although they have no data tracking increases in the diagnosis of physical illness, as the information would be hard to determine, they did study the diagnosis of mental disorders; specifically, depression. Intermountain Healthcare found that 46.1% of patients who were with Intermountain were likely to be diagnosed with depression, compared to only 24.1% in traditional care settings; a **22-percentage point change** (Boroyan, 2016). These findings are indicative of the better synthesis of information doctors in an integrated setting receive, which lead to a faster diagnosis. Given the effects of less fragmentation in healthcare resulting in a better synthesis and faster diagnosis, the assumption can therefore be made that patients in integrated care with physical illnesses are also diagnosed at a rate higher than patients in traditional care. This study has relatively strong evidence as it was evaluated at a 95% confidence interval, and the results were determined to be statistically significant.

Finally, a systematic search on 5 databases (MEDLINE, EMBASE, Cochrane Library, Web of Science Core Collection, and EBSCO) reaffirmed that integrated health systems witnessed lower rates of hospital admissions (found to be on average **2.5 times lower**), however they also examined mortality and found **no statistically significant changes in the mortality** of patients in integrated systems compared to traditional systems (Liljas, 2019). This systematic search has relatively strong evidence as it was evaluated at a 95% confidence interval, and the results were determined to be statistically significant.

Integrated networks saw **4 statistically significant effects**: they were shown to decrease the use of the emergency room, decrease the use of hospital admissions, cause less primary care physician encounters, and produce a percentage diagnostic change for mental illnesses. However, this alternative showed no significant changes in mortality. This alternative is **moderate** based on the criterion. As all of these results were significant, the strength of the evidence was on average **very strong**.

## Viability

According to *Definitive Healthcare*, **roughly 76% of hospitals are members of integrated systems**; and there are now around 500 integrated networks in existence in the United States (Definitive Healthcare, 2017; Lambert, 2018). Therefore, pursuing integrated healthcare has less potential for improving diagnosis as only 24% of hospitals still need to be integrated into a network.

Data on physician views regarding integration does not exist. However, following 9 interviews with physicians within (4 physicians) and outside (5 physician) of integrated networks, I will be assuming physician opinions regarding integration are **generally positive**. None of the physicians interviewed stated any negative or neutral comments regarding integration; all were in favor. One physician who was not a part of an integrated system stated, “I don’t care what the government says they can and cannot do, they *need* to mandate integration. Do you know how many problems that would solve for me?”



This **physician opinion is very important** in the implementation of integrated care as the fragmentation of information and care can only be solved if physicians are willing to input their information into the integrated systems, and use the notes from other doctors in the system to help inform the diagnostic process.

## Equity Potential

*Health Affairs* reported that 14-29% of patients nationally are denied healthcare because physicians do not believe the patients need any services. Racial and ethnic minorities are on the higher end of this range due to personal bias, and although women were not disaggregated within the data, it can be assumed that women were also towards the higher end of the range as they experience bias within the healthcare system as well (Algeria et al., 2016). The Brookings Institute found that these groups are also spoken to, rather than given the opportunity to vocalize their symptoms, essentially leading to worse outcomes for patients as they are not being heard (Butler & Sheriff, 2021).

While data regarding the direct effects of integrated healthcare on minorities and women specifically does not exist, *Health Affairs* speculated that integrated healthcare could increase equitable care. Though physicians encounter biases where they are not listening to their marginalized patients regarding their symptoms and concerns, they are more likely to listen to another physician's notes within their network detailing their patients symptoms (Algeria et al., 2016). Additionally, marginalized patients would have a lessened burden to communicate information from their previous appointments as all the information would already be accessible by specialists and PCPs (Algeria et al., 2016).

Although there is speculation regarding the equitable potential for integrated healthcare, there is no evidence or implementation changes to this alternative that can ensure equity. Therefore, integrated healthcare will be rated as having **weak equity potential**.

## ALTERNATIVE 3: Make Electronic Health Records, Patient Accessible

### Cost

#### Implementation Monetary and Time Cost:

The cost of purchasing and installing any sort of EHR system (including a PAEHR system) was estimated to range between \$15,000 to \$70,000 per provider in 2007; as that was over a decade ago, the costs may actually be higher now due to inflation (Bloomenthal & Glaser, 2007). Developing a new system where information is becoming patient accessible requires software engineers to begin from scratch and build an entirely new system, so the cost of implementation would equal the cost of a new installation (Essen et al., 2018). Furthermore, the installation of a new system takes between six to nine months (Uzialko, 2021). Therefore, the average median costs I will be using for evaluation will be **\$42,500** and **7.5 months**.

#### Reduction in Cost to Providers Per Patient

PAEHRs should reduce costs due to a decrease in unnecessary tests as diagnostic screening would become informed by better information given by the patients. Evidence directly illustrating reduced costs associated with the transition from standard EHRs to PAEHRs, does not currently exist. Therefore, in order to evaluate the average rate of the reduction of the annual cost by using patient accessible electronic health records, I will be examining a couple studies highlighting the percentage reductions in costs for hospitals with increased patient access to information, as patient access to information is what PAEHRs will achieve.

In a five-year mixed methods study, researchers studied the effects of patient access to information across 1800 patients piloting an information-informed provider plan. The study found that following patient access to information, the plan's per capita expenditures were consequently 10.8% lower (Greene, Jeffery et al., 2019). Furthermore, a *Health Affairs* study examining over 32,000 patients becoming engaged at different levels following access to information saw cost reductions ranging from 8% to 12% (Greene, Jessica et al., 2015).

The limitation of these studies include how the reduction in costs seen to providers will be proportionate to the level at which patients choose to access their EHRs, as accessibility itself does not predict engagement. Further limitations include the scarcity of evidence supporting the cost reduction. Despite these limitations, given that the range of cost reduction goes from **8% to 12%** for the highlighted studies, the median average cost I will be using for evaluation will be a **10% reduction** in costs for healthcare providers annually.

### Variability in Cost Reduction and Strength of Evidence:

Given the **4-percentage point range** of cost reduction from the highlighted studies, PAEHRs show a **low variability in cost reduction**. However, as the evidence of cost reduction is from only 2 studies, the strength of the evidence is **very weak**.

### Scope of Effects

Patient access to electronic health records is meant to increase patient information. By increasing patient information it should change patient behavior to help better inform the diagnostic process and make sure that they receive their diagnoses faster. Therefore, while the effects of patient accessible health records compared to electronic health records have not been studied; patient behavior affected by patient information from patient access for health records can be assumed to help reduce diagnostic error.

In 2017, Norwegian hospitals established patient accessibility to health records, for citizens 16 years and older, through the national health portal *Helsenorge*. The citizens were recently surveyed, and 1037 respondents participated in the survey, most of whom either used the PAEHR regularly (29.4%) or when necessary (29.2%). The survey found that patients are extremely likely to **access to their health record to prepare for a hospital appointment (64.0%), share documents with their general practitioner (37.5%) or family (24.9%), and look up their health information for their own knowledge (88.3%)** (Zanaboni et al., 2020). The majority of the respondents understood the content (85.2%) and were very satisfied with access (92.7%) and patients with complex, long-term, or chronic conditions seemed to benefit the most (Zanaboni et al., 2020). There are a few limitations to this study, as the study could not be evaluated on confidence intervals, so the strength of the evidence cannot be determined. Additionally, this study was conducted in Norway. However, there is a possible correlation regarding the effect of patient access on healthcare, as according to the Legatum Prosperity Index (an annual ranking based on wealth, economic growth, quality of life, health, education, and personal well-being), Norway has the second-best healthcare system in the world as of 2022 (second only to Denmark) (World Population Review (a), 2022; World Population Review (b), 2022)

Furthermore, in a meta-analysis examining PAEHRs role in diabetes, 17,387 patients were observed. Through the study, researchers found a beneficial effect in PAEHRs helping patients reduce their absolute values of HbA1c (a blood test that is used to help diagnose and monitor people with diabetes), once diagnosed, from -0.540 to -0.093 (Neves et al., 2020). HbA1c levels are a major predictor of mortality in type 2 diabetes, and patient access to their EHRs decreased these rates at statistically significant levels, therefore it can be assumed that **PAEHRs have an effect on mortality rates**.

Finally, The Office of the National Coordinator for Health Information Technology has recently begun assessing the effects of PAEHRs on diagnostic actions for asthma. The office found that PAEHRs

cause a **3% greater use of spirometry** (a test used to diagnose asthma or other conditions that affect breathing) (Health IT, n.d.). Therefore, it can be assumed that patient access to what information is being recorded, and knowledge of their symptoms and tests, helps inform and push for better diagnostic testing. These results were statistically significant at the 95% confidence interval.

PAEHRs saw **5 main effects**: PAEHRs resulted in the use of health records to prepare for hospital appointments, the sharing of documents with general practitioners or families, and the general knowledge of patients. They were also shown to have an effect on mortality rates and create a greater use of diagnostic testing. This alternative is **moderate** based on the criteria because there is a moderate scope of effects. Additionally, as only two of the studies were statistically significant at the 95% confidence interval the **strength of the evidence is moderate**.

## Viability

According to the American Hospital Association (AHA) **93% of surveyed hospitals and health systems allow patient access to EHRs upon request**; this is essentially the same ability PAEHRs will allow (Monica, 2018). This means there is extremely little room for improvement as only 7% of hospitals would truly need to implement PAEHRs.

**Physicians have a generally favorable opinion of PAEHRs.** A survey conducted by Stanford Medicine found that 63% of doctors agree that PAEHRs have led to improved patient care in general practice and specialized practice, and 66% of primary care physicians report that they are satisfied with their current PAEHR system (The Harris Poll, n.d.).

**Physician opinion is very important** in the implementation of patient accessibility and patient-informed care can only be effective if physicians are willing to integrate patient concerns, symptoms, and opinions into their diagnostic process.

## Equity Potential

A majority of PAEHRs users say that the accessibility to their health records help enable them to make sure their health information is accurate for a faster diagnosis (64% of users); furthermore, those with less education (whom statistically we can assume to be racial and ethnic minorities), those with lower incomes (whom statistically we can assume to be women), and those with chronic illnesses (who are more likely to be women) felt that they derived the most value from PAEHRs and achieved deeper engagement in the process of managing their health and healthcare (Gibbons, 2011; Dusenbery, 2018; The Joint Commission). This data supports PAEHRs being an equitable alternative.

Although there is no evidence showing the equitable potential of PAEHRs for women, a recent study of Kaiser Permanente enrollees found that only 31% of African American members registered to use their PAEHRs compared to 41.7% of white members (Gibbons, 2011). This difference was found to be statistically significant at 99% confidence interval. The study cited that although the proportion of Internet users who are black has grown consistently every year, African Americans remain less likely to go online than whites. Similarly, African Americans continue to trail whites in broadband use at home and are less likely than whites to own a desktop computer (51% for African Americans versus 65% for white people) (Gibbons, 2011).

Therefore, although PAEHRs are in practice an equitable alternative, computer use can deter these effects. As such, although this alternative has the potential for equity it cannot be ensured. Therefore, PAEHRs will be rated as having **moderate equity potential**.

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*Overall Outcomes Matrix*

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		Capitation Payment	Integrated Healthcare	PAEHRs
<b>Cost</b>	<i>Monetary Cost</i>	\$10,000	\$1.9 Billion	\$42,500
	<i>Time of Implementation</i>	5 Months	21 months	7.5 Months
	<i>Reduction in Cost</i>	10.5% Reduction	6.5% Reduction	10% Reduction
	<i>Variability in Reduction</i>	High Variability	Medium Variability	Low Variability
	<i>Strength of Evidence</i>	Strong	Strong	Weak
<b>Scope of Effects</b>	<i>Scope of Effects</i>	Wide	Moderate	Moderate
	<i>Strength of Evidence</i>	Strong	Strong	Moderate
<b>Viability</b>	<i>How many hospitals implement this already?</i>	6%	76%	95%
	<i>Physician Opinion</i>	Low	High	High
	<i>Is Opinion Important?</i>	No	Yes	Yes
<b>Equity Potential</b>	<i>Equity Potential</i>	Moderate	Weak	Moderate

\*\*\*The cells highlighted in green represent the best outcomes for each sub-criteria; some sub-criteria have two rows highlighted as two columns were equal in achieving the highest outcome for the sub-criteria.

## Recommendation

Based on the evaluation of the alternatives by the given criteria, I recommend pursuing a **transition from fee-for-service reimbursement models to capitation payment models**. Although PAEHRS had the lowest variability in their cost reduction, the strength of evidence was weak, and although IHNS had strong supporting evidence, the cost of implementation was the highest and the cost reduction gained after implementation was the lowest among the alternatives. However, although capitation payment models had high variability in their cost reduction, they are the quickest alternative to implement (5 months) and come at the lowest implementation cost. Additionally they had the highest predicted reduction in cost for providers, as well as strong supporting evidence. Capitation payment models were also the only alternative to have both a wide scope of effects that help decrease diagnostic error, and strong supporting evidence. Furthermore, capitation payment models are implemented in the least amount of hospitals as of now (and therefore have the most room for improvement), and do not need positive physician opinion to be effectively implemented. Finally, capitation payment models are able to be designed so that there are equitable reimbursements for all demographics. Therefore, it is the best alternative to pursue.

## Scope of Effects

### Main Comparisons Chart

FEATURES	Capitated Payment	IHNS	PAEHRS
Increased Diagnostic Screenings	✓		✓
Increased Preventative Care	✓		
Lower Risk of Mortality	✓		✓
Accepting Sicker Patients	✓		
More Follow-ups	✓		
Less PCP Encounters	✓	✓	
Decreased Use of ER		✓	



## Implementation

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The Department of Health and Human Services (HHS) has two different implementation methods they can pursue, which will subsequently determine the relevant actions, actors, and potential pitfalls of implementing capitation reimbursement models in hospitals. HHS could choose to either implement through new agency regulations that will require hospitals to transition to value-based payment models (including capitation models) and frame it as a necessity to increase patient safety, or implement through incentives to encourage hospitals to transition to capitation-payment models.

### Implementing Through Regulations

It is not very likely that HHS would be able to mandate a transition into capitation payment models specifically, as mandates are only created to protect patients from harm. Therefore, a mandate cannot be preventative and force a specific model, but rather reactionary and only work against a harmful one (a mandate cannot force hospitals to use capitation models, they can only make them stop using FFS models). This is why I chose to keep the mandate broad and focus on transitioning to values-based payment models, which include capitation models as a form of reimbursement, to at minimum get hospitals to eliminate the harmful effects of fee-for-service payment models. If HHS chooses to implement new agency laws and regulations for hospitals, they must go through Congress. As HHS is aware, while the department can help draft the new laws, and will be in charge of promoting and enforcing the new regulations, the agency itself will not be able to pass the regulation without the congressional vote (Fowke, n.d.). As such, in pursuing this implementation method, HHS will need to focus on developing advocacy messages, as well as identifying and securing the approval of house representatives who are willing to push this regulation. Furthermore, as healthcare must be on the policy agenda for successful legislation, the timeframe of implementation is undetermined. Following the passing of the new regulation, HHS will have to set aside a group of employees willing to enforce the transition of hospitals to values-based reimbursement models and install consequences for noncompliance.

In terms of benefits of pursuing this alternative, regulating hospitals to change their reimbursement models means that hospitals must comply with the new mandate and will therefore guarantee the elimination of fee-for-service models. Additionally, HHS can provide a given time period for hospitals to complete the transition (Office of the Federal Register, n.d). However, there are pitfalls to this implementation method. As the new regulations must be voted on and passed through Congress, there is no guarantee of its success and may subsequently come with compromises to the regulation to make it more bipartisan. Additionally, as it would be a mandate to transition to values-based models as a whole, instead of capitation payment models specifically, there is no guarantee that following this regulation there would be an increase in capitated hospitals.

### Implementing Through Incentives

The other implementation method HHS can pursue would be to implement subsidies for hospitals looking to transition to capitation models or incentivize the transition to capitation models by providing financial benefits to providers. Pursuing this implementation method keeps the actors within HHS and does not rely on external legislation. However, this alternative also carries its own pitfalls, as subsidies and financial incentives require dipping into the agency budget without guarantee that hospitals will transition to capitation models in order to take advantage of these incentives.

HHS would need to determine the most effective incentives, identify which resources they need for effective implementation (i.e. money) and where it will come from, as well as create a division to design and follow-through on the implementation for the incentives. As incentives would be an internal

implementation method though, the timeframe for implementation could be mapped out by the department.

### Next Steps

Health effects following either of these implementation methods should be evaluated to better inform health policy and diagnostic error in the future, as this is merely the first step. For both, there should be evaluations on how many hospitals end up transitioning to capitation models and what health outcomes (i.e. screening tests, mortality rates, hospital utilization, etc.) resulted for patients within these models, by assigning a division to track these changes. I recommend obtaining this data from hospitals before transitioning, and then evaluating it annually after the transition to track improvements.



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## Appendix A: Brief Origin of Gender Disparities

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Gender misdiagnosis comes as a result of poor health education and research conducted on female bodies, as well as implicit bias. As Maya Dusenbery, researcher and author of the book *Doing Harm: The Truth About Bad Medicine and Lazy Science Leave Women Dismissed, Misdiagnosed, and Sick*, stated, “there is a general lack of knowledge about women symptoms, bodies, and conditions that disproportionately affect them. That’s the legacy of decades of women being underrepresented or excluded from the research (Seegert, 2018).” Firstly, symptoms can appear differently in a woman’s body, then they would in men (Seegert, 2018). As an example, when men are experiencing heart attacks, they feel a tightness and pressure in their chest (Heart Attack, 2021). Heart attack symptoms in women, however, tend to be a little different and can include shortness of breath, nausea, sweating, and fatigue (Heart Attack, 2021). Doctors are normally trained to look for these classic male symptoms of a heart attack and as a result may miss a heart attack in a female patient (Lupton, 2019). Similarly, it does not help that because the media only portrays the male symptoms of heart attacks, women can not even recognize or advocate that they are having a heart attack themselves (Lupton, 2019). Consequently, a study conducted by the American College of Cardiology found that women often wait an average of one hour before getting medical help for a heart attack because physicians, as well as themselves, prove unable to identify their symptoms (Reiter Law Firm). Furthermore, the medical help they receive might still be wrong, as women have a 50% higher chance of receiving the wrong initial diagnosis following a heart attack, than men (Heart Matters). And heart attacks are only one of many afflictions that appear differently in males and females, as medical issues such as strokes or even contracting the flu draw the same issues from the medical community (Vital Record, 2017).

Additionally, there are about 80 different autoimmune diseases in the United States with about 23.5 million to 50 million Americans suffering from them. Of this estimated number of people with autoimmune diseases, about 75% are female according to the American Autoimmune and Related Diseases Association (Four Conditions, 2019). Yet due to physicians being unable to identify autoimmune diseases in women, it typically takes about five years from the onset of symptoms for women to get diagnosed with an autoimmune disease and this delay can put women through unnecessary suffering (Reiter Law Firm). Moreover, women are more likely to be misdiagnosed when they’re suffering from a disease or an illness that is unique to women, such as polycystic ovary syndrome (typically abbreviated PCOS), endometriosis, or ovarian cancer (Reiter Law Firm). These women may actually be told that they simply have irritable syndrome, that their hormones are imbalanced, or that they merely need to lose weight; even though weight gain is often a symptom of these issues (Seegert, 2018).

Finally, there is a lack of trust in women’s self-reports about what they’re experiencing, and a tendency to dismiss or psychologize complaints (Northwell Health). Since the 19<sup>th</sup> century, when Sigmund Freud made hysteria a catch-all psychological explanation for unexplained complaints which manifested as physical symptoms in women, women have been more likely to have their medical issues attributed to psychosomatic causes (Dusenbery, 2018). Interestingly enough, the reality is that women do have more medically unexplained symptoms (also called nonspecific, function, somatoform (NFS) syndromes) than men (Williams et al, 2018). This means that there will be no external evidence of the pain that these women are feeling, even though the pain exists and could be a warning sign for something more fatal (Williams et al, 2018). However, this means that when it comes to diagnosis women are less likely to be believed, and more likely to be dismissed, when they are in serious pain (Seegert, 2018). These dismissals prolong the time it takes for an accurate diagnosis for women, as doctors believe the problem has already been solved. As an example, Crohn’s disease takes on average 12 months to be diagnosed in a male, and 20 months in a woman (Dusenbery, 2018). Ehlers-Danlos Syndrome takes four years to be diagnosed in a male, and 16 years to be diagnosed in a woman (Dusenbery, 2018).

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## *Appendix B: Brief Origin of Racial Disparities*

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Racial disparities in diagnosis also exist because of poor health education and research conducted on minority bodies, as well as implicit bias. Black people, especially black women, are underrepresented in clinical trials that require consent and overrepresented in studies that do not (Snyder, 2020). Additionally, health conditions that disproportionately impact black people, such as uterine fibroids, diabetes and heart disease receive very little government research funding (Beim, 2020). Fewer than 5% of federally funded lung disease studies in the last 20 years have focused on people of color, even though black Americans are one-third more likely than whites to have asthma and over three times more likely to die from it (Konkel, 2015). Moreover, black people are significantly underrepresented in biomedical research databases including genetic data repositories and related analyses, as almost 80% of the individuals included in genomics studies are of European descent and most of the minority population being studied are of Asian ancestry (Beim, 2020). These studies are important as they help determine the risk of passing a disease onto one's child, help determine genetic diseases, assist in guiding the administration of drugs to the patient as well as prevent future diseases, and help inform cancer prevention and treatment (ASHG).

Although, racial disparities in research are better analyzed for African-Americans, they are not the only group affected. For instance, although blacks and Latinos make up 30% of the U.S. population, they only account for just 6% of all participants in federally funded clinical trials (Konkel, 2015). Additionally, a review of government-funded cancer research studies found that all racial/ethnic minorities (including Asian Americans, Native Hawaiians, Pacific Islanders, and American Indians), are also underrepresented in cancer clinical trials, and less than 2% of these studies focused on minority health needs (Chen et al., 2014).

Furthermore, in addition to a lack of research, there are many diseases or symptoms that appear differently on minority bodies than they do on white bodies, which causes doctors to struggle attributing a correct diagnosis to the patient, due to an inability to identify the problem (Prichep, 2019). For instance, while jaundice is diagnosed due to the redding of the eyes on white people, the eyes of black people turn yellow (New Health Advisor, 2020). Additionally, while psoriasis on white skin usually shows up as pink or red patches with silver white flakes, on black skin it appears as purple patches with gray scales or a dark brown color (Lockett, 2020). On black skin, psoriasis patches are also often more widespread (Lockett, 2020). While, black skin was highlighted in many studies, the underlying factor resulting in different symptoms appearing on minority bodies, was the increase of melanin; therefore, a majority of minorities are at risk for underdiagnosis for this reason (Bass, 2021).



\*Psoriasis on different skin colors. Image retrieved from American Academy of Dermatology Association.  
<https://www.aad.org/public/diseases/psoriasis/treatment/could-have/skin-color>

Finally, implicit racial bias runs rampant through the healthcare system (Batten, 2020). These biases lead to fewer healthcare interventions and transplants for people of color (DeAngelis, 2019). Additionally, black people are less likely to be prescribed pain medication and are less likely to receive chemotherapy and radiation therapy than their white counterparts (The Joint Commission). A 2012 meta-analysis found that black patients were 22% less likely than white patients to get any pain medication, and 29% less likely to be treated with opioids, due to the stereotype that black patients are more likely to abuse prescription painkillers (despite white Americans having the highest rates of prescription drug abuse) (Meghani et al., 2012). These disparities even extend to black children, where a 2015 study found that white children with appendicitis are almost three times more likely to receive opioids in the ER than black children (Goyal et al., 2015). Many healthcare providers also underestimate the pain of their black patients, believing that black people simply don't feel as much pain as white people and therefore treat them accordingly (Hoffman et al., 2016). As a result of all these factors, black people are more likely to die after being diagnosed with breast or prostate cancer, more likely to die in childbirth, and more likely to have their symptoms dismissed (DeAngelis, 2019).

Bias in the healthcare system is not exclusive to black people though. All non-white patients have been shown to receive fewer cardiovascular interventions, fewer renal transplants, be less likely to be prescribed with pain medications (both non-narcotic and narcotic), and be more likely to be blamed for being too passive about their healthcare (The Joint Commission). These reactions have cyclical effects as non-white patients become less likely to seek help and fulfill prescriptions since they do not trust their doctors, leading to worse healthcare outcomes (DeAngelis, 2019).



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### *Appendix C: Kaiser Case Study*

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#### Brief Kaiser Permanente Case Study

Kaiser Permanente is currently the largest nonprofit integrated health care system in the United States, with over 9.6 million members (Selvan et al., 2015). Kaiser additionally uses a capitated payment reimbursement model, and allows patient access to EHRs (Kaiser Permanente Thrive); thus, Kaiser is essentially the perfect marriage of existing evidence for better quality medical care.

Kaiser Permanente (KP) is currently recognized for having a decreased total annual office visit rate by 26.2% and decreased telephone visits by nine times the total rate (Health Information Exchange, 2021). While there are not many stats on the program as a whole, KP Hawaii has been ranked No. 1 in Hawaii for cancer screenings and diabetes care and as mentioned before, increased diagnostic screenings decrease diagnostic error (NCQA, 2020). Additionally, in 2016 KP's Hawaii's Medicare and Medicaid plans were recognized as No. 1 in the state for the 12th time (NCQA, 2020). In California, Kaiser was able to decrease hospitalization rates for coronary heart disease by 30%, heart attacks by 56%, and strokes by 20%, between 1998 and 2007 (McCarthy et al., 2009). In 2004, they were noticed for having a heart disease mortality rate low enough that Northern California KP members were 30% less likely to die from heart disease than other Californians (McCarthy et al., 2009). Furthermore, KP California has a 37% reduction rate in hip fractures and is rated No. 1 in osteoporosis management which they attribute to their open access EHRs (McCarthy et al., 2009). As a whole program, greater than 90% of KP physicians and 95% of KP patients are satisfied with the Kaiser Program, and as previously stated satisfaction improves healthcare quality and diagnosis (Health Information Exchange, 2021). According to the U.S. News & World Report's 2021-2022 Best Hospitals Rankings, Kaiser remains ranked among the nation's best hospitals in all areas of practice and remains a prominent example of the proof of the existing evidence (Permanente, 2021).

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## *Appendix D: Grants as a Federal-Level Alternative*

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As HHS is a federal agency (and furthermore AHRQ is a research agency), it would also be helpful if there could be an alternative to help decrease diagnostic error at the federal level through research. Therefore, the following section examines evidence of conducting research through a review of available literature, and then details implementation of the alternative.

### Literature Review: Improving, Conducting, and Implementing Research

The diagnostic process and the challenge of diagnostic errors have been neglected within the national health care research agenda (Wachter, 2010; Zwaan et al., 2013). As a result, there are currently substantial gaps in what is known about the diagnostic process and diagnostic error in health care today and these knowledge limitations affect not only the field of diagnosis but also patient care (Committee on Diagnostic Error in Health Care, 2015). Therefore, an improved understanding of diagnosis and diagnostic error has the potential to inform and improve all areas of health research.

There are a number of reasons why diagnosis and diagnostic errors have been cited to be underrepresented in current research activities, including the shortage of sources that have valid and reliable data for measuring diagnostic error, a lack of awareness of the problem, the “perceived inevitability of the problem,” a poor understanding of the diagnostic and clinical processes, a lack of applicable performance measures on diagnosis, and the need for financial and other resources to address the problem (Croskerry, 2012). However, a major barrier to research on diagnosis and diagnostic error is the disease-focused approach to medical research funding. The National Institutes of Health's structure and funding mechanisms are often organized by disease or organ systems, which facilitates and incentivizes the study of these specific areas but impedes research efforts seeking to provide more comprehensive understandings of diagnosis (Committee on Diagnostic Error in Health Care, 2015). In a study surrounding the misdiagnosis of stroke, Newman-Toker (2014, p. 12) asserted that diagnostic research “invariably falls between rather than within individual Institute missions.” As such, the topic of diagnosis is not centralized within the NIH research portfolio. Furthermore, what available research there is for funding for diagnosis often targets the diagnosis of specific diseases, but not diagnosis as a whole, the diagnosis of several diseases with similar presentations, or the diagnostic process itself (Committee on Diagnostic Error in Health Care, 2015). Therefore, a viable solution would be to have multiple federal agencies (eg. The NIH, CDC, CMS, etc.) commit dedicated funding to implementing this research agenda.

There are a few limitations to the ability of medical research to be implemented in practice. Firstly, Chalmers & Glasziou (2009), estimated that 87.5% of all health research is being avoidably “wasted.” Of the 100% of research conducted, 50% are never published in full. Published reports of research must be “sufficiently clear, complete, and accurate for others to interpret, use, or replicate the research correctly” (Glasziou, 2014). But at least 50% of reports do not meet these requirements (Glasziou, 2014). Measured endpoints are also often not reported, methods and analysis are poorly explained, and interventions are insufficiently described for others (researchers, health professionals and patients) to use (Chalmers & Glasziou, 2009). All these problems are deemed avoidable, and hence represent a further “waste.” Furthermore, of the 50% of studies that are published, only 25% are normally found to be sufficiently well reported and therefore to be usable and replicable. Finally, of those 25%, about half (12.5%) have no serious, avoidable design flaws (Chalmers & Glasziou, 2009). Henceforth, the percent of research that does not satisfy these stages and is thus deemed as waste, is 87.5% of health

research. However, this limitation is ultimately a moot point as it does not discount the need for research to be conducted. It merely means incentives to help conduct research should be explicit so that money and resources are not wasted.

Another limitation is that even while evidence-based practice is being conducted and published, it's been found that research suggests it takes hospitals and clinics about 17 years to adopt a practice or treatment after the first systematic evidence shows it helps patients (Luciano et al., 2019). However, there are discrepancies to this average. Covid-19 was first identified in December 2019, and by December 2020 the Pfizer vaccine became the first vaccine to receive emergency use authorization from the FDA. (Solis-Moreira, 2021) Therefore, implementation of medical research is not necessarily a matter of fact, but rather a matter of perceived urgency and incentive. Thus, incentives to implement research based on diagnosis must be available.

#### Alternative 4: Create Grants with the NIH to Fund Diagnostic Error Research

As discussed within the evidence review, there is a lack of medical research surrounding diagnosis and decreasing diagnostic error. This lack of research creates information gaps and inhibits physicians from being able to correctly diagnose their patients, thereby perpetuating the existence of diagnostic error. Therefore, one alternative the government could pursue would be to support funding for research surrounding these issues by creating grants with the NIH that is specific to research improving doctors' ability to diagnose typically misdiagnosed medical issues, or research specific to reducing diagnostic error as a whole. Additionally, these grants could be bigger for research highlighting or specific to improving diagnosis for women and minorities. This alternative requires government funding and therefore a proper budget must be set aside or advocated for.

#### Implementation of Alternative

In 2020, the NIH funded 11,331 grants with an average award cost of \$566,744 for each grant (NIH, 2021). By partnering with HHS and directing less than 2% of that funding (1.77%) to specifically targeting diagnostic error research, the NIH could fund 200 grants annually without stepping out of their FY budget. For implementation to be successful, HHS might need to create an advocacy strategy to persuade the NIH to redirect some of their budget for this research, and additionally will need to advertise the new existence of these grants for researchers. Obtaining approval from the NIH should not pose much of a challenge though as the NIH has highlighted in previous studies that healthcare research continually produces large amounts of results and revised methods of treatment and care for patients, which, if implemented in practice, can potentially save lives and improve the quality of life of patients (Hanney et al., 2017). As their own mission aligns with that of AHRQ's, there is not much discourse to settle.

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