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# Factors Influencing Doctors Ordering of Clinical Lab Tests: A Qualitative Study

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## Abstract

Qualitative studies exploring the factors behind a doctor's decisions to order clinical laboratory blood testing are lacking. A better understanding of these factors can help in formulating interventions that could improve the quality of health care and limit costs. The purpose of this qualitative case series study was to identify factors that influence a doctor's decision to order routine clinical laboratory blood tests. Fifteen doctors from Western New York, working in different hospital settings, were interviewed. There were 5 doctors in each case type: major, community, and private hospitals. When analyzed by case, there was a difference between the three groups in the ordering of tests based on fear of malpractice. The majority of the doctors from the community hospitals group (4 of 5) and private practice group (3 of 5) said that they had ordered tests based on the fear of malpractice. However, in the major hospital group, only 1 doctor followed this pattern. Although, the majority of the doctors (13 of 15) held favorable views of the guidelines for administering the blood tests, most (8 of 13) thought that they were impractical for use in their practice, and hence needed major modifications. To increase effectiveness for guideline adherence, a multifaceted local team approach is recommended that includes a review of guidelines by a committee comprised of respected local doctors in consultation with the area doctors. In addition, the development of continuing education could have a positive effect on guideline adherence and the reduction of unnecessary testing. This reduction could result in increased quality of care and reduced cost burden to the health care system.

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# Dedication

I dedicate this dissertation to my dad, Lakshmanan and my brother, Ganesh who are both smiling from the sky and are happy for me because they always believed in me. I also dedicate this to my Amma, Parimalakantham, who has endured lot of hardships, and would be the most proud to see me complete this journey.

# Acknowledgments

I would like to begin by profusely thanking my dissertation chair, Dr. Magdeline Aagard, for her dedication, patience, and guidance in making my journey a success. I would also like to thank Dr.Ronald Bucci and university research reviewer Dr. Patrick Tschida for their valuable contributions to the refining of the dissertation.

My thanks also go to Jennifer Jamison Forgnone for making this a better dissertation with her patient proofreading and correction of my grammar. In addition, my thanks go to the local Western New York medical society that provided the doctor list. This dissertation would not have been possible without the participation of the 15 doctors who were willing to provide their valuable time during their busy schedules.

Finally, I would like to thanks all my well-wishers and friends. Most importantly, this dissertation would not have been possible without the unwavering support from my wife, Kavitha, and daughters Maler and Tulesi who have sacrificed a lot for me to complete my dissertation.

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# Chapter 1: Introduction to the Study

## Introduction

Studies exploring the factors behind a doctors' decisions to order clinical laboratory testing are lacking. A better understanding of the factors that have an effect on a doctor's decision to order a laboratory blood test could help in formulating interventions that could improve the quality of health care and potentially reduce health care costs. In this study, I explore some of the factors behind doctors' decisions to order clinical laboratory testing to better understand which evidence-based interventions could be helpful in improving health care quality and reducing cost for the community.

In this chapter, I present background information regarding the burgeoning costs of health care in the United States, the role played by clinical laboratory blood testing in the escalation of the costs, and the unnecessary and inappropriate use of the clinical lab blood testing. Drawing on available literature, I explore the reasons behind a doctor's decision to order clinical lab blood tests. I then present the problem statement and discuss the purpose of the study, the research questions, and the theoretical framework. A concise description of how I conducted the qualitative case series study follows, along with relevant definition and assumptions. Finally, this chapter concludes with discussions of the scope, delimitations, limitations, and significance of the study, followed by a summary.

## Background

Current estimates are that the United States has the most expensive health care system and is spending close to 18% of its gross domestic product (GDP) on health care

(Channick, 2013; Squires, 2012). The health care expenditures were close to $3 trillion in 2011, and is expected to grow at an annual rate of 2.5% every year (Channick, 2013). The cost of health care is projected to increase to $5 trillion by 2022, constituting 25% of the federal budget (Blumenthal, Stremikis, & Cutler, 2013). The current rate of growth is unsustainable, and it places a substantial burden on the nation. Therefore, there is a concerted effort by the Government to reduce healthcare costs for a sustainable future.

Multiple factors are responsible for rising health care costs and one of the major contributors is the use of expensive technologies and tests (Reinhardt, Hussey, & Anderson, 2002). Laboratory testing constitutes approximately 3-5% of health care spending (Song et al., 2011). Direct costs associated with lab testing added $60 billion to health care expenditures in 2012 (Warren, 2013). A vast majority of medical decisions are influenced by clinical laboratory tests. An estimated 70% of the downstream treatment and management of patients such as hospital admissions, prescriptions, follow-up imaging studies, and surgeries have been attributed to the initial lab testing (Carlson, Amirahmadi, & Hernandez, 2012). Hence, the costs associated with lab testing are much higher than the annual cost of $60 billion per year (Zhi, Ding, Theisen-Toupal, Whelan, & Arnaout, 2013).

A large body of evidence has shown inappropriate lab utilization has contributed to the escalating health costs (Kim, Dzik, Dighe, & Lewandrowski, 2011). Unwarranted and duplicate medical testing results in a financial burden on the health care system. The current waste related to the ordering of unwanted and unnecessary testing is close to half a trillion dollars per year (Kelley, 2009). In the United States, preoperative testing alone

costs a minimum of $18 billion annually (Pasternak, 2009; Schein et al., 2000). Some researchers have challenged the value of the routine ordering of clinical testing for admissions and before routine operations in a hospital setting (Chung, Yuan, Yin, Vairavanathan, & Wong, 2009). Previous studies have indicated that over 90% of the testing ordered is not required (Brown & Brown, 2011; Chung et al., 2009). Even though clinical societies have guidelines requiring doctors not to order clinical tests, these recommendations are routinely ignored (Card et al., 2014). The reduction of the routine clinical testing alone could result in a savings of at least $10 billion annually (Vogt & Henson, 1997). More importantly, the reduction and/or elimination of unindicated testing could improve efficiency, patient safety, and experience, and the overall health care (Fischer, 1999; Roizen, 1997).

Ample evidence shows that defensive medicine has led to a significant amount of unwanted clinical lab testing. In 2011, 10% of health care costs resulted from defensive medicine (Norbeck, 2012). In a 2012 web-based survey study in Massachusetts, 96% of the participating doctors reported practicing defensive medicine that included ordering laboratory tests. Sethi, Obremskey, Natividad, Mir, and Jahangir (2012) report that, on average, 24% of all ordered tests are for defensive medicine rather than clinical reasons. Routine diagnostic panels have a low yield. Maung, Kaplan, Schuster, Johnson, and Davis (2011) conducted a large multiyear study of 2171 patients' who visited emergency rooms with a suspected diagnosis of syncope, and who had diagnostic workups ordered before examination and the gathering of clinical information. The authors indicate that the diagnostic yield of the tests ordered was less than 15%. Brown and Brown (2011),

and Chung et al. (2009), have further shown that routine preoperative lab testing is not required in many instances. Although there are clinical guidelines regarding appropriate preoperative testing in elective surgery, poor compliance has resulted in unnecessary tests being performed. In a recent study on elective ENT surgery, Leung, Nazeer, Smith, and McRae (2015) note that 69.2% of blood tests were unnecessary, and that none of these tests ordered affected the treatment of the patient.

## Problem Statement

There is no single factor that increases the utilization of clinical laboratory testing. Some possible reasons behind widespread routine clinical testing include medico-legal worries, hospital policy, and resistance to changes in ingrained behaviors. The ordering doctor may also assume that other doctors treating the patient will require the test, which could result in the delay of surgical procedures/interventions if the test is not ordered (Hickner et al., 2014; Johnson & Mortimer, 2002; Mancuso, 1999; Roizen, 1997; Smetana & Macpherson, 2003).

Doctors order all lab testing, and more than 60% of future management and treatment decisions regarding patient care are influenced by the initial lab results (Carlson et al., 2012; Kim et al., 2011). However, it is not clear if the doctors would be ordering the clinical testing of admitted patients if not for hospital protocols or defensive medicine. Although a large body of evidence shows increased lab utilization and rising costs, the actual factors influencing a doctor's decision to order clinical tests is poorly understood. A qualitative study exploring the factors behind decisions could improve a doctor's understanding of lab test utilization. Exploring the reasons behind a doctor's

decision to order a lab test may help generate standardized medical testing and create algorithms. This could lead to better quality health care and a significant reduction in the health burden.

## Purpose of the Study

The purpose of this study is to identify some of the factors that influence a doctor's decision to order clinical laboratory blood tests. I use a qualitative case series approach to assess factors influencing a doctor's decision to order lab tests based on data I gathered from interviews that consisted of pre-set, open-ended questions.

## Research Questions

The main research question of this study is, "What factors drive or influence ordering of clinical lab tests?"

Some of the factors that I explore in the study relate to the following sub-questions:

- What is the most important factor in ordering a clinical lab test?
- Is the clinical validity and necessity of a test important for ordering a test?
- Do academic organizational guidelines and algorithms influence ordering a lab test?
- How up-to-date is the doctor on the latest guidelines and validity of tests?
- Would the clinical test be ordered if not for defensive medicine?
- Will the doctor order, or not order, a test based on insurance/affordability, even if the clinical decision calls for it?
- Would knowing the cost of the test change the doctor's ordering behavior?

## Theoretical Framework

My central focus in this study is inappropriate lab testing and the reasons why doctors make the decision to order lab tests. To best address why doctors make these decisions, as well as to identify the factors that influence those decisions, I use the prescriptive decision making theory as the theoretical framework in my case study approach. Prescriptive theory falls under the field of judgment and decision making (JDM) theories (Baron, 2012). The focus of prescriptive theory is to improve an individual's decision making by understanding how they make decisions (Bell, Raiffa, & Tversky, 1988). This theory has been increasingly applied in clinical settings to formulate clinical guidelines and policies (Baron, 2012; Shaban, 2005).

Baxter and Jack (2008) have suggested that listening to individuals' stories and their views of reality helps researchers understand their actions. The case study approach facilitates the gathering of these stories through interviews.

Decision making theories evolved from research on methods for structured decision making when there is an element of risk and uncertainty involved. Broadly speaking, JDM can be approached in different contexts and philosophies. Some of the main theories include classical decision making (CDM) and naturalistic decision making (NDM), as well as normative, descriptive, and prescriptive models.

In CDM, which was developed as one of the first JDM theories, the decision maker acts with clear and complete certainty when faced with a problem. The individual is cognizant of all the potential problems, consequences, and solutions, which leads them to select the optimal solution. Classical decision-making models are mainly used in

controlled settings and environments, and in pure theoretical situations (Shaban, 2005). However, the world is not an ideal, uniform, and controlled setting, and hence CDM may not be applicable in real day-to-day situations.

Because of the criticism that the world (and thus the workplaces) is not ideal. The new NDM theory was developed in the mid-1980s. NDM theory recognizes the uncertain, dynamic day-to-day world, and takes into account the cognitive limitations with which humans operate (Klein, 2008). NDM theory assumes that the individual making the decision has only limited knowledge of the situation and acts based on his or her perception of the situation. The decision is made based on his or her experience (Klein, 2008).

Descriptive theories take into account the real world and human behavior, and researchers use them to explain how individuals make decisions and judgments in a dynamic and ever-fluctuating world. Descriptive theory emphasizes on the process by which an individual arrives at a decision. The theory does not address the quality of the judgment (Katsikopoulos & Lan, 2011).

Normative theories are similar to CDM, in that they assume that the individuals making decisions are rational and that the environment in which they exist is optimal. Normative theory assumes that good decisions will be made based on statistics and probabilities. This is not practically applicable, however, in the real world; ordinary people in a dynamic and non-ideal environment make day-to-day decisions. This is particularly true in a clinical health care setting in which decisions have to be made immediately with no time for statistical and theoretical analysis. Moreover, such types of

analysis cannot be standardized to all patients and may be valid for only one point in time (Hastie & Dawes, 2010).

Bell et al. (1988) assert that the main idea of JDM is to help an individual make better decisions. The authors call this prescriptive theory. The central purpose of prescriptive theory is to explore how individuals make their decisions and propose solutions to improve the judgments or decisions. Because of the growing discontent with and opposition to existing normative and prescriptive theories, Bell et al. have identified a need for new thinking about JDM (Cohen & Knetsch, 1992; Simon et al., 1987; Tversky & Kahneman, 1974). Prescriptive theory aims to address the deficiencies in the normative and descriptive approaches (Bell et al., 1988; French & Insua, 2000; Keeney, 1992). The existing classic approach seems precise and inflexible with strict adherence to rules, and hence is less intuitive and more demanding to use. On the other hand, the qualitative approaches were easier use and understand, but they are ad hoc (Simon et al., 1987).

Normative theories can be classified broadly in the domain of philosophy. Descriptive theory falls under the domain of psychological science, while prescriptive models can broadly be included in the domain of engineering. Prescriptive theory has been increasingly used for JDM in clinical settings to assist doctors in making decisions regarding optimal patient care (Grimshaw & Russell, 1993).

Howard (1966) coined the term *decision analysis*, to describe formal procedure by which decisions are analyzed. It is a structured method by which decisions are analyzed to better understand the possible factors causing problems that can be rectified to improve

the decision-making process, and it considers the realities of the day-to-day world in which decisions are made (French & Insua, 2000). The process involves participation that is more human, while understanding their limitations, and being cognizant of descriptive realities.

The prescriptive approach not only focuses on merging normative and descriptive decision-making, but it also provides practical solutions to approach decision problems (Brown & Vari, 1992; von Winterfeldt & Edwards, 1986). Greater understanding of human limitations may lead to better solutions (Riabacke, Danielson, Ekenberg, & Larsson, 2009).

## Nature of the Study

I designed this qualitative case series study to explore the reasons behind doctors' decisions to order clinical laboratory tests. I chose general practitioners, internists, and hospitalists because they provide initial care to patients and order most of the initial lab tests. I interviewed the participants using open-ended questions. Some of the factors explored include the utility, affordability, and availability of a test, as well as insurance coverage.

A case study approach involves analyzing a facet of specific case in depth (Baxter & Jack, 2008). A research study can involve one case or multiple cases. The case study approach ensures that the issue is studied through more than one lens and explores multiple facets. A case study approach should be considered when a researcher is trying to find answers to the how and why questions, and when there is no clarity between the

studied phenomenon and context (Yin, 2003). Inappropriate lab testing and why the doctors make decisions to choose lab tests have not been explored.

This study is a qualitative study to explore the reasons behind doctors' decisions to order clinical laboratory tests. Specifically, I am seeking to determine how these decisions are related to test utility, affordability, and insurance, and the doctors' lack of understanding of the test. Of the available qualitative approaches, the case study method is the best fit.

The participants in the study are doctors who work in local hospitals in Western New York. All doctors who practice in Western New York are eligible for the study because they would be prescribing clinical tests for their patients. I recruited doctors were recruited for the study from a local Western New York medical society, which provided the database of doctors practicing in the area. I assigned each doctor a unique identifier based on the type of practice. A computer randomly selected these unique identifiers. After institutional review board (IRB) clearance from Walden University, I sent letters and/or emails to the doctors to ascertain their willingness to participate in the study. The doctors who agreed to participate in the study were chosen based on a first-come, first-served basis, taking in to account the variety of practices (i.e. community hospitals, major health groups, and private practices). I recruited a total number of 15 participants for the study with a minimum number of five each from community hospitals, major health groups, and private practices. Hospitals with no more than 100 hospital beds and that did not belong to University setting constituted the community group. Major hospital group has more than 100 hospital beds, and is part of a University setting. The private practices

consisted of individual practices with between 1-10 doctors working individually or as in groups and they do not have any hospital beds. As indicated, I de-identified all participant information and used only unique numbers generated by computer for the study. I conducted pilot testing with a couple of participants, and these doctors were not included in the actual study.

I collected the data through interviews. A pre-prepared questionnaire served as a template for conducting the interviews. The purpose of the interview was to identify some of the factors that influence a doctors' decision to order clinical laboratory blood tests. I initially planned to conduct 30-45 minute interviews, but most interviews concluded in 20 minutes. I made plans to schedule additional interviews, as required, especially if there were discrepancies or needed clarifications; however, there was no need for any additional interviews. All the interviews were digitally audio-recorded.

I developed the raw data into individual case records. I then transcribed and coded all data. Initially, I used Dragon speech recognition software to transcribe the interviews, but reverted to manually transcribing them while listening to the digital audio recordings and comparing them to the notes that I took during the interviews. I analyzed each statement in the transcript to identify themes. This was done by reading and re-reading the transcript and comparing it with the field notes until categories and themes emerged. I entered the field notes along with interview transcription into the NVivo software, which I used to break down the data into categories and designate nodes. The first step was to look at the data and create broad categories or nodes for data analysis. The software

helped me identifying the relationships within the data sets. I conducted the analysis for core consistencies, patterns, and themes.

Using the research questions and theoretical base, I identified the main categories and subcategories from the interview transcripts and field notes. By repeatedly reading the transcripts, I made revisions to the categories and coding (Kohlbacher, 2006). Once the interviews were transcribed and read, I conducted open coding. This involved summarizing whole sentences in one or two words. Deviations from the topic of interest were left un-coded. The process of coding reduced the material, which I then organized into categories and themes that emerged from the interview transcripts.

While there was no need to re-interview participants, I asked them to read their interview transcripts and to validate or refute the answers they provided. This was done shortly after the data collection (see Burnard, Gill, Stewart, Treasure, & Chadwick, 2008). In addition, I coded the interviews at two different periods to ensure they matched.

## Definitions

*Clinical laboratory blood test:* Any test performed in a laboratory federally accredited and certified in accordance with the CLIA (clinical lab improvement act). These tests are carried out in hospitals, clinics, and when performed in a draw station, require ordering by a licensed medical professional. The blood tests help in aiding doctors to make diagnostic and therapeutic decisions and to administer optimal care to their patients (Forsman, 2002).

*Standardized medical algorithms:* Guidelines provided to doctors by national, state, medical, insurance, and local healthcare organizations (hospitals). These guidelines

advise doctors on what test to order and which cannot be ordered for a particular medical condition (Johnson et al., 2002).

*Western New York:* A region located in the westernmost part of New York State. The region includes the counties of Allegany, Cattaraugus, Chautauqua, Chemung, Erie, Genesee, Livingston, Monroe, Niagara, Ontario, Orleans, Schuyler, Seneca, Steuben, Wayne, Wyoming, and Yates (see Appendix A). The region includes the three major cities of Buffalo, Rochester, and Niagara Falls ("The regions of Western New York," 2008).

## Assumptions

The purpose of this study is to identify some of the factors that influence a doctors' decision to order clinical laboratory blood tests. Based on my review of literature, I assume that there were identifiable factors that influence doctors' decisions to order lab tests. The rising cost of health care in the United States and the contribution of clinical lab testing to health care costs have also been shown in the literature. Although the literature shows a large body of evidence showing increased lab utilization and rising costs, the actual factors influencing a doctor's decision to order clinical tests are poorly understood. There is also a gap in literature as to why doctors and other health care providers order clinical lab tests the way they do. The scholarly consensus is that doctors order tests because they are bound by hospital policy guidelines and really have no choice in what they order. Scholars also believe that doctors are worried about medico-legal issues and order additional tests that are not required.

## Scope and Delimitations

In this study, I chose to explore the specific factors that influence a doctor's decisions to order a particular clinical laboratory blood test because there is a gap in literature, and I determined that identification of reasons could result in evidence-based interventions that could potentially be helpful in improving health care quality and reducing costs for the community.

For this study, I selected doctors practicing in various hospitals in Western New York. These hospitals may have different policies than those in other regions of the state, or in the rest of the country. I recruited the doctor participants through random and purposeful selection from a Western New York medical society based on their work in different hospital settings (community hospitals, major health groups, and private hospital setting). I assumed that a random, purposeful selection of doctors would provide a wider range of workplace views from doctors working in different settings.

## Limitations

Generalization of the results may be difficult because of the limited number of interviews. It may also be difficult to generalize findings of the study to other practice settings. The participants in the study are from Western New York. Each hospital and practices come with a unique set up, and the nuances of the respective study sites may not be the same as those found in other contexts.

## Significance of the Study

In this study, I explore the factors behind a doctor's decisions to order clinical laboratory blood tests. This study results in evidence based interventions that may be

helpful in improving the health care quality and reduction in cost for the community. Studies exploring the factors influencing doctors' decisions to order clinical laboratory testing are lacking and hence, the phenomenon is poorly understood. Literature review shows a gap in the scholarly understanding of factors influencing a doctor when ordering a clinical laboratory blood test. A better understanding of the factors influencing a doctor to order tests could help in formulating interventions that may improve the quality of health care for the patient through the reduction of errors, as well as significantly reduced health care costs.

## Summary and Transition

In this qualitative case series study, I explored the reasons behind doctors' decisions regarding the ordering of clinical laboratory testing. Health care costs continue to escalate, and clinical lab testing plays a role in this escalation. I focused on doctors practicing in differing hospital settings. I collected data for this qualitative case study through a series of interviews with doctors recruited from a local Western New York medical society. I developed the raw data collected by digital recording into individual case records, and then transcribed, coded, and analyzed the data for patterns.

Qualitative studies exploring the reasons behind health care provider's decisions to order clinical laboratory testing are lacking, and this study may help in proposing solutions to the problem. I discuss this gap in the literature in detail in Chapter 2.

# Chapter 2: Literature Review

## Introduction

Researchers have estimated that the United States has the most expensive health care system and is spending close to 18% of its gross domestic product on health care (Channick, 2013; Squires, 2012). The current rate of growth is unsustainable and places a huge burden on the nation. There are multiple factors that drive up health care costs, and one of the major contributors is the extensive use of laboratory tests (Reinhardt et al., 2002). Laboratory testing is responsible for approximately 3-5% of health care spending (Song et al., 2011). Studies show that inappropriate lab test utilization has contributed to the escalating health costs mainly because of defensive medicine (Kim et al., 2011). Norbeck (2012) found that in 2011, 10% of health care costs were resultant from defensive medicine. Although there is large body of evidence linking increased lab utilization to rising costs, the actual factors influencing a doctor's decision to order clinical tests are poorly understood.

The purpose of this study is to identify some of the factors that influence a doctor's decision to order clinical laboratory blood tests. The approach of the study is a qualitative case series. I assess factors and reasons influencing doctors' decisions to order lab tests is assessed based on interviews consisting of pre-set, open-ended questions.

## Literature Search Strategy

The idea for me to study this area was conceived in 2014. Initially, my study was broad and I considered including all possible factors that could influence a doctor's decision to order clinical laboratory tests. My original intent for the study was to include

all regions of the country and different practice settings. However, I considerably narrowed the study in the winter of 2016, to just some of the factors and reasons influencing a doctor's decision to order laboratory tests. I also limited the scope of the study to doctors practicing in Western New York.

The library databases and search engines that I used in the study included PubMed, CINAHL and Medline simultaneous search, and Google Scholar. I limited the literature search to articles from peer-reviewed journals published in the past 10 years. However, in cases where there were limited articles, the limit of 10 years was not applied. I made every effort to include the latest and most up-to-date peer reviewed literature.

I based my search on the six broad topics of the dissertation that include the following: (a) expense statistics for health care in USA and the burden on the health care system, (b) the role and evidence of clinical laboratory testing contributing to health care costs (escalation or decrease), (c) the role of doctors' ordering of clinical testing in increasing costs to the health care system, (d) evidence of factors driving doctors to order lab tests, (e) decision based theories, and (f) prescription theories.

In my searches, I used the following Boolean phrases: *cost of health care AND USA, health care of USA AND GDP, laboratory testing AND costs, inappropriate/ appropriate lab test AND utilization, technology AND health costs, clinical lab tests AND reduction in cost, clinical lab tests AND defensive medicine, and factors driving costs of healthcare.*

I did not include dissertations or conference papers for this review because I found enough peer-reviewed articles.

## Theoretical Framework

Prescriptive decision-making theory served as my theoretical foundation. The focus of prescriptive theory is to improve an individual's decision making by understanding how they make decisions (Bell et al., 1988). This theory has been increasingly applied in clinical settings to formulate clinical guidelines and policies (Baron, 2012; Shaban, 2005).

Baxter and Jack (2008) proposed that listening to individuals' stories and their views of reality could help researchers understand their actions. The case study approach has helped facilitate my gathering of participants' views through interviews. My central focus is on inappropriate lab testing and why doctors decide to order lab tests. I also sought to identify possible interventions for the problem. To best address why doctors make decisions, and to identify the factors that influence their decisions, I determined that the appropriate framework would be to apply the prescriptive decision making theory using a case study approach.

Prescriptive theory falls under the field of judgment and decision-making theories (JDM) (Baron, 2012). Decision making theories have evolved based on research for methods for structured decision making when there is an element of risk and uncertainty involved. Broadly speaking, JDM can be approached in different contexts and philosophies. Some of the main theories include CDM and NDM as well as normative, descriptive, and prescriptive models.

IN CDM, which was one of the first JDM theories, the decision maker acts with clear and complete certainty when faced with a problem. The individual is cognizant of

all potential problems, consequences, and solutions, which leads him or her to select the optimal solution. Classical decision-making models are mainly used in controlled settings and environments in pure theoretical situations (Shaban, 2005). However, because the world is not an ideal, uniform, and controlled setting, CDM may not be applicable in real day-to-day situations.

Because of the criticism, that the world and the work place are not ideal, a new naturalistic decision-making (NDM) theory was developed in the mid-1980s. Naturalistic decision-making theory recognizes the uncertain, dynamic day-to-day world, and takes into account the cognitive limitations with which the humans operate (Klein, 2008). Naturalistic decision-making theory assumes that the individual making the decision has only limited knowledge of the situation and acts based on their perception of the situation. He or she makes a decision based on their experience (Klein, 2008).

Descriptive theories take into account the real world and human behavior. Descriptive theory tries to explain how individuals make decisions and judgments in a dynamic and ever-fluctuating real world. The emphasis of descriptive theory is on the process by which an individual arrives at the decision. The theory does not address the quality of the judgment (Katsikopoulos & Lan, 2011).

Normative theories are similar to the CDM models. They assume that the individuals making the decisions are rational and that the environment they exist in is optimal. Normative theory assumes that good decisions will be made. The theory assumes that the decisions made will based on statistics and probabilities. This is not practically applicable because, in the real world, ordinary people in a dynamic and non-

ideal environment make day-to-day decisions. This is particularly true in a clinical health care setting in which decisions have to be made on the spot with no time for statistical and theoretical analysis. Moreover, such types of analysis cannot be standardized to all patients and may be valid for only one time point (Hastie & Dawes, 2010).

Bell et al. (1988) first put forth prescriptive theory. There was a need for a new thinking about JDM because of growing discontent and opposition to existing normative and descriptive theories (Cohen & Knetsch, 1992; Simon et al., 1987; Tversky & Kahneman, 1974). Prescriptive theory aims to address the deficiencies in the normative and descriptive approaches (Bell et al., 1988; French & Insua, 2000; Keeney, 1992). The existing classic approaches were precise and inflexible with strict adherence to rules and hence was less intuitive. They are more demanding to use. On the other hand, even though the qualitative approaches are easier use and understand, they are ad hoc (Simon et al., 1987).

Bell et al. (1988) assert that the main idea of JDM was to help an individual make better decisions. The authors called it prescriptive theory. The central purpose of prescriptive theory was to explore how individuals made their decisions and propose solutions to improve the judgements or decisions. The focus of the theory is improvement in decision-making.

Normative theories can be classified broadly in the domain of philosophy. Descriptive theory falls under the domain of psychological science, while prescriptive models can broadly be included in the domain of engineering. Prescriptive theory has

been increasingly used for JDM in clinical setting to assist doctors make decisions regarding optimal patient care (Grimshaw & Russell, 1993).

Howard (1966) coined the term decision analysis, to describe a formal procedure by which decisions are analyzed. It is a structured method by which decisions are analyzed to better understand the possible factors causing problems that can be rectified to improve the decision-making process, and takes in to account the realities of day-to-day world in which the decisions are being made (French & Insua, 2000, p. 5). The process involves more human participation, by understanding their limitations, and through cognizance of the descriptive realities.

The prescriptive approach not only focuses on the merging the normative and descriptive decision-making but it provides practical solutions to approach decision problems (Brown and Vari, 1992; von Winterfeldt & Edwards, 1986). By greater understanding of the human limitations and cognizance, better solutions may be possible (Riabacke et al., 2009).

## Literature Review

As I noted early in this Chapter, my literature search was based on six broad topics of the dissertation that include the following: (a) expense statistics for health care in USA and the burden on the health care system, (b) the role and evidence of clinical laboratory testing contributing to the costs (escalation or decrease), (c) the role of doctors' ordering of clinical testing in increasing costs to the health care system, (d) evidence of factors driving doctors to order lab tests, (e) decision based theories, and (f) prescription theories.

**Cost of Health Care in the United States and the Burden on Health Care Systems**

Current estimates are that the United States has the most expensive health care system in the world and costs are heading towards an unsustainable course. There has been a substantial growth in U.S. health care costs in the past two decades, such that the current expenditure rate is 18% of the gross domestic product. Health care costs have risen from a manageable 5% of the GDP in 1960 to close to 18% in 2011 (Squires 2012). Squires (2012) projects the gradual increase of health care costs to an unsustainable 20% of gross domestic product by 2020. Squires asserts that the current cost of health care is unsustainable and will be a disastrous to existing government programs such as Medicare and Medicaid. There is a tremendous amount of wastage in the health care system, and as much as $2.2 trillion in additional savings in the next decade could be achieved by stopping unnecessary waste (Squires, 2012).

According to the health and economic data from the 30 countries that constitute the Organization for Economic Cooperation and Development (OECD), the health care costs of the United States are the highest (Reinhardt et al., 2002). Spending on health care in the United States is much higher than other OECD countries. Some of the factors that have contributed to escalating costs in U.S. health care include spending on expensive technology, and on clinical laboratory testing. The costs of technology for medical procedures exceeds all the OECD countries. For example, in comparison to Japan, U.S. health care costs are much higher, even though Japan has three times more magnetic resonance imaging (MRI) machines and six times more computerized tomography (CT) machines per capita. The Japanese have reduced cost of MRIs and CTs by imposing price

regulations. This results in lower machine cost. In comparison, the CT and MRI machines in the United States are expensive to purchase and maintain. There is also inappropriate and indiscriminate use of the technology; people with no clinical indications often have the testing done, which increases the cost (Reinhardt et al., 2002).

The results of the overspending in U.S. health care is evident in a study by Squires (2012). Squires compared U.S. health care to 12 other industrialized nations in relation to health care spending, supply, utilization, prices, and quality. The 13 industrialized countries included in the study were Australia, Canada, Denmark, France, Germany, Japan, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. Squires found that the United States spends far more on health care than any other country but had the worst health quality. In comparison, Japan spent the least and had the best health care. This is primarily because of Japan's aggressive price regulation.

Blumenthal et al. (2013) propose some reasons why health care costs in the United States are rising substantially. The authors also provide strategies to contain health care costs. These include the reduction of insurance benefits, and an increase in the share of costs by the people who use it. Blumenthal et al. also propose reducing the waste (which accounts for one third of health care costs) by reengineering systems, steering providers toward choosing less wasteful options, and the reducing administrative costs. Kelley (2009) proposes additional strategies for cutting costs, and Berwick and Hackberth (2012) support the reduction or elimination of U.S. health care cost.

Berwick and Hackberth (2012) target five areas for reduction in health costs: 1) unwanted use; 2) reduction of fraud and abuse; 3) eliminate administrative/systematic inefficiencies; 4) eliminate clinical inefficiencies; and 5) target preventable condition and concentrate on primary care. Billions of dollars could be saved and the quality of health care could improve year after year if the targeted areas are addressed and implemented. Berwick and Hackberth also identify the overtreatment of the patients as an area where waste could be cut. Overtreatment includes the performing of unwanted tests, procedures, and prescriptions. The conservative estimate is that wastages add 20% to health care costs. The approximate estimate is that between $ 158 billion and $228 billion in wasteful spending occurred in 2011. The elimination of the waste may lower the health care costs to sustainable levels.

Norbeck (2012) identified additional factors that drive up the health care costs in the United States: the rise of chronic diseases, addictions, aging population, health mandates, defensive medicine, and expensive technologies, such as lab tests and imaging studies. The Congressional Budget Office proposed that defensive medicine and malpractice insurance drive up the health care costs by between 1-2% per year, which amounts to $27 to $54 billion dollars per year (Beider & Hagen, 2004). As pointed out in earlier studies, expensive technologies also contribute to a huge cost increases in health care. Thus to address the escalating costs, all factors contributing to driving the health care costs need to be addressed.

**Evidence of Clinical Laboratory Testing Contributing to the Costs and the Role of Doctors**

Multiple reviews and independent studies support the significant contribution of clinical lab testing to health care costs in the United States. One of the main types of unnecessary cost could be preoperative testing before routine ambulatory surgeries. Programs aimed at reducing this type of unnecessary testing could contribute significantly to reduction in wasteful spending.

Carlson et al. (2012) examine the indiscriminate use of lab tests in the U.S. health care system is analyzed in a systematic review. The authors point out the dangers posed by the indiscriminate use of lab tests. Carlson et al. also argue that the burden posed by indiscriminate use of lab tests has not been measured. As of 2007, the costs directly associated with clinical lab testing was about 2-3% of health care costs (Wolcott, Schwartz, & Goodman, 2008). However, more than 70% of the subsequent treatment decisions are based on initial lab tests (ACLA, 2007). The reduction of the indiscriminate use of laboratory testing will involve change in organization's quality deigns and utilizing industrial parameters such as lean and Six Sigma concepts (Carlson et al., 2012).

Zhi et al. (2013) conducted a meta-analysis of a multi-database systemic review of articles published between 1997 and 2012. The authors examine the under or over utilization of laboratory testing, and found that the mean rates for over utilization was 20.6%. Zhi et al. also found that overutilization during initial testing was six times higher than during repeat testing, which explained over half (54%) of the overall variability in overutilization finding that the overutilization of lab tests varies systematically by clinical

setting (initial vs. repeat), test volume, and measurement criteria. However, the authors suggest that the doctors need to further analyze reasons for over utilization during initial evaluation. Zhi et al. assert that if correct tests and fewer tests are ordered, the result may be fewer errors and better care.

Multiple studies have consistently shown unnecessary blood testing is routinely conducted. Schein et al. (2000) studied patients who underwent routine cataract surgery and had preoperative medical testing. Although numerous studies have shown that the value of preoperative testing is uncertain, Schein et al. examined the impact of such testing on quality of care, especially intra- and post-operative medical complications. The authors conducted a randomized prospective quantitative study on 19,557 elective cataract operations in 18,819 patients performed in nine centers. Patients were randomly assigned to one of two groups: patients with clinical tests and without clinical tests. Medical tests performed including electrocardiography, complete blood count, and measurement of serum electrolytes, urea nitrogen, creatinine, and glucose. Schein et al. recorded any adverse medical events and interventions on the day of surgery and on every day for seven days following the post-operative study. The outcome was that the overall complications rate was the same for the two groups (Schein et al., 2000). Moreover, there were also no significant differences in complication rates between the two groups, indicating that there is no benefit to conducting routine clinical testing. Schein et al. conclude that routine medical testing does not compromise or contribute to the safety of patients while in surgery or seven days after the procedure.

Johnson and Mortimer (2002) note that the routine blood tests ordered in advance of surgery are not often reviewed before the surgery and thus may be of no value. The authors reviewed the medical records of 100 patients who were undergoing selective surgical procedures under general anesthesia, and noted the number of tests ordered, as well as associated costs. For the 100 patients, 773 tests were performed. Of the 773 tests, ordered and performed 70 tests were abnormal (9.1%). The surgical management was altered based on blood results for only two patients (0.2%) (Johnson & Mortimer, 2002). Although eight complications did arise from the surgeries none of them could have been detected based on, the tests ordered before the surgery. Although blood results were ordered for all these patients, the blood results were present in the medical notes in only 57% of the cases. Based on these statistics, Johnson and Mortimer estimate that each hospital could save over $75,000 per year by ceasing the indiscriminate ordering of tests.

In another large study, Benarroch-Gampel et al. (2012) conclude there is no need for preoperative testing in patients who are to undergo elective low-risk ambulatory surgeries. The authors conducted a multivariate analysis in this retrospective analysis of 73,596 patients who had undergone elective hernia repair surgeries. The patients were identified from National Surgical Quality Improvement Program database from 2005-2010. More than half of the patients underwent preoperative blood testing and the complication rate among these patients was 0.3%. Benarroch-Gampel et al. concluded that preoperative testing was overused and academies and societies of medicine should curb this practice. It did not matter what the hospital size was, or if the setting was rural or academic. The unnecessary blood testing remained the same. Vogt and Henson (1997)

examine whether the ordering of unindicated preoperative laboratory clinical tests is different between individuals who are healthy versus those who are sick and have been scheduled to have surgery. The authors examined the implications of such clinical lab testing in a prospective, cross-sectional study of 383 consecutive patients who were scheduled for surgery in a university hospital setting. The results were that clinical laboratory testing was not indicated in two-thirds of the patients undergoing surgery. The cost savings for the hospital was $80,000 per year (Vogt & Henson, 1997). The authors conclude that the large percentage of the clinical tests ordered is not indicated and should be eliminated as they result in significant health care costs.

This brings up the question of whether blood testing is necessary and if it plays a role in patient management, or if the doctors are just following the institutional guidelines. In an editorial, Roizen (1997) touches on the quality issues related to unnecessary testing that led to unintended consequences. He also discusses the complexity associated in limiting preoperative testing. In a meta-analysis of various hospital laboratory tests, Card et al. (2014) provides evidence from the literature regarding the usefulness of clinical laboratory blood testing useful or not. The authors concluded that careful selection of testing is needed, as not all procedures are necessary or useful.

Chung et al. (2009) also addresses the question of whether the lack of blood testing leading leads to compromised patient care. In this quantitative, randomized, prospective, pilot study of 1,061 patients, the authors evaluated if preoperative testing can be eliminated from routine surgeries without compromising patient care. The researchers

randomly assigned patients to a preoperative testing or no testing groups. The data were collected and the reviewers blindly assessed the data. Data were collected at two time points: a week following surgery followed by a month after surgery. Chung et al. conclude that there was no increase in adverse events in patients who were assigned to the no clinical testing group compared with subjects for whom clinical testing had been conducted. This suggests that there was no real value in preoperative testing in selected routine surgical patients. Chung et al.'s study clearly indicates that the elimination of testing will not compromise patient care.

Smetana and Macpherson (2003) support this hypothesis in their investigation of the role of all routine tests that are done before a surgery. The authors concluded that routine testing is ineffective, expensive, and unnecessary before a surgery. Patients need to be tested based on clinical history and physical findings. Smetana and Macpherson assert, however, that doctors order the clinical lab testing because of institutional guidelines and hospital mandates.

Hospitals and national medical academies have provided guidelines to reduce unnecessary testing. In a review article, Fischer (1999) focuses on guidelines to eliminate unnecessary clinical lab testing. The author suggests that each common clinical test is described and indications are clearly described to the doctors'. There is a need for organizational, structural and clinical changes that were necessary for the success of the program, the merits that the program provides for the doctors, nurses, and the administrators. There have been concerted efforts by several health care systems to implement organization and structural systems including computer entry order

restrictions in place to reduce unnecessary testing. These efforts have reduced unnecessary clinical laboratory testing.

In a controlled clinical trial in a tertiary teaching hospital setting that Feldman et al. (2013) conducted between 2008 and 2009 the doctors and nurses at an inpatient setting were presented with fee schedules at the time of order entry in the lab order entry system. During the initial six-month base line period of the study, no fees were displayed. During the intervention period over the next six months, the fee schedule was prominently displayed while ordering the testing. 61 tests were selected randomly to appear on the ordering system. Feldman et al. examined the total number of tests ordered per patient per day and they recorded and compared the total fees/charges associated with the ordered tests were also recorded and compared between the baseline and the intervention period. The rate of ordering was reduced by an average of 3.72 tests per day when the fee schedule was displayed compared with the no fee schedules being displayed. The authors conclude that displaying the fee schedule to the providers at the time of order entry on the screen resulted in a modest decrease in test ordering. Adoption of this method may result in a reduction of inappropriate and unnecessary testing.

In a similar retrospective study, Krasowski et al. (2015) show that simple changes to the computer ordering system and the link to electronic medical records can reduce costs significantly to the health care system by preventing some of the inappropriate medical testing. The authors conducted the study from 2009 to 2014 at the University of Iowa's711-bed academic medical center that serves as a tertiary/quaternary care center. Test order restriction were placed on 170 send out clinical tests and required approval by

the pathology department. A 23% post-implementation reduction on ordering resulted in a direct cost savings of approximately $ 600,000.

Khalifa and Khalid (2014) also show that implementing changes in health care resources and computerized order systems can reduce laboratory-testing over-utilization. The setting of their study was a tertiary care hospital where 537,177 lab tests were ordered during the six-month time of the study from January to June 2013 (Khalifa and Khalid, 2014). The authors assert that more than 11% of the lab tests were repeated and simply not necessary as they were duplications from different departments ordering the same tests. Three tests were mainly responsible for the duplication, which were Complete Blood Count, Renal Profile and Blood Glucose. Khalifa and Khalid conclude that organizational, structural, and clinical changes are necessary for addressing overutilization. In addition, for the program to be a success, doctors, nurses, and the administrators need to be trained and made aware of the problem.

In a similar study, Warren (2013) explores the over utilization of lab tests at the University of Michigan Health System (UMHS) laboratory test utilization program in relation to computer entry controls and structural changes. The University of Michigan Health System is a large health care system that had 45,000 inpatient admissions, 1.8 million outpatient visits and procedures, and $4.52 billion in gross charges in 2012 (Warren, 2013). The UMHS laboratory test program was created in 2008 with help of multidisciplinary groups including lab, and pharmacy, as well as pathology and hospital administration. One of the critical components linking the groups was the UM-Care Link, an order entry system for inpatients. The UM-Care Link supports decision making for

doctors and nurses by providing simple prompts such as providing alternate tests or suggesting not ordering a test. The order system contents were developed by peer-reviewed medical evidence and input by medical content experts with close oversight by the pathology department. The study looked at the impact of the UMHS laboratory test program and noted a significant reduction in costs of health care.

Structural controls along with health care providers who are aware and well trained are essential for the success of a program. In a quantitative pre-and post-intervention, retrospective study of 640 patients, Mancuso (1999) compared preoperative protocols followed in a hospital during elective ambulatory surgeries two years before guideline implementation and two years after the implementation. This was (Mancuso, 1999). There were 361 patients before the guideline implementation and 279 patients after the implementation. Mancuso found a reduction in tests from before (an average of eight tests) to after implementation of guidelines (an average of 5.6 tests). The percentage decrease in individual tests ordered was between 23-44% (Mancuso, 1999). More importantly, there was a decrease in morbidity and an increase in quality of patient care. The majority of patients in the post-intervention group did not suffer from any complications because of reduced testing. The new implemented guidelines have been effective in reducing clinical lab testing before surgeries and have not resulted in increased complications for the patients.

Maung et al. (2011) conducted a retrospective study with 2,171 patients at a Level I trauma center to explore the utility of inpatient clinical testing of syncope-related fall patients for a span of three years. Diagnostic work up for the patients included

electrocardiograph, cardiac enzymes, echocardiogram, and carotid duplex or computed tomography angiography. Abnormal results were not common (2.9% - cardiac enzymes, 3.8% - echocardiogram, and 4.6% - carotid imaging) (Maung et al., 1999). Only 42 patients required further intervention. Maung et al. concluded that the diagnostic workup for syncope had a very low yield and standard testing should not be based on protocols but should rather be indicated by clinical information.

In a study of lab test utilization, Kim et al. (2011) argue that utilization efforts should not be based on individual tests, but instead as a broader management strategy. The authors examined a lab test utilization management program over a ten-year period in a large 898-bed tertiary care medical center. Some of the salient features of the program were having an institutional organizational structure to support the test utilization program, the role of pathologists in leading the program, and a selection tool for tests. During the ten-year period, the hospital program decreased the test utilization by 26%, saving millions of dollars for the hospital system (Kim et al., 2011).

There are nationally mandated guidelines, such as the National Institute for Health and Care Excellence (NICE) protocols in the United Kingdom. There are also guidelines for appropriate preoperative testing. However, the compliance of NICE protocols has been poor. Leung et al. (2015) studied the cost savings and reasons for lack of compliance. The authors conclude that nearly 70% of blood tests performed in the institutions they studied were not required as they did not contribute to patient care. Preoperative tests were overused and could be reduced by staff training and guideline dissemination.

Onuoha, Hatch, Miano, & Fleisher (2015) studied compliance of doctors' to recommended academy testing guidelines. In this single center retrospective cohort study, the authors examine the incidence of unindicated preoperative testing of ambulatory low-risk surgical patients. The analysis of indications for testing was based on the guidelines from American Society of the Anesthesiology (ASA). The authors analyzed data from 3111 patients who had ambulatory surgery at a hospital over a six-month period. The data collected included blood tests, cardiac tests, and echocardiogram. The authors found that more than half of the patients admitted for ambulatory surgery had at least one unindicated laboratory test performed preoperatively. Up to two-thirds of the blood tests (CBC, coagulation studies, and metabolic panels) were not indicated. Onuoha et al. conclude that, in spite of the ASA's guidelines, the amount of unindicated preoperative clinical testing remains high. This is particularly troubling because the study was conducted in an academic tertiary institute. The authors further note that better studies are needed to understand the problem of overuse as this information would help in develop of practical solutions.

**Evidence for Factors Driving Doctors' to Order a Lab Test**

It is clear that there is a lot of waste within the U.S. health care system and clinical laboratory testing is one of the contributors. Guidelines from hospitals and national medical academies to reduce the unnecessary testing have had a minimal impact on reduction in cost or unnecessary testing. There may be several reasons behind decisions made by doctors, ranging from lack of awareness of alternatives to medicolegal worries.

The literature search below reviews qualitative study manuscripts exploring the reasons behind a doctors or health care provider in ordering a clinical laboratory test. In my review, there was scarcity of literature. There are only three related studies I could find. Hence, I include all qualitative manuscripts including survey and questionnaire based studies.

Brown and Brown (2011) conducted a qualitative study to explore doctors' decision making regarding lab testing. The authors explored the utility of pre-operative testing and approaches to control such testing. The study was conducted in a single hospital. Brown and Brown interviewed 23 doctors and nursing administrators in a semi structured format. The questions were open-ended and were limited to preoperative tests such as routine blood tests and chest radiographs. The authors sought opinions from the participants regarding whether or not a test is necessary, and why they ordered a particular test. The results were that most participants felt that the pre-operative testing was not necessary and was wasteful. Brown and Brown also found reasons for ordering a test include other doctors might want so, medico legal concerns, concerns that surgery may be delayed or cancelled. The authors conclude that perioperative testing may not be necessary but there are barriers to stopping it.

Sethi et al. (2012) studied the implications of the practice of defensive medicine across clinics in the United States. The concentration of the study was on orthopedic practices with a close look at the financial implications. The study was an internet-based survey of 2000 orthopedic surgeons across the United States. There were 1214 respondents, of which 1168 (96%) reported having practiced defensive medicine. The

most common practice of defensive medicine was the ordering of clinical tests that includes radiographs CT, MRI and laboratory blood tests primarily to avoid possible malpractice liability. On average, one fourth of the tests ordered were the result of defensive medicine, and had nothing to do with patient care. The cost associated with defensive medicine per respondent was approximately $100,000 per year. This would account for over $2 billion annually for defensive medicine in the specialty of orthopedic surgery (there are 20,400 practicing orthopedic surgeons in the United States). Policies must be aimed at reforming liability risks to cut down unnecessary testing and costs.

Hickner et al. (2014) explore the challenges faced by doctors in primary care settings regarding the selecting, ordering, and interpreting clinical laboratory tests. Their study consisted of a randomized questionnaire-based survey of doctors specializing in internal and family medicine, and was sponsored by the Centers for Disease Control and Prevention. The survey was conducted in 2011 about the tests the doctors ordered, and uncertainty regarding ordered tests. A total of 1768 doctors responded to the survey. The results showed that the doctors ordered some type of clinical laboratory blood testing for an average of 31.4% patients seen by the doctors every week. The doctors were uncertain about the tests they were ordering for about 15% of the cases and had difficulty interpreting results in more than 8% of the reports received. According to Hickner et al., the most significant factors affecting the decision to order or not order a test were related to costs to the patient and insurance coverage restrictions. Additionally, the doctors noted they did not have time to call the clinical labs to find out if alternate testing options were

available. Hickner et al. conclude that the doctors were uncertain about the tests ordered and their result interpretations.

There are approximately 500 million primary care patient visits per year. Taking the level of uncertainty reported there are potentially 23 million patients per year who may be having incorrect testing or whose tests are incorrectly interpreted. This raises concerns about the safe and efficient use of laboratory testing. There are added concerns regarding incorrect management resulting in complications. All this adds to cost and decreases the quality of health care for the patients.

**Reasons for Doctor Non-Adherence to Clinical Guidelines**

In recent years, professional and national organizations have developed several clinical guidelines and protocols to improve quality of care. However, all of the guidelines will be ineffective if the doctors do not adhere to them. It has been shown in several reports and studies that changing doctor's behavior is difficult (Cabana et al., 1999; Baiardini, Braido, Bonini, Compalati, & Canonica, 2009; Wilensky, 2016). Researchers have also shown that the most doctors do not adhere to clinical guidelines (Cabana et al., 1999; Baiardini et al., 2009; Ennis, 2015).

In their comprehensive review of 76 studies conducted between January 1966 and January 1998, Cabana et al. (1999) described some of the reasons for the non-adherence of doctors to clinical guidelines. Only five of the studies were of qualitative and they studied patient characteristics and constraints of doctors. The authors concluded that the main barriers to doctors' adherence related to awareness of, familiarity with, or

agreement with the guidelines. Doctors' lack of agreement with guidelines was high at over 90% for certain clinical guidelines (Cabana et al., 1999).

Baiardini et al. (2009) explore the factors that could make it difficult for doctors to adhere to guidelines and the reasons are multiple and complex. The main factors include lack of familiarity, and lack of knowledge that guidelines existed. Doctors also show a lack of agreement with the proposed guidelines. In addition, the doctors felt that the guidelines were an oversimplification of a complex problem. Many also feel that the guidelines inhibited their autonomy in making clinical decisions. Smith (2000) reviewed 4127 publications in relation to understanding of doctor attitude and performance relating to clinical guidelines in an extensive meta-analysis. The author asserts that no single factor that will make doctor adhere to guidelines. Smith concludes that the answer was not simple and suggested that the guideline development should be theory-driven and evidence-based, as well as taking into account the views of doctors.

Keffer (2001) summarizes the perceptions of doctors related to guidelines and algorithms. Keffer reported that "Despite wide promulgation, clinical practice guidelines little is known about the process and factors involved in changing doctor practices in response to guidelines" (p. 1566). The author concludes that a doctor's attitude is one of the major influences regarding adherence to clinical practices and his or her acceptance will help adaptation to any guidelines.

**Decision-Based Theories: Classical, Naturalistic, Normative and Descriptive Models**

Decision-making theories involve methods for structured decision-making. Various theories and philosophies exist regarding judgment and decision making (JDM), which include CDM, NDM, and normative, descriptive, and prescriptive models.

One of the first JDM developed and described was CDM. Shaban (2005) explains the theory and discusses potential problems facing the individual and selecting the optimal solution. According to Shaban, CDM models are mainly used in controlled ideal settings and pure theoretical situations (Shaban, 2005). Several researchers, including Beach and Lipshitz (1993), Li (2009), and Zsambok (1997), have argued that the CDM does not really reflect real situations. This is because the world is not an ideal, uniform, and controlled setting. People are diverse and CDM thus does not apply. CDM should only be applied to laboratory experimental settings.

In response to the limitations of CDM, a new naturalistic decision-making (NDM) theory was developed in the mid-1980s. Klein (2008) reviewed NDM theory's recognition of the uncertain world, including dynamic events, differences in people, and human cognitive limitations. NDM assumes that the individual making the decision has only limited knowledge of the situation and acts based on their perception of the situation. The decision is made based on their experience (Klein, 2008).

Lipshitz and Strauss (1997), Lipshitz, Klein, Orasanu, and Salas (2001), and Zsambok and Klein (2014), describe the essential characteristic features, concepts, and models associated with NDM and its application. Vroom and Yetton (1973) provide a basis for effective problem solving and decision-making based on timeliness, quality and

rationality, an individual's decision to accept his or her superior's decision and execute the same in an effective manner. In a later review, Vroom and Jago (2007) reiterate the decisiveness of the leaders in decision-making based on the situation.

Normative theories are similar to the CDM. They assume that the individuals making the decisions are rational and that the environment they exist in is optimal. Normative theory assumes that good decisions will be made. The theory assumes that the decisions made are based on statistics and probabilities. This is not practically applicable because, in the real world, ordinary people in a dynamic and non-ideal environment make day-to-day decisions. Hastie and Dawes (2010) pointed out that normative theories are not practical in a clinical health care setting where decisions have to be made on the spot with no time for statistics and theoretical analysis. Moreover, such type of analysis cannot be standardized to all patients and may be valid only one point in time.

Katsikopoulos and Lan (2011) propose that the difference between descriptive and normative theories is that descriptive theory takes into account the real world and human behavior. Descriptive theory tries to explain how individuals make decisions and judgements in a dynamic and ever fluctuating real world. The emphasis of the descriptive theory is the process by which an individual arrives at the decision. As Dillon (1998) explains, normative theories consider what a people should do whereas descriptive theories explain what the person actually does or has done.

**Prescriptive Model Theories**

Cohen (1981) and Kahneman and Tversky (1982) described the growing discontent and opposition to existing normative and descriptive theories. Kahneman and

Tversky point out there was a need for new thinking about JDM because of the deficiencies of existing classic approaches. The authors describe the adherence to rules, inflexibility and lack of intuitive nature of the classical approaches. Kahneman and Tversky also argue that the elements of expectation and surprise play a role in decision-making and thus make normative and descriptive models more demanding to use. Because of the deficiencies associated with normative and descriptive approaches, Bell et al. first put forth prescriptive theory in 1988.

The prescriptive theory aims to address deficiencies in the normative and descriptive approaches. The central goal of the prescriptive theory was to analyze or investigate how individuals make decisions and to propose solutions to improve these judgments or decisions (Bell et al., 1988; Keeney, 1992). The focus of the theory is improvement in decision-making.

Normative theories can be classified broadly in the domain of philosophy. Descriptive theory falls under the domain of psychological science, while prescriptive models can be broadly included in the domain of engineering. Prescriptive theory has been increasingly used for JDM in clinical settings to assist doctors make decisions regarding optimal patient care (Grimshaw & Russell, 1993). Prescriptive theories analyze the method by which the decisions are made, which is termed as decision analysis. In a review of decision analysis, French and Insua (2000) identify the factors that affect the decision-making processes. The authors also describe how human limitations and descriptive realities affect decision making and its relation to the prescriptive approach.

Howard (1966) coined the term decision analysis, which is a formal procedure by which decisions are analyzed. It is a structured method by which decisions are analyzed to better understand the possible factors causing problems that can be rectified to improve the decision-making process, and takes in to account the realities of day-to-day world in which the decisions are being made (French & Insua, 2000, p. 5). The process involves more human participation, understanding their limitations, and cognizance of descriptive realities. The prescriptive approach not only focuses on merging normative and descriptive decision making but it provides practical solutions to approach decision problems (Brown & Vari, 1992; von Winterfeldt & Edwards, 1986).

The importance of human elements such as limitations and cognitive capabilities in relation to decision-making is well reviewed in the literature (Keeney, 1992; Kahneman & Tversky, 1982; Larsson, Sahlsten, Segesten, & Plos, 2011). In response to human limitations, decision aids may be helpful including the effective use of technology (computer-aided entry), and the development of alternate decision-making guidelines, as well as visual aids such as charts may be helpful (von Winterfeldt & Edwards, 1986; Brown & Vari, 1992; French, 1995).

## Summary and Conclusions

In this literature review, I describe the burgeoning costs of the health care system. Several review papers and independent manuscripts explain the role and contribution of clinical lab testing to the health care costs in the United States. I further describe some of the main factors contributing to unnecessary costs in preoperative testing before routine ambulatory surgeries. In addition, I also explore programs aimed at reducing unnecessary

testing, such as the role of guidelines from hospitals and national medical academies. Further, I discuss concerted efforts by several healthcare systems to implement organization and structural systems including computer entry order restrictions to reduce unnecessary testing. I also review qualitative studies exploring reasons such as defensive medicine behind health care providers' reasons behind ordering clinical laboratory blood tests.

Although a large body of evidence shows a connection between increased lab utilization and rising costs, the actual factors influencing a doctor's decision to order particular clinical laboratory blood tests are poorly understood. There is a gap in literature regarding why doctors and other health care providers order clinical lab tests the way they do, (i.e., ignoring medical guidelines and hospital policies). A qualitative study exploring the factors behind decisions would help improve understanding of doctors' lab test utilization. Exploring the reasons why doctors order lab tests may help generate standardized medical testing and create algorithms that could lead to better health care quality and a significant reduction in health costs. In Chapter 3, I describe the qualitative case study assessing the factors and reasons influencing the doctors' decisions to order lab tests based on interviews that consider pre-set, open-ended questions.

# Chapter 3: Research Method

## Introduction

Current estimates are that the United States has the most expensive health care system in the world and is spending close to 18% of its gross domestic product on health care (Channick, 2013; Squires, 2012). The current rate of cost increases is unsustainable and places a significant burden on the nation's economy. There are multiple factors that drive up health care costs. One of the major factors driving the healthcare costs is inappropriate use of laboratory tests (Reinhardt et al., 2002). Laboratory testing constitutes approximately 3-5% of health care spending (Song et al., 2011). Studies show that defensive medicine has contributed to inappropriate lab test utilization and escalating health care costs. Doctors 'order tests that may not be required because of the fear of malpractice lawsuits (Kim et al., 2011). Researchers estimate that 10% of the costs of the health care in 2011 resulted from defensive medicine (Norbeck, 2012).

Although a large body of evidence links increased lab use to rising costs, the actual factors influencing doctors' decisions to order clinical tests are poorly understood. The purpose of this study is to identify some of the factors that influence a doctor's decision to order clinical laboratory blood tests. I use a qualitative case series study approach to assess the factors influencing doctors' decisions to order lab tests using data from interviews consisting of pre-set open-ended questions.

## Research Design and Rationale

The main research question of the study is, "What factors drive or influence the ordering of clinical lab tests?"

Some of the factors that I explore in the study related to the following sub-questions:

- What is the most important factor in ordering a clinical lab test?
- Is clinical validity and necessity a test important for ordering?
- Do academic organizational guidelines and algorithms influence ordering a lab test?
- How up-to-date is the doctor on the latest guidelines and validity of tests?
- Would the clinical test be ordered if not for defensive medicine?
- Will the doctor order, or not order, a test based on insurance/affordability, even if the clinical decision calls for it?
- Would knowing the cost of the test change the doctor's ordering behavior?

This is a qualitative case series study to explore the reasons behind doctors' decisions to order clinical laboratory tests. I chose general practitioners, internists, and hospitalists because they provide initial care to patients and order most of the initial lab tests. I interviewed the participants using open-ended questions. Some of the factors that I explore includes the utility, affordability, and availability of a test, as well as insurance coverage.

There are five different approaches to conducting qualitative research: (a) narrative research, (b) phenomenology, (c) grounded theory, (d) ethnography, and (e) case report studies. I chose the case study method.

Narrative researchers seek to illustrate real-life experiences and could use any written text. Some of the material can be stories that may be biographical or

autobiographical. The material could be from journals, photographs, letters, or recorded conversations that express views and values (Sandelowski, 1991). Narrative researchers work to identify themes and patterns in individuals' lives as they describe them (Sandelowski, 1991). In this study, I explore experiences related to the ordering of clinical laboratory tests rather than the stories of the individual themselves; thus, a narrative research approach would not have been appropriate.

Phenomenological researchers describe lived experiences and associated qualities related to the experience (Patton, 1990). A phenomenological study captures individuals' experiences and focuses on the essence of shared experience (Patton, 1990). This can range from imagination and emotion to perception or thought. The experiences are gathered as data from the people who have experienced the phenomenon studied. The data for analysis is collected through interviews, stories, or observations. Phenomenology was not suited to my research study because the problem studied was not a shared social experience of a particular phenomenon. Rather, I explore doctors' reasons behind ordering tests, which is neither a phenomenon nor a shared experience.

Grounded theory is a qualitative research method in which researchers ground theories in well-planned data collection and analysis. The data collection, interpretation, and development of the theory are interdependent processes (Glaser & Strauss, 1967). Common methods used in grounded theory include observing the participants, interviewing, and the collecting texts. In participant observation, the researchers involve themselves in the daily routines and lives of study participants. This enables researchers to develop a theory and allows them to frame a set of questions to further develop the

theory. The comparative process and theoretical sampling is carried out until the researcher reaches the saturation point at which there are no new ideas coming from the research (Corbin & Strauss, 1990). Grounded theory only allows for collection and analysis of data and does not help in the conceptualization of a study design. Hence, this research design was not appropriate for this study because I am not seeking to develop a new theory, rather I am seeking to address why doctors make the decisions they do regarding the ordering of laboratory tests.

An ethnographic study involves the study of culture, ethnic groups, geographic location, and ethnicity. The study involves an outside observer who is immersed in a culture-sharing group to study their beliefs and practices (Creswell, 2012; Whitehead, 2005). In this study, I am not proposing to study one particular ethnic group or culture. Instead, I focus on individuals in different settings. The ethnographic method was thus not suitable.

A case study approach involves analyzing a facet specific case in depth (Baxter & Jack, 2008). A research study can involve one case or multiple cases. The case study approach ensures that the issue is studied through more than one lens, and enables researchers to explore multiple facets. A case study approach should be considered when the researcher is trying to find answers to the how and why questions, and when there is no clarity between the studied phenomenon and context (Yin, 2003). Inappropriate lab testing and why the doctors make decisions to use lab tests have not been explored.

This a qualitative study explores the reasons behind doctors' decisions to order clinical laboratory tests. I consider test utility, affordability, insurance, and doctors' lack

of understanding of a test. Given the available qualitative approaches, the case study method was the best fit.

## Role of the Researcher

My role as a researcher in the study is to recruit and interview the participants. I have no personal or professional relationship with any of the participants. All participants are volunteers from local medical professional societies. Hence, I did not and do not have any supervisory or instructional relationship with or power over the participants. This is important because personal or power relationships between the researchers and participants can raise ethical and validity concerns. Because there are no personal or power relationships with me, I was able to avoid the associated ethical and validity concerns.

An additional role of the researcher is to protect the confidentiality and privacy of the participants. I addressed this by de-identifying sensitive information, and by not disclosing participants' personal information to anyone. The informed consent form specified this and informed the participants that they had access to their data and outlined how the data were protected. I described the study to the participants in the language they could understand, highlighting the nature of the study, what data, I sought to collect from them, and how I intended to use the data. I also told the participants that I aimed to better understand reasons doctors order clinical tests, and that the results of the study would bring about a much-needed increase of information on the topic.

## Methodology of the Study

### Participants and Sample Selection Logic

The participants in the study are doctors who work at local hospitals in Western New York. All doctors who practice in Western New York are eligible for the study because they prescribe clinical tests for their patients. I recruited the doctors for the study from a local Western New York medical society, which provided the database of the doctors practicing in the area. Each doctor was assigned a unique identifier based on the type of practice. A computer randomly selected these unique identifiers. After institutional review board (IRB) clearance from Walden University (Approval # 07-26-16-033820), I sent letters and/or emails to the doctors to ascertain their willingness to participate in the study (Appendix E). The doctors who agreed to participate in the study were chosen based on a first come, first served basis, taking in to account the variety of practices (community hospitals, major health groups, and private practices). I recruited a total of 15 participants for the study with a minimum number of five each from hospital, community, and individual practices. As indicated, I de-identified all participant information and only unique numbers generated by computer were used for the study. I conducted pilot testing with a couple of participants who were not included in the actual study. The pilot test helped me determine if there were any limitations or flaws in the study design or interview questions (Turner, 2010).

The appropriate sample size of any qualitative study is determined by its purpose (Guest, Bunce, & Johnson, 2006). Other factors that determine the sample size for this study were the heterogeneity of the doctors, and the settings in which the doctors work

(community hospitals, major health groups, and private practices). In addition, the available budget and resources also dictated the sample size. As Guest, et al. (2016) suggest, a group of 15 participants is the smallest accepted sample size for any qualitative study. Because the current study featured multiple doctors (*n*=5) in different hospital settings localized to Western New York, it is possible that saturation was achieved.

**Instrumentation**

I collected data in this case study through interviews. I prepared a questionnaire that served as a template for conducting the interviews. The purpose of the interviews was to identify some of the factors that influence a doctor to order a particular clinical laboratory blood test. I initially planned to conduct 30-45 minute interviews, but most interviews concluded in 20 minutes. I made plans to schedule additional interviews, if required, especially if there were discrepancies and needed clarifications. However, there was no need for any additional interviews. All the interviews were digitally audio-recorded.

Semi-structured interviews can result in bias. Bias is a non-random deviation of results from the actual truth (Noble & Smith, 2015; Turner, 2010). Bias is a form of systematic error that can be located in the design, conduct, or analysis of a study. Bias can happen before, during, or after the study. Pre-study bias includes design flaws, selection bias, and channeling bias (Pannucci & Wilkins, 2010). These errors can be prevented by having a well-designed study with rigorous predefined selection criteria for the participants. Bias during the study can relate to interviewing and recall (Pannucci & Wilkins, 2010).

To minimize bias, I used open-ended questions, which are standard protocols for interviews. After I completed the interviews, I carried out a detailed case analysis, followed by cross case synthesis analysis. Because there were 15 individual cases from three different hospital settings, I had adequate opportunity to study the similarities and differences between them. The listing of the similarities and differences among the cases and different hospital settings, as well as age groups and sex, allowed me to analyze the data through different structured objective lenses rather than relying on my own general impression (Eisenhardt, 1989).

Where such policies existed, I reviewed the hospital policies regarding ordering clinical laboratory blood tests from the hospitals or practices that employed the doctors recruited for this study. Document analysis involves the systemic review of documents and can be used in addition to qualitative research methods as one method of triangulation (Bowen, 2009). The review of hospital protocols could provide context for the study and develop interview questions. Most of the doctors 'work locations did not have any specific policies related to clinical laboratory blood testing. Only work location of two doctors' participating in my study had any hospital protocols or policies. However, I was not able to review hospital records because the doctors' working in the locations that had policies declined permission to seek the document from the hospital.

I asked aall participants identical open-ended questions. This allowed the participants to provide detailed information and their point of view without any restrictions. Moreover, it allowed the researcher to follow up with additional relevant probing questions as needed (Turner, 2010). To ensure the quality of the data, I

performed member checking for all the participants. This was the third method of triangulation. I made sure that the participant understood the question posed. If a participant, did not understand the question it can lead to incorrect responses, which will lead to incorrect findings. To assure that the interviewee understood questions correctly interventions such as unstructured, exploratory interviews with the participants can be considered. In this process, interviewees are requested to describe key concepts relating to the research question. Another way to ensure quality is to check for the lack of internal consistency within a given statement, which may provide clues to the interviewer are misunderstanding the statement (Bergman & Coxon, 2005). I did member checking for all participants. The participants were recruited through random selection and they worked in different hospitals. All these ensured credibility and validity of the data generated through the interviews.

**Procedures for Recruitment, Participation, and Data Collection**

The doctors were recruited for the study from a local Western New York medical society. The local medical society provided the database of the doctors practicing in the area. Each doctor was assigned a unique identifier based on the practice. These unique identifiers were randomly selected by a computer. After institutional review board (IRB) clearance from Walden University, letters and/or emails were sent out to the doctors to ascertain their willingness to participate in the study. The doctors who accepted to participate in the study were chosen based on the first come first served basis, taking in to account the variety of practices (i.e. hospital based, to community hospitals and individual practices). A total number of 15 participants were recruited for the study with

a minimum number of five each from community hospitals, major health groups, and private practices. The data were collected from doctors through interviews conducted at non-hospital site (church, park, and pre-arranged interview rooms). Since data collection did not involve particular patient details, local hospital IRB review was not required.

In total, I recruited 17 participants for the study. I conducted pilot testing with the first and the second participant. I assessed the data from these participants to confirm the interview questions ability to capture the rich data that is required for a meaningful analysis. The interview transcripts were assessed by me and the University faculty peer to assess the richness of the data and it was deemed adequate. The data from the two participants were not included in the final study. A total number of 15 participants were recruited for the main study with five participants each covering hospital, community and individual practices. The study protocol and recruitment were the same as for the pilot study. All participant information was de-identified and only unique number generated by computer were used for the study. I collected the data utilizing the interview protocol in Appendix F. The plan was to perform one interview per participant. The interview took place in a prearranged place. Each initial interview was expected to last from between 30-45 minutes but actually lasted approximately 20 minutes. There was extensive notetaking and journaling throughout the interview and the study. An additional interview was to be scheduled only if there is any discrepancy in the interview information and if there was a need for clarification. The time frame for the completion from recruitment to data analysis was four months.

**Data Analysis Plan**

I developed the raw data into individual case records, in which the data was transcribed and coded. Initially, I used Dragon speech recognition software to transcribe the interviews but reverted to listening of the digital audio recording and notes that were taken during the interviews. I analyzed each statement in the transcript themes. This was done by reading and re-reading the transcript and comparing it with the field notes. Categories and themes emerged. I entered the field notes along with interview transcription into the NVivo software. The data was broken down into categories and nodes were designated utilizing the NVivo software. The first step was to look at the data and create broad categories or nodes for data analysis. The software helped in me identify the relationships within the data sets. I conducted the analysis for core consistencies, patterns and themes.

Based on the research questions and theoretical base, I identified the main categories and sub categories from the interview transcripts and field notes. I carried out revisions to the categories and coding based on repeated readings of the transcripts (Kohlbacher, 2006). After I transcribed and read the interviews, I conducted open coding. This involved summarizing whole sentences in one or two words. Deviations from the topic of interest and were left un-coded. The process of coding reduced the material, which was then organized into categories and themes that emerged from the interview transcripts.

As indicated in the data collection section, the interviews were to be validated by re-interviews with some participants to check the data (member check of the respondent

answer). While there was no need to re-interview, I requested that participants read through their interview transcripts to validate or refute the answers provided by them. This was done shortly after the data collection (Burnard et al., 2008). In addition, I coded some interviews at two different time periods to ensure if they corroborated and matched.

## Issues of Trustworthiness

### Credibility

Credibility ensures that a study measures or tests what it is actually intended to assess (Mays & Pope, 2000). The extensive literature search, random sampling, triangulation, member checks, negative case analyses, and peer reviews of the research project all help ensure a study credibility (Shenton, 2004). Thus, I carried out an extensive literature search for this study. The participants were recruited through random selection of samples. Member checks were done in this study in that participants were requested to read through their interview transcript and validate or refute the investigator findings soon after the data collection. The study findings also underwent a peer examination and scrutiny with University mentors in the dissertation process. All these factors will ensure credibility of the study.

### Transferability

Transferability is the degree to which the current study can be generalized (Anney, 2014). Transferability of a study can be achieved by providing thick description and performing theoretical or purposive sampling (Anney, 2014). In this study, there could also be difference in hospital policies of Western New York hospitals from rest of the regions of the state and the country. I interviewed doctors recruited through random

and purposeful selection from a local Western New York medical society who worked in different hospital settings (Federal, local government and private hospital setting). I assumed that random, purposeful selection of doctors would provide a wider range of workplace views in different settings. The study methodology, instrumentation, and collection of data are all detailed. The description is thick with rich data. This allows for transferability of the study (Houghton, Casey, Shaw, & Murphy, 2013).

**Dependability**

Dependability means ensuring that the results, interpretations, and recommendations of the study are based on true data that can be supported (Anney, 2014). Dependability could be established by a good audit trail, code re-code strategies, and peer examination (Anney, 2014). In this study, all interviews were digitally recorded with extensive additional notes taking and journal keeping. The recorded interviews were transcribed using a computer software and then coded. The coding was done manually and using NVivo software. This ensures a good audit trail. A few interviews were coded twice at two different time periods. Notes were compared for corroboration and match. The study findings underwent peer examination and scrutiny with University mentors in the dissertation process. All these factors helped ensure dependability of the study (Houghton et al., 2013).

**Confirmability**

Confirmability refers to ability of other researchers to confirm and corroborate the study's findings (Anney, 2014). Confirmability can be achieved in a qualitative study through a reflexive journaling practice (Anney, 2014). I collected the data through

interviews utilizing an interview protocol, and recorded them using digital audio recording. There is of the audio and paper transcript of the audio recorded. The data collected will be made available to an external observer with redaction of personal details of the participants, if required. I engaged in extensive notetaking and journaling throughout the interviews and the study. The reflexive journal practice will ensure the confirmability of the study.

**Ethical Procedures**

The doctors were recruited for the study from a local Western New York medical society. The local medical society provided the database of the doctors practicing in the area. Since the interviews happened at a non-hospital site and also does not involve particular patient details, local hospital IRB review was not required. Since none of the participants worked with me, there was no conflict of interest or any concern for power differentials. After institutional IRB clearance from Walden University (Approval # 07-26-16-0338204), letters and/or emails were sent out to the doctors to ascertain their willingness to participate in the study (Appendix E). Doctors who participated in the study signed a consent form. This study was voluntary and the participants had the right to exit the study at any time. None of the doctors was provided any incentive for participation in the study. Any information provided by the participants was and will be kept confidential and will not be used for any purposes outside of this research project. Data was and will be kept secure in a password-protected computer. All information collected was stripped of personal identification details and provided individual unique identifiers. The key for the unique identifiers was and will be kept in a secure location

with the investigator in a locked cabinet. Data will be kept for a period of at least 5 years, as required by the university. I had no ethical concerns in this study.

## Summary

In this qualitative case series study, I explore the reasons behind doctors' decisions in the ordering of clinical laboratory testing. The data collection involved the interviewing several doctors from Western New York, practicing in differing hospital settings (private practice, community and major hospitals). I collected the data for the study through a series of interviews utilizing an interview protocol. Because the interviews happened at a non-hospital site and also did not involve particular patient details, local hospital IRB reviews were not required. In addition, I do not disclose any personal details of the doctors who interviewed, including their work locations. All information collected was stripped of person identification details and provided individual unique identifiers. The key for the unique identifiers is being kept in a secure location with the investigator. Because the interviews are, do not disclose any patient or provider details there is no concern about violations of HIPAA laws.

The raw data collected by me through audio digital recording were developed into individual case records. The collected data were transcribed and coded. The data obtained can be examined at individually or compared with the other case data collected. The comparison with other cases resulted in emergence of patterns. I performed the analysis for core consistencies, patterns, and themes. I also used directed content analysis to analyze the data. In Chapter 4, I discuss the study results in detail.

# Chapter 4: Results

## Introduction

The purpose of this qualitative case series study is to identify factors that influenced a doctor's decision to order routine clinical laboratory blood tests. I assess the factors and reasons influencing doctors' decisions to order routine clinical laboratory blood tests using data from interviews that consisted of pre-set, open-ended questions (see Appendix F for interview guide).

The main research question of the study is "What factors drive or influence the ordering of clinical lab tests?"

Some of the factors that I explored in the study related to the following sub-questions:

- What is the most important factor in ordering a clinical lab test?
- Is the clinical validity and necessity of a test important for ordering a test?
- Do academic organizational guidelines and algorithms influence ordering a lab test?
- How up-to-date is the doctor on the latest guidelines and validity of tests?
- Would the clinical test be ordered if not for defensive medicine?
- Will the doctor order, or not order, a test based on insurance/affordability, even if the clinical decision calls for it?
- Would knowing the cost of the test change the doctor's ordering behavior of?

In this chapter, I describe the research setting, demographics, and methods of data collection and analysis. I also discuss the evidence of trustworthiness including

credibility, transferability, dependability and confirmability of the results, and conclude by presenting the results of the study.

## Research Setting

The participants in the study are doctors who work in the local hospitals in the Western New York region that includes Allegany, Cattaraugus, Chautauqua, Chemung, Erie, Genesee, Livingston, Monroe, Niagara, Ontario, Orleans, Schuyler, Seneca, Steuben, Wayne, Wyoming, and Yates Counties (see Appendix A). All doctors who practice in Western New York were eligible for the study because they prescribed routine clinical blood tests for their patients. The doctors were recruited for the study from a local Western New York medical society. The local medical society provided the database of the doctors practicing in the area. Each doctor was assigned a unique identifier based on their practice. These unique identifiers were randomly selected by a computer. I obtained appropriate approvals from the Walden University IRB to conduct the study (IRB approval number 07-26-16-0338204), and the local medical society to use their database of doctors in Western New York area. Once the approvals were obtained, the local medical society sent out letters and/or emails to the doctors to ascertain their willingness to participate in the study (see Appendix E for an example letter). The doctors who agreed to participate in the study were chosen on a first come, first served basis. I also took into consideration the type of practice (major hospital system, community hospitals, or individual practices). Once each category reached five participants, the recruiting was terminated.

The first two doctors who agreed to participate in the study, underwent the pilot testing using the pre-formed questionnaire guide (see Appendix F for interview guide). My dissertation chair and I reviewed the answers to the questionnaire, and we deemed them as containing rich information. Hence, no changes were made in data collection or analysis strategies.

## Demographics

In all, I interviewed, 15 doctor participants (eight female and seven male doctors) from the three major groups of hospitals. The three hospital groups were classified as the community hospitals, major health groups, and private practices. Three different hospitals were represented in the community hospital group. In this group, I interviewed three female and two male doctors. In the major hospital group, there were three different hospitals represented. There were three female and two male doctors in this group. Finally, four different practices comprised the of private practice group which was represented by three male and two female doctors. All doctors were board certified in internal medicine and/or family medicine, and on average, they had been practicing in the community for a minimum of 10 years.

## Data Collection

I collected data for the study using interviews. I prepared a questionnaire that served as a template for conducting the interviews (see Appendix F). The purpose of conducting interviews is to identify some of the factors that influence a doctor to order routine clinical laboratory blood tests. The doctors were recruited through a local Western New York medical society through dissemination of letters/and or emails using

their data bank. The doctors who agreed to participate in the study were chosen on a first come first served basis. I also took into consideration the type of practice (i.e. major hospital system, community hospitals or individual practices). Once each category reached five participants, the recruiting was terminated.

After the doctors reached out by phone or email, indicated their willingness to participate, I scheduled interviews. The scheduling of interviews was done through phone and/or text based on mutually convenient times and place (away from the work place of the doctor). The majority ($n$ = 13) of the interviews were conducted in a local coffee shop. One interview each was conducted in a quiet room in a church and a local park.

Prior to conducting the interview, I explained the study to each doctor and they were requested to sign an IRB approved consent form. On signing of the consent, the interview began and was digitally recorded. The interviews lasted an average of 20 minutes, with the shortest lasting 12 minutes and the longest at 25 minutes. Only the first two participant interviews were digitally recorded and were transcribed later utilizing a voice recognition software (Nuance Dragon). For the rest of the thirteen interviews the Dragon software was not used because of improper and unintelligible transcription of interviews. I listened to all 15 interviews individually and transcribed them into an electronic text document. None of the interviews had to be repeated for data discrepancy or for lack of data clarity. I provided the doctors with copies of their respective transcript and consent form between three to seven days after the interview. The delay was because of lack of photocopiers in coffee shops and the time it took for transcribing the

interviews. I requested the doctors verify the accuracy of the transcription as part of member checking.

I encountered no unusual circumstances in data collection. Some of the deviations from the initial plan were as follows. The initial plan was to conduct an interview that was expected to last between 30-45 minutes. However, none of the interviews lasted more than 25 minutes. The initial plan stipulated that the interviews were to take place in a pre-arranged quiet conference room. None of the interviews occurred in a pre-arranged conference room. Instead, they took place in a quiet corner in local coffee shops, local church and park. All the interviews were acceptable and provided adequate rich data.

As per the protocol of the study, in addition to the interviews, I reviewed hospital policies regarding ordering clinical laboratory blood tests (if any) of different hospitals from which the doctors are recruited for this study. Twelve of the doctors stated that there was no hospital policy or documentation of ordering for clinical laboratory blood tests. Three of the doctors from two locations (community and a major hospital) said some protocols are available for select clinical blood tests. However, these doctors indicated that the selected tests were not routine clinical laboratory blood tests but pertain to cardiac markers in the intensive care units. When I asked if they were willing to share the protocol documents, they answered negatively. Each said that such a document is hospital property and made it clear that they were not comfortable sharing the document with me, or with me approaching the hospital for the document.

## Data Analysis

I transcribed the 15 interview audio files into electronic text documents, and organized them into to three categories. The Word file contains 15 document titles as shown below, sorted alphabetically by title:

- C = community hospital –name of hospital- person interviewed
- H = major hospital –name of hospital- person interviewed
- P = private practice –name of the group- person interviewed

**Interview Questions**

- How would you describe your clinical practice? What is the role of clinical testing in your practice?
- How do you incorporate routine testing in your practice?
- How does routine testing help your patients?
- How do you decide what test to order?
- Why do you need clinical testing on your patients?
- How necessary is clinical testing?
- Do you have protocol for ordering tests? If so, how did you decide this protocol?
- In protocol, which of the test you will consider necessary or unnecessary?
- Is the protocol based on latest clinical guidelines and evidence-based medicine?
- How do you feel about efforts to reduce or limit clinical testing?
- What do you think can be done to limit clinical testing?

- Do you think limited clinical testing can be done in your practice?
- How would it benefit patients?
- How would it benefit your practice?

**Nodes Titles from Interview Questions**

Four parent nodes were created in NVivo 11 to reflect the core questions, based upon a cursory scan of the interviews.

- Q01. Describe the clinical practice.
- Q02. Clinical testing in your practice.
- Q03. Necessity of clinical testing.
- Q04. Opinion testing practices in general.

**Coding Process**

The fifteen interview files were imported into NVivo 11 qualitative software. Each line was manually read and coded for the four parent nodes shown above. Multiple subcategories were created as content within each of the four nodes was manually read and coding was refined within these nodes. This resulted in 57 sub categories (Appendix G shows nodes with frequencies). The coding was done for the categories case by case to identify emerging themes.

Q01. Describe clinical practice

Q02. Clinical testing your practice (five subcategories)

- a. Role of clinical testing in your practice
- b. How incorporate routine testing

- c. How routine testing helps patients
- d. Factors decide what test to order
- e. Why clinical testing on your patients

Q03. Necessity of clinical testing (four subcategories)

- General necessity of clinical testing
- How determine if test is necessary
- Protocol or guidelines (two subcategories)
  - Changes - adaptations
  - Types of protocols or guidelines (six subcategories)
    - Based academic or evidence-based (two subcategories)
      - Not applicable
      - Yes
    - Formal
    - Hospital protocol
    - Literature and clinical experience
    - National forums
    - No personal
- Review – Resources (three subcategories)
  - Hospital committee reviews
  - Doctor reviews
  - Resources (six subcategories)
    - CME's CE's

- Conferences - Meetings
- Hospital education lectures
- Journals
- Medical update alerts
- PubMed

Q04. Opinion testing practices in general (seven subcategories)

- Clinical guideline recommendations (four subcategories)
  - Good in general
  - Must modify for patients
  - Negative - impractical
  - Neutral
- Consequences patients face if alterations (five subcategories)
  - Depends
  - Negative
  - None or unknown
  - Positive
  - Unspecified effect
- Cost drives ordering of tests (four subcategories)
  - Depends
  - Do not know
  - No - cost has no effect
  - Yes - cost changes behavior

- Fear of malpractice (two subcategories)
  - No additional tests
  - Yes - on occasion
- Felt pressure to reduce or limit (three subcategories)
  - No pressure
  - Not asked
  - Some pressure
- Insurance coverage and affordability (two subcategories)
  - Affordability
  - Coverage
- Reduction of testing in general (two subcategories)
  - No reduction of testing
  - Some reduction of testing

**Coding Strategy**

In general, I designed the coding strategy to provide reminders within various nodes rather than attempt to code every line of text to every node possible. I coded the interview transcripts for context to capture more content than might seem necessary. In this study, categories had multiple meanings, and content was coded to multiple nodes when relevant. Every word in the interview transcript was not coded because that would have become burdensome to read and analyze since connections can be made throughout. The themes were codes for each case type based on the place of work (major hospitals, community hospitals, and private practices). Dr. C1 from a community hospital had a

different view on routine blood testing when compared to the other 14 doctors interviewed. I thus analyzed this case as a discrepant case.

## Evidence of Trustworthiness

### Credibility

Credibility ensures that the study measures or tests what it is actually intended to assess (Mays & Pope, 2000). The extensive literature search, random sampling, triangulation, member check, negative case analysis, and peer review of the research project will all help in insuring the credibility of a study (Shenton, 2004). I carried out an extensive literature search for this study. The participants were recruited through random selection of samples. Member checks were done in this study in that participants were requested to read through their interview transcript and validate or refute the investigator findings soon after the data collection. The study findings also underwent a peer examination and scrutiny with University mentors in the dissertation process. All of these will ensure credibility of the study.

### Transferability

Transferability is the degree to which the current study could be generalized (Anney, 2014). Transferability of a study could be achieved by providing thick description and performing theoretical or purposive sampling (Anney, 2014). In this study, there could also be difference in hospital policies of Western New York hospitals from rest of the regions of the state and the country. I interviewed doctors recruited through random and purposeful selection from a local Western New York medical society who worked in different hospital settings (Federal, local government and private

hospital setting). I assumed that random, purposeful selection of doctors would provide a wider range of workplace views in different settings. The study methodology, instrumentation, and collection of data is detailed. The description is thick with rich data. This allows for transferability of the study (Houghton, Casey, Shaw, & Murphy, 2013).

**Dependability**

Dependability is ensuring that the results, interpretations, and recommendations resulting from the study are based on data that can be supported and is true (Anney, 2014). Dependability could be established by a good audit trail, code re-code strategies, and peer examination (Anney, 2014). The interviews in this study were digitally recorded with extensive additional notes and journal keeping. The recorded interviews were mainly transcribed by directly listening to the interviews. For the initial two interviews, computer software was used, but I reverted to manual listening and transcription. After this, the interviews were coded by using NVivo 11 software. This ensured a good audit trial. The study findings also underwent peer examination by the dissertation chair. All of this will help ensure dependability of the study (Anney, 2014).

**Confirmability**

Confirmability is the ability of the other researchers to confirm and corroborate the study findings (Anney, 2014). Confirmability could be achieved in a qualitative study through reflexive journal practice (Anney, 2014). I collected the data through interviews utilizing an interview protocol, and recorded them using digital audio recording. There is of the audio and paper transcript of the audio recorded. The data collected would be made available to the external observer with redaction of personal details of the participants, if

required. I engaged in extensive notetaking and journaling throughout the interviews and the study. The reflexive journal practice will ensure the confirmability of the study.

**Ethical Procedures**

The doctors were recruited for the study from a local Western New York medical society. The local medical society provided the database of the doctors practicing in the area. Since the interviews happened at a non-hospital site and does not involve particular patient details, local hospital IRB review was not required. Since none of the participants worked with me, there was no conflict of interest or any concern for power differentials. After institutional IRB clearance from Walden University (Approval # 07-26-16-0338204), letters and/or emails were sent out to the doctors to ascertain their willingness to participate in the study (Appendix E). Doctors who participated in the study signed a consent form. This study was voluntary and the participants had the right to exit the study at any time. None of the doctors were provided any incentive for participation in the study. Any information provided by the participants was and will be kept confidential and will not be used for any purposes outside of this research project. Data was and will be kept secure in a password-protected computer. All information collected was stripped of personal identification details and provided individual unique identifiers. The key for the unique identifiers was and will be kept in a secure location with the investigator in a locked cabinet. Data will be kept for a period of at least 5 years, as required by the university and will be destroyed after this period. We did not have ethical concerns in this study.

## Study Results

**Research Question 1.**

There was no emerging theme from this question.

**Research Question 2.**

a. Role of clinical testing in your practice

b. How incorporate routine testing

c. How routine testing helps patients

d. Factors decide what test to order

e. Why clinical testing on your patients

**Emerging theme: Importance of clinical presentation and history in ordering routine blood test**. All of the doctors ($N$ = 15) who participated in the study, irrespective of the hospital group with whom they were affiliated, reiterated the importance of routine clinical laboratory blood testing for diagnosis, monitoring of treatment progress, or prognostic purposes. When questioned about the role of clinical lab blood testing, community hospital Dr. C5 commented, “This is very important because management of patients will depend on this.” When asked to elaborate on the need for clinical blood testing and the incorporation of tests, Dr. C5 said, **“**For me, all tests are important and give a particular indicator of a progress of a patient and I order based on what symptoms they come in for, duration, clinical history, and medication history. The clinical history is particularly important.” Dr. H3 from the major hospital group also stressed the importance of the role of clinical lab blood testing in his practice and answered, “Tests are very important for the things described earlier such as diagnosis and prognosis and for

discharge." When Dr. H3 was asked how he incorporates routine lab testing in his practice, the doctor replied, "Depending on patient needs, like what they are admitted for, their diagnosis, like clinical history." Doctor P1 from private practice commented, "It is essential to have clinical blood testing in my practice as it helps me in follow up of my patients, as most of them are chronic in nature, like diabetes, and to monitor their progress and also for diagnosis." Doctor H1 from the major health group commented:

> The role of clinical lab blood testing is absolutely critical because it is necessary to first provide with a diagnosis, and with patients who have systemic illness, which can only be defined by certain types of laboratory tests and also gives us an indication of inflammatory markers.

Doctor H1's views were mirrored by Dr. H2, who commented, "Clinical lab blood testing ensures there is stability of medical conditions, helping follow up of chronic medical conditions, and also helping with the substantiating of what patient history is."

All of the doctors also expressed the feeling that the incorporation of clinical blood testing or ordering of a clinical blood test depends on the patient's medical condition. The other co-factors that are important for ordering of the blood test were a patient's past and present medical and medication history. When asked to elaborate on the need for clinical blood testing and incorporation of tests based on the patient's condition, Dr. C5 from the community hospital group responded, **"**For me, all tests are important and give a particular indicator of a progress of a patient and I order based on what symptoms they come in for, duration, clinical history, medication history. The clinical history is particularly important." Dr. H3 from the major hospital group for the

same question replied that, “Depending on patient needs, like what they are admitted for, their diagnosis, like clinical history.” Dr. P5 from a private practice group answered that, “Generally, all new patients get a basic CBC, chemistry and additional tests are added depending on their medical condition and diagnosis.” Dr. P2, also from private practice group, answered:

> I do this after I see the patient. Like after I examine them and depending on the clinical findings I order them, provided it is indicated. Things like medical history and medication history will also be factored in and will dictate what test to order.

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors. There was no disagreement noticed between the community, private and major hospital groups. All the doctors who participated in the study, irrespective of the hospital group they were affiliated with, reiterated the importance of routine clinical blood tests in patient care. The major factors that influenced the doctors to order a particular blood test depended on clinical presentation, diagnosis and medical history.

**Research Question Q03. Necessity of clinical testing**

General necessity of clinical testing

How determine if test is necessary

Protocol or guidelines

**Emerging Theme: Criticality of routine blood tests for managing the patient**

All of the doctors ($N$ = 15) who participated in the study expressed the feeling that, in general, routine clinical blood testing is critical to patient care. Thus, they all

incorporate blood testing in some form based on the patient needs. Some of the doctors elaborated on the specifics of diseases they manage, such as diabetes and Hb1ac test orders. When answering the question on the need for clinical laboratory testing on patients, Dr. H5 from the major hospital group responded that:

> In my practice the majority of the patients get their blood work for monitoring if their drug treatment is working and if dosage need to be adjusted. For example, Hb1ac for diabetes control and LDL level monitoring and one increases or decreases dose of Metformin or insulin or statins based on levels.

While answering the question on the role of clinical lab testing in his practice, Dr. P3, who works as a private practitioner, commented that:

> The role of blood testing is critical in my practice. I see mainly elderly population with long standing illness. The common conditions I treat in my practice are diabetes, hypertension, and heart disease. Monitoring of glucose, Hb1ac, and cholesterol, and electrolytes are absolutely essential in my patients and this is where the role of blood testing comes in.

Dr. C4 from the community hospital group mentioned that the type of tests ordered depended on patient disease state. While responding to the question of the incorporation routine lab testing her practice, she replied:

> All of my patients get a screen of blood tests. I mean new patients; the screen depends on what there are coming in for after the initial consult. Then my regular patients will have routine Hb1Ac every six months or sooner or a year depending on their sugar control. Same applies to hyperlipidemia patients. For Hep B and

> syphilis patients it depends on results of the screen and it just depends on treatment. These are a few examples of how I incorporate tests in my practice.

Other doctors described how they order blood tests, such as preordering, before they see patients in order to save time for the patients by having the results in the office when they see the patients. In her answer to the question on the factors that dictate a particular clinical laboratory blood test, Dr. H4 of a major hospital group responded:

> Well I look at what medical problems that the patient has, I look at what medications that they are on and I get to look what their last tests were and when they were ordered and then order routine blood tests on that basis. In the setting that I am in, we try to pre-order blood tests before the patient comes in for the visit so we are prepared and we can tell them how their diabetes is being managed or their electrolytes are ok and they are adhering to their medication. So, the routine testing I order is based on the problem they have, the medications they are on, the testing order before and what interval it was. But of course, when they get in they may have a completely different problem and then one might order additional tests you did not order before, which necessitates the patient for a second lab visit but all patients are completely understanding about that.

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors. There was no disagreement noticed between the community, private and major hospital groups. All the doctors who participated in the study, irrespective of the hospital group they were affiliated to agreed that clinical blood tests were critical of

patient management and would incorporate testing before patient visit or based on the patient's disease state.

**Emerging Theme: Utilization of resources to maintain knowledge**

All of the doctors (*N* =15) who participated in the study were well aware of the recent literature and seem to be aware of latest clinical guidelines for clinical laboratory testing. There were several ways that they obtained their information. The majority of them obtained their information on the latest blood tests or guidelines from the academy meetings (n=12, 80%) and /or peer reviewed medical journals (*n* = 11, 73%). Some of the doctors also received information from attending local continuing medical education courses (*n* = 5, 33%) and hospital lunch lectures. (*n* = 2, 13%). Electronic sources, such as medical update alert, and public sources, such as web of science or PubMed were utilized infrequently (*n* = 1, 7%). Dr. P5 from the private practice group commented:

> I do review most if not all of the guidelines and tests that come out. I review this on a periodic basis, like anytime the test or guidelines come out. There are multiple resources I use which ranges from PubMed to journals to meetings.

Dr. P2 from the provide practice group commented:

> I go to ACP conference every year and I think I am up to date with new guidelines and tests to a great extent. Other resources are the journals I get as part of my ACP membership like JAMA and Annals of Internal Medicine.

Dr. C4 from the community hospital group commented that:

> There is no hard and fast rule. In general, I hear it in the conferences I go to or alerts that come up from the medical update I subscribe to or even read in the medical journals that I get as a part of being a member of ACP.

Similarly, Dr. H1 who works for a major hospital system commented:

> I review on a weekly basis the web of science that includes all the disease entities responsible for taking care of. I do this on a weekly basis and I am also involved in in teaching and also attend conferences from those we get a review.

Analyzing the utilization of resources from a case study perspective, the doctors from community hospitals obtained their continuing medical education mainly through journals from their medical societies (3 out of 5), while only two doctors attended major national conferences. All of the doctors belonging to the major hospital and private practice groups went to national conferences. They also read journal from their respective medical societies.

**Q04. Opinion on ordering of routine blood testing practices in general**

Clinical guideline recommendations

Consequences patients face if alterations

Cost drives ordering of tests

Fear of malpractice

Felt pressure to reduce or limit

Insurance coverage and affordability

Reduction of testing in general

**Emerging Theme: Guidelines are impractical without modification**

The majority of the doctors interviewed had a favorable opinion of academy guidelines (*n* = 13, 80%). Even though there was a favorable opinion of the guidelines, many of those same doctors (8 of 13, 62%) thought they were impractical and needed some modification or alteration to be adapted to the patients they treat. There were no uniform guidelines followed across different groups. More than half of the doctors interviewed did not have a specific protocol they followed (*n* = 9, 60%), they ordered per the needs of the patient. Three doctors followed hospital protocols, but all of them modified the clinical testing based on patient clinical requirements.

Generally, doctors had good opinion on the guidelines as described by Dr. H2 from a major hospital group and Dr. P5 from private practice setting. Dr. H2 commented:

> My opinion is again, if you are within an institution rather than a private practice because I am with an institution it means any institution based approach that I follow. The academy recommendations every other year. I think it is being assessed and reassessed and that is a good thing. Although I may not have been closely following the academies recommendations my institution does.

Dr. P5 agreed and said, "I think some of the guidelines and algorithms are helpful. Generally, they are good. I have generally good opinion on the guidelines."

As described earlier, even though there was a favorable opinion of the guidelines by the doctors, many of them (62%) modified or altered protocols and adapted them to the patients they treated. This opinion is reflected in the comments below from Dr. C2 and Dr. C3 from the community hospital group, Dr. H4 from the major hospital group, and Dr. P3 from the private practice group. Dr. C2 said:

> I do not follow verbatim the guidelines. Sometimes I have to change the protocol and sometimes I do not even order the test if I feel the test results would not come in time for the critical management of the patient. If it published in a peer-reviewed journal, I accept it but it does not mean that I follow it 100%. If a patient requires something, I do it and as long as the insurance covers it, I do not have a problem. Generally, the guideline studies are well designed but it may not fit all patients. I view them favorably but one cannot stringently follow them, as the guidelines does not take all factors in to account. They are very general and as I said, one needs to adapt.

Dr. C3 commented, "Guidelines are useful but they need to be adapted by the individual doctors according to the individual patient needs." Dr. H4 explained:

> I think it is for the general population and they are quite appropriate for it. If you are dealing with a high-risk population, one may have to modify the guidelines. One of the things about the guideline is that it is a 'guide-line' and one need to take into other factors. As I said before it is just a 'guideline.' One needs to looks at other factors and decide to use it appropriately or modify it.

Dr. P3 said:

> I think it ok for general population. I do modify the guidelines as per the patient. Generally, it is ok. One needs to looks at other factors and decide to use it appropriately or modify it. Guidelines works in general but modifications are essential.

Only two doctors thought that the academic guidelines are impractical and are of no value. Dr. C5 from the community hospital group and Dr. H1 from the major hospital group had an outright negative opinion on clinical guidelines and algorithms. Dr. C5 commented that, “They are not practical for day to day practice. Clinical guidelines are impractical and does not work for complicated patients I deal with on a day to day basis.” Dr. H1, who commented, put similar views forth:

> We often don't use them because most of the patients don't fit in the little neat black boxes. I personally have found that each individual patient differs and therefore using guidelines that are applied to thousands of patients who have hundreds of different diseases are really not that helpful.

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors. There was no disagreement noticed between the community, private and major hospital groups. The majority of the doctors from community hospitals group (4 out of 5) thought that the clinical protocols need to be modified according to patient clinical needs, rather than following them verbatim. Three out of 5 doctors from private practice group, and 2 out of 5 from the major hospital group, held similar views. Only one each from the private practice group and major hospital group felt that the guidelines could be followed as is. Based on this, most doctors thought that the guidelines are impractical to follow as published and will require modification based on patient clinical presentation.

**Emerging theme: Negative impact of reduction of blood test in patient management**

The majority of the doctors ($n$ = 11, 74%) expressed the opinion that reducing clinical blood tests would have negative effects on patient management and quality of care. When Dr. C3 from the community hospital group was asked to comment about his opinion on reduction of clinical laboratory blood testing, he said, “One just cannot reduce testing for reduction sake.” Dr. C3 also added, “I dread to think about it. Just reducing for reduction sake can have adverse effects on the patient care. I think it is not ethical and certainly one should not be think to cut tests to reduce costs.” Dr. H3 from the major hospital group and Dr. P4 from a private practice group also echoed similar views. Dr. H3 commented, “I don’t like doctors put on pressure to reduce testing. It can result in inadequate sub-optimal care of the patient.” Dr. P4 said, “The consequences could be severe based on what tests are not ordered. I would not recommend cutting anything especially if patient management is compromised.”

Three of the doctors (20%) were not sure what the consequences of reducing blood test would be on a patient. Dr. H4 from the major hospital group said, “I mean I do not know the consequences.” Dr. P5, a private practitioner, also said, “There is no way of knowing this. As I said it could be bad or it could be good but when individualizing to one patient it is an unknown.” Dr. C2, who worked at a community hospital, also echoed similar views. She said, “I think I do not know. The patient would not probably know.”

Only one doctor felt that the reduction of clinical tests could be of some benefit to the patient. Dr. C1, who works for a community hospital, said, “My thought process for ordering a test is that there should be an indication for any test, including CBC. So, it should not be ordered, I think patient will be at the least saved a needle prick every day.”

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors. There was no disagreement noticed between the community, private and major hospital groups. The majority of the doctors from community hospitals group (3 out of 5), private practice group (4 out of 5), and 3 out of 5 from the major hospital group thought that the reduction of clinical blood testing would have a negative impact on proper patient care and would not consider reducing testing. Only one from community hospital group felt that the reduction of routine clinical tests could be of benefit to the patient care. Because this case was different from all the other 14 cases, I reviewed it as negative case analysis in the discussion.

**Emerging Theme: Influence of cost, affordability, and insurance has no impact in ordering of clinical blood tests**

Knowing the cost for a clinical blood test influences less than one third of the doctors interviewed ($n$ = 4, 27%). They would consider switching to a different blood test or consider ordering test with less frequency. A similar number ($n$ = 4, 27%) of doctors would consider costs depending on the patient's clinical situation and would consider modifications. For example, when Dr. H4 from the major hospital group was asked the question on whether the doctor will order or not order a test based on insurance affordability, even if the clinician's clinical decision based upon it, she commented:

> I have had patients in the past who have to pay cash as they lack insurance. For example, I have had a patient who has been on ACE inhibitors and normally I check electrolytes regularly but for this patient because they lost insurance and

> because they had well controlled BP, I did not order blood tests that I would have ordered normally probably against my best judgement. What are you going to do? I had him go to catholic system to see if he can have blood tests done there because sometimes they waive fees. If there are affordability issues, I try to steer the patient away from LabCorp or Quest and go to these hospitals where they can have test done free sometimes or at a much-reduced rate because they have some funds allocated for such situations.

A similar sentiment was echoed by Dr. P1 who works for a private practice:

> As said many times, I will order what is needed for good care for the patient. Insurance affordability could be an issue and these instances one tries to find an alternative; like alternate tests, alternate labs, or payment plans and on. If it is absolutely required for patient care, I will order it.

Dr. C2 also would try to find alternative tests if coverage lacked for any given test with specific examples. She commented:

> There may be other ways to support the diagnosis and treatment. For example, if they stop Hb1ac coverage we may want to go back and perform glucometer testing. There are alternatives. We can still manage but this alternative is another lab test.

Similarly, Dr. H2 from the major hospital group said:

> I will still follow protocols that are needed to diagnose. On occasions, I may not order an indicated test I mentioned earlier, for example, when I mentioned CBC that is not under the protocol and they have no specific complaints. If they don't

> have insurance I would still order the required test periodically but may be less frequently but would not skip anything critical for patient care.

More than one third of the doctors (*n* = 6, 40%) interviewed said that knowing the cost would not influence what tests they order. One doctor was not sure what she would do. The majority of the doctors (*n* = 14, 93%) interviewed felt that there was adequate insurance coverage for the routine clinical blood tests they ordered. Affordability of the clinical test by a patient was an issue for only one third of the doctors (*n* = 5, 33%). Of the five doctors who felt affordability could be an issue, they found ways to reduce burden of the patients by either talking and negotiating with insurance companies to get the required test approved or found alternate hospitals and clinics that may perform the tests not covered at a much-reduced rate or even free. Dr. H1 from the major hospital group said:

> First, we do normally is to submit a prior authorization. Then try to appeal it to see if we can get permission to do the blood tests. If denied, we try to actually negotiate with the laboratory doing the tests to see if we can actually get done for a lesser cost or find some other mechanism for doing the test.

He also said:

> If there is problem with the insurance covering that has been we go through various appeal processes, try to find other mechanisms by which to get the testing done. We are not specifically driven by the type of insurance card the patient carries. We are driven by the needs of the patient.

Dr. P1 from the private practice group said:

> I generally do not encounter such issues. In the cases, I do have issues I submit preauthorization and if it still not approved I look to see if there are any alternate tests or even talk to the insurances to see if there is away. As said many times, I will order what is needed for good care for the patient. Insurance affordability could be an issue and these instances one tries to find an alternative; like alternate tests, alternate labs, or payment plans and on. If it is absolutely required for patient care, I will order it.

While the knowledge of cost may have some influence to change ordering pattern to reduction in clinical blood testing, the affordability or insurance coverage did not.

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors, a minority of doctors from each group said that knowing the cost would change the test ordering behavior. Only one each from the major and private group and two from the community hospital group would consider an alternate test or delaying test ordering a few months when they reviewed the cost of tests. Some doctors ($n$ = 4, 2 from the community and 2 from the private groups) would consider cost based on each patient. However, the majority of the doctors would not consider any reduction of tests based on costs ($n$ = 6). It seemed that the insurance did not impact the pattern of ordering of patient test because all doctors thought that their patients received good and adequate coverage from insurances. The results should be viewed with caution and not generalized because of the small sample size of this study and also because insurance coverage varies based on geographic region and income levels.

**Emerging Theme: Fear of malpractice law suits influence blood test ordering depending on the type of hospital practice**

All 15 doctors interviewed agreed that clinical blood tests should not be ordered out of fear of lawsuits, and that a doctor should be ordering, only required blood tests. Dr. C3 from the community hospital group commented:

> I would not be inclined to order for the fear of someone suing me. My obligation is towards proper care of the patient and if I do this the rest will take care of itself. One should not be ordering anything unless it is indicated.

Dr. H1 from the major hospital group commented:

> I personally don't order anything for fear of malpractice. We order things because we think are necessary for the patient's care. Not sure exactly what the circumstances in which things are done only from point of malpractice, but my guess is that it is not very helpful to do this.

Dr. P1 agreed with the above sentiments, and said, "I don't do that myself and it is not helpful."

The fear of malpractice lawsuits did influence half of the doctors ($n$ = 7, 47%) to order more clinical blood tests than what were required at some time in their practice. However, all the influenced doctors tried to limit unnecessary testing when possible. Dr. C2 from the community hospital group commented:

> There is going to be few of those. It's more not fear for malpractice. I feel to be surer of a certain diagnosis or to support a certain diagnosis additional blood tests

> may need to be ordered. Very occasionally I and my colleagues do order some tests that may be not be really indicated.

Dr. P2 who works in a private practice group commented:

> It does happen in my institution and I don't blame the doctors who do it because it is become a litigious environment. Personally, I order a test only when indicated and really malpractice it usually does not enter my mind while managing a patient. There are circumstances where there may be indications that patient or family demanding a few tests and in those circumstances, I have ordered tests that are not indicated but those are only in a few times.

Dr. H4 who works for a large hospital group also agreed and said:

> I would not say that probably really, I consciously ordered many blood tests for fear of malpractice. May be a PSA where it is unclear if treatment makes any difference. I do not order many tests defensively. I think as a physician one gets pushed in those in lines of imaging rather than blood tests.

This was a qualitative case study in which doctors were selected from community, private and major hospital groups. The coding was analyzed based on the work setting of the doctors. There was no disagreement noticed between the community, private and major hospital groups. When the coding was analyzed by case type and between different hospital settings there was major noticeable difference between the three groups. The majority of the doctors from the community hospitals group (4 of 5) said that they have ordered tests based on the fear of malpractice. However, in the major hospital group only

one doctor admitted to ordering more tests for the fear of malpractice. The rest ($n$ = 4) did not order additional testing. In the private practice group 3 out of 5 doctors said that they do not increase ordering of tests for the fear of malpractice suits.

**Emerging Themes: Negative impact of reduction in routine clinical blood testing**

More than half the doctors ($n$ = 9, 60%) of the doctors felt that the reduction of clinical testing would have a negative impact on the clinical care and quality of care for their patients. Thus, they would not even consider reduction because they feel that it will result in sub optimal, care of the patients they take care of. Dr. C3 commented, "I will not reduce testing if it is indicated and that is my bottom line. I just described my bottom line. One just cannot reduce testing for reduction sake." Dr. C4 commented:

> Mostly there should not be any reduction. I suppose one might ask what good does this do if the patient does not complain. Well it still does tell me to adjust medication doses based on the blood levels. Generally, I order what I require, which is important for me to assess the patient.

Dr. H1 working for a major hospital group and Dr. P5 from the private practice group also aired similar views. Dr. H1 commented:

> My issue with blood testing is that when the patient need it, it needs to get done. If it is not indicated, then it should not be done. It's an individual issue for each patient that is involved. I don't approve of anyone doing a test for no good reason unless there is clinical indication.

Dr. P5 said, “Generally I order what is required. It may be that I could consider reducing some of the routine testing, but it may be to the detriment of patient care. I do not think I will reduce any testing.”

The others ($n$ = 6, 40%) said that they may consider the reduction of routine clinical blood tests, but were quick to add that it depends on the circumstances. The factors they would consider were mainly the clinical presentation of the patient. It was clear that there was reluctance to reduce testing for their patients. For example, Dr. P2 from the private practice group commented:

> There is no point in trying to reduce a test if it is indicated. I can understand that there is no need for daily tests for in-patients; but for out-patients, it is critical to have any blood test that is needed based on clinical needs. If it is restricted, then it will affect patient care.

Some doctors, like Dr. C1 from the community hospital group, felt that there is some room for cutting some hospital testing. He said:

> Certain tests are ordered every day, for example, CBC or BMP or CMP. For me it is not necessary. Depends on WBC or RBC, ordering every day, there is no point checking that every day. If electrolytes are normal and for pneumonia, there is no point in ordering or checking or ordering CBC every day and I don’t.

Dr. H4 from the major hospital group also commented, “I think we do over test but there is a role of blood test in diagnosis and monitor chronic conditions and medications we prescribe and investigate complaints.”

When the coding was analyzed by case type and between different hospital settings there was no major noticeable difference between the three groups in reduction of routine blood testing. The majority of the doctors (60%) from the community group (2 out of 5), major hospitals group (3 out of 5), and private practice group (4 out of 5) said that they will not consider any reduction in routine blood testing. Forty percent of doctors (community group: 3 out of 5, major hospitals group: 2 out of 5, and private practice group1 out of 5) said that that they will consider some reduction to the routine blood testing.

## Discrepant Case Analysis

Dr. C1 from a community hospital had a different view on routine blood testing when compared to the other 14 doctors interviewed. He was the only one who said that the reduction of the routine laboratory blood testing may result in a good outcome for the patient. He said, “My thought process for ordering a test is that there should be an indication for any test, including CBC. So, it should not be ordered, I think patient will be at the least saved a needle prick every day.” In answering a question relating to his opinion on clinical guidelines and recommendations he said “They are good and bad. One thing for certain is that there is a lot of unnecessary testing.”

While Dr. C1 said, there is unnecessary testing that needs to be reduced, he also said the role of blood testing is very important. He commented “It is very important. The blood test is not only important in diagnosis. Naturally it also helps in prognosis.” When asked how he incorporates routine lab blood testing in his practice his answer was “Actually I would say there are no routine tests. It depends on the need of the patient or

circumstances." When pressed on how the routine tests are incorporated in his practice and how it helped his patients, he answered "My circumstances are different because I am a hospitalist and there is no routine testing." When asked to elaborate on this he said that he takes care of patients who are admitted in hospitals and in his opinion there is nothing called routine testing he will order.

It could be that even among the different practices there are subtypes of practices in which doctors take care of only a subset of patients. For example, patients in hospice will require an entirely different type of care and so would patients in nursing homes or rehabilitation care. For these group of doctors their way of practice and ordering of blood testing may be entirely different.

## Summary

This qualitative case series study uses interviews to explore the reasons behind a doctor's decisions to order routine clinical laboratory test. The results show that the role of routine clinical laboratory blood testing is important to the doctors. They stress the critical role that routine blood testing plays in patient care. The doctors agreed that clinical blood tests are important in patient management and they would incorporate testing before patient visits and would order tests based on patients' clinical presentations and diseases. The majority of the doctors feel that reducing clinical blood testing would have negative effects in managing patients. Doctors remain up-to-date on clinical guidelines for utilization of blood tests from a variety of sources.

The majority of the doctors are favorable to the guidelines on blood testing, however, they feel that they are impractical to utilize for their patients and hence would

modify protocols as per their patients' needs. The influence of cost, affordability, and insurance driving or reducing the ordering of clinical blood tests was minimal. However, the fear of malpractice lawsuits did influence increased or same level ordering of clinical blood test based on the hospital group they worked for. The majority of the doctors from the community hospitals group ordered more tests based on the fear of malpractice, while this was a minority position in the major hospital group. In the private practice group 3 out of 5 doctors report that they do not increase the number of tests because of fear of malpractice suits.

The doctors also feel that a reduction in clinical testing would have a negative impact on clinical care and quality of care for their patients and would not consider r reducing routine clinical blood tests they order. In Chapter 5, I compare the findings of the study with the peer-reviewed literature and interpretation will be concluded based on the results. I then provide recommendations based on the results of the findings. In addition, I will also discuss the positive social change impact based on the study findings.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Introduction

Studies exploring the factors behind doctors' decisions to order clinical laboratory testing are lacking. A better understanding of the factors that have an effect on the decision of a doctor to order laboratory blood tests can help in formulating interventions that could improve the quality of health care and potentially reduce health care costs. The purpose of the study is to identify factors that influence a doctor's decision to order routine clinical laboratory blood tests. In this qualitative case series study, I assessed the factors and reasons influencing the doctor's decision to order routine clinical laboratory blood tests using data from interviews that consisted of pre-set, open-ended questions.

I find that routine clinical laboratory blood testing is important to the doctors, and doctors agreed that clinical blood tests are important to patient management. Participants report that the most important factors in ordering a routine clinical blood test are a patient's clinical history, presentation, and medication history. Most doctors think that the reducing clinical blood testing would result in sub-par patient care. Doctors use a variety of sources to remain current on clinical guidelines for the utilization of blood tests. The main source of continuing education was medical journals and attending the annual meetings organized by the medical societies of which they are members. Although the majority of the doctors are favorably disposed to the guidelines put forth by these medical organizations, they express the feeling that these guidelines are impractical to adopt with all of their patients. Because of the impractical and general nature of the

guidelines, they do not consider them to useful for patient care. The guidelines and algorithms needed major modification before they can be adopted to their patients.

The influence of cost, affordability, and insurance on the ordering of clinical blood tests is minimal. The fear of malpractice lawsuits does influence increased ordering of clinical blood tests. The doctors also assert that reduction of clinical blood testing would have a negative impact on the clinical care and the quality of care for their patients, and thus they will not consider reducing the routine clinical blood tests they order.

## Interpretation of Findings

In the literature review, I describe studies showing that doctors ordered unwanted tests based on lack of time, restrictions due to insurance coverage, and lack of awareness in availability or utilization of certain tests (Hickner, 2014). In a randomized questionnaire-based survey of 1,768 doctors specializing in internal medicine and family medicine sponsored by the Centers for Disease Control and Prevention, an average of 31.4% of patients seen by the doctors every week had some type of clinical lab testing ordered (Hickner, 2014). Hickner (2014) found that the doctors were uncertain about the tests that they were ordering for about 15% of the cases and had difficulty interpreting results in over 8% of the reports received. Hickner also report that the most important factors posing problems in ordering or not ordering tests were related to costs to the patient and insurance coverage restrictions. Doctors do not have time to call clinical labs to find out if alternate testing options are available. Hickner conclude that the doctors were uncertain about the tests ordered, and about their interpretation. This raises concerns

about the safe and efficient use of laboratory testing, and the quality of health care for patients. In this study, I found that there was no similar concern among the doctors interviewed. All the doctors who I interviewed are satisfied with the insurance coverage. They further report that they know about the clinical tests they order.

In recent years, professional and national organizations have developed several clinical guidelines and protocols to improve quality of care. However, these guidelines will be ineffective if doctors do not adhere to them. Several reports and studies assert that changing doctors' behaviors is difficult (Cabana et al., 1999; Baiardini, Braido, Bonini, Compalati, & Canonica, 2009; Wilensky, 2016). Researchers have also shown that most doctors do not adhere to clinical guidelines (Cabana et al., 1999; Baiardini et al., 2009; Ennis, 2015).

In their comprehensive review of 76 studies conducted between January 1966 and January 1998, Cabana et al. (1999) describe some of the reasons for the doctors'non-adherence to clinical guidelines. Only five of these studies were qualitative, and they studied patient characteristics and constraints of doctors. The authors conclude that the main barriers to doctors' adherence related to awareness of, familiarity with, or agreement with the guidelines. Doctors' disagreement with guidelines was high, at over 90% for certain clinical guidelines (Cabana et al., 1999).

While the majority of doctors (80%) in this study show a favorable opinion of clinical guidelines, their opinions do not necessarily translate to following these recommendations. None of the doctors in the study follows clinical guidelines verbatim because they consider it impractical to do so. The doctors in the current study feel that the

guidelines established by the medical and government organizations are general and do not take into account the complex nature of each patient they encounter in day-to-day practice. They also felt the recommendations are overly simple and do not address specific comorbidities their patients present. Hence, they consider that the guidelines and recommendations lack in relevance and are impractical to use.

In an extensive meta-analysis, Smith (2000) reviewed 4,127 publications in relation to understanding doctors' attitudes and performances relating to clinical guidelines, Smith asserts that no singlefactor that will make doctors adhere to guidelines. Smith concludes that the guideline development should be theory-driven and evidence-based while taking into account the views of doctors. In this study, I find that clinical presentation, diagnosis, and medication history are the driving forces behind the ordering of clinical blood tests (Smith, 2000). These factors require further analysis and should be considered before any guideline development.

Baiardini et al. (2009) state that a doctor's adherence to guidelines is a complex phenomenon. The main factors include lack of familiarity with the guidelines and not even knowing that guidelines existed. Doctors also show a lack of agreement with the proposed guidelines. In addition, the doctors felt that the guidelines oversimplify complex problem. Many of them also feel that guidelines inhibit their autonomy in making clinical decisions. The doctors in my study also thought that the guidelines oversimplify complex problem, and that general blanket clinical recommendations do more harm than good to the patients. This was the reason why they modify or completely ignore clinical guidelines and recommendations.

Keffer (2001) summarizes the perceptions of doctors related to guidelines and algorithms, and reported "despite wide promulgation [of] clinical practice guidelines [,] little is known about the process and factors involved in changing physician practices in response to guidelines" (p. 1566). The author concludes that a doctor's attitude is one of the major influences in adherence to clinical guidelines, and his or her acceptance will help adaptation of any guidelines. In this study, I found that even although doctors have favorable opinions of guidelines, they unanimously feel that the guidelines cannot be used for their patients. They feel that the complexity of their patients 'needs are overlooked or simplified in the guidelines, and hence the guidelines require major modifications.

Sethi et al. (2012) studied the implications of the practice of defensive medicine across clinics in the United States. There were 1214 respondents in their study, of which 1168 (96%) reported having practiced defensive medicine. The authors assert that the most common practice of defensive medicine involves ordering such clinical tests including radiographs, CTs, MRIs, and laboratory blood tests, mainly to avoid possible malpractice liability. On average, 25% of all tests are ordered for defensive medicine reasons and have nothing to do with patient care (Sethi et al., 2012). In a different qualitative study exploring doctors' decision making on clinical laboratory testing (Brown & Brown, 2001), the participants felt that pre-operative testing was not necessary. The authors also found that more tests are ordered by doctors because of medico-legal concerns. My study confirms that doctors order additional unrequired blood testing because of worries about lawsuits. However, the fear of lawsuits is greater in

doctors practicing in rural community hospitals, and was less common among doctors working in larger hospitals.

## Trustworthiness of the Study

Issues of trustworthiness are related to credibility, transferability, dependability, and confirmability of the study. Credibility ensures that the study measures or tests what it is actually intended to assess (Mays & Pope, 2000). The extensive literature search, random sampling, triangulation, member check, negative case analysis, and peer review of the research project all help insuring the credibility of a study (Shenton, 2004). I carried out an extensive literature search for this study, recruited the participants through random selection of samples, and conducted member checks throughout the data collection. The study findings have also undergone a peer examination and scrutiny with university mentors in the dissertation process.

Transferability is the degree to which a study can be generalized (Anney, 2014). Transferability of a study could be achieved by providing thick description and performing theoretical or purposive sampling (Anney, 2014). My study findings are based on interviews of 15 doctors in three different hospital work settings of major hospitals, community hospitals, and private practices in Western New York. Because the study captures a small group of doctors in a single region in one state, it may be difficult to generalize findings of the study to other practice settings. Each hospital and practice is unique in its setup, which varies widely within and across states. All of the nuances of different hospital groups within and across different states may not have been captured in this study. While this may be a limitation, the study methodology, instrumentation, and

collection of data is detailed and the description is thick with rich data that allows for transferability of the study (see Houghton, Casey, Shaw, & Murphy, 2013).

Dependability is ensuring that the results, interpretations, and recommendations resulting from the study are based on data that can be supported and are true (Anney, 2014). This study has a good audit trail, with digital recording of audio and good record keeping of transcripts. The study findings also underwent a peer examination and scrutiny with university mentors during the dissertation process. All of this helps ensure dependability of the study (see Casey et al., 2012). Confirmability is the ability of the other researchers to confirm and corroborate the study findings (Anney, 2014). Confirmability was achieved in the study through extensive journal keeping of the data during the interviews. I will make available the transcripts of the data collected to the external observers (with redaction of personal details of the participants), if required. This will ensure the confirmability of the study.

## Recommendations

The clinical guidelines and algorithms that have been developed by the professional medical societies do not take into account individual patients' needs and hence do not work when adapted to real world settings. In the current study, doctors interviewed state that the guidelines cannot be adapted to their patients and hence they are not rooted in reality. My recommendation based on the study is to develop guidelines that can be adapted for all patients. This can be done by including a statement in the document that all information in the guidelines can be modified and adapted to the needs of patients at the local hospitals and private practice groups. This would ensure that the

guidelines promulgated are not seen as a cookbook or a one size fits all approach. Rather it would that confer autonomy to doctors. Providing this authority to doctors and local hospitals would complement the decision-making and has a better chance of acceptance (Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999).

Another recommendation is to setup local committees composed of respected doctors in the area and ask them to review the guidelines with the understanding that their recommendations will be incorporated into the local hospitals and private practices. The local committee should incorporate the views of local doctors including leeway for the adapting the guidelines and/or algorithms to individual patients. In addition, the committee doctors should provide active forms of continuing medical education regarding the guidelines to the local doctors. Active forms of continuing education may include providing regular lectures, workshops on the topics in their working environment, and educational material in form of fliers (Cantillon & Jones, 1999; Farmer et al., 2011; Mostofian, Ruban, Simunovic, & Bhandari, 2015). Although none of the studies targeting clinical blood test ordering that I reviewed specifically address this method. This form of multifaceted approach seems to have had effectiveness for guideline adherence related to prescribing medication and a reduction in the ordering of radiographs (Davis & Galbrath, 2009; Farmer et al., 2011). Because adherence to guidelines is related to a doctor's behavior, these interventions could result in success.

In recent years, professional and national organizations have developed several clinical guidelines and protocols to improve quality of care. However, all of the guidelines will be ineffective if the doctors do not adhere to them. It has been shown in

several reports and studies that changing doctor's behavior is difficult (Cabana et al., 1999; Baiardini, Braido, Bonini, Compalati, Canonica, 2009; Wilensky, 2016). Researchers have also shown that the most doctors do not adhere to clinical guidelines (Cabana et al., 1999; Baiardini et al., 2009; Ennis, 2015).

## Implications

This study has a positive social change at an individual level for the doctor and the patient. For the doctor, following clinical guidelines with modifications tailored for each patient could improve quality of care without compromising the doctor's autonomy. In the current environment, this can potentially increase the reimbursement rates for doctors because of the improved health of the patients and fewer re-hospitalizations. Further, patients will receive the best and most up-to-date, consistent care with fewer costs. Because of the well-published nature of the clinical guidelines, informed health care empowers patients.

On the organizational level (i.e., for hospitals and private practices), there can also be increased monetary incentives. Because of the standardized higher quality of patient care, there would be decreased utilization of clinical laboratory blood tests and thus a decrease in interventions and hospitalizations that happen on a regular basis based on the results. Decreases in utilization of tests, interventions, and hospitalizations would lead to considerable reductions in the costs to hospital systems, payers, and the government. The monies that are saved could be spent on other initiatives such as primary care.

Based on the literature review in Chapter 2, there is a significant amount of waste in the U.S. health care system, and clinical laboratory testing is one of the contributors to

this waste. Guidelines from hospitals and national medical academies to reduce unnecessary testing have had a minimal impact on reducing costs or compliance to reduce unnecessary testing. Current estimates are that the United States has the most expensive health care system in the world and is heading toward an unsustainable course. There has been a substantial growth in U.S. health care costs in the past two decades, with a current expenditure rate of 18% of the GDP (Squires, 2012). Health care costs have risen from a manageable 5% of the GDP in 1960 to close to 18% in 2011. Squires (2012) projects health care costs will increase to an unsustainable 20% of GDP in 2020. Squires proposes that the current costs of health care are unsustainable and will be disastrous to existing government programs such as Medicare and Medicaid. There is a tremendous amount of waste in the health care system, and as much as $2.2 trillion in additional savings over the next decade can be achieved by stopping unnecessary waste. Billions of dollars will be saved and the quality of health care would improve year after year if the targeted areas are addressed and implemented.

Berwick and Hackberth (2012) identify the overtreatment of patients as one specific area of waste. Overtreatment includes unwanted tests, procedures, and prescriptions. The authors estimate that waste adds 20% to health care costs. The approximate estimate is that between $158 billion and $228 billion in wasteful spending occurred in 2011 (Berwick and Hackberth, 2012). The elimination of the waste may lower health care costs to sustainable levels.

Norbeck (2012) identified additional factors that drive up the health costs in the United States: the rise of chronic diseases, addictions, aging population, health mandates,

defensive medicine, and expensive technologies such as lab tests and imaging studies. The Congressional Budget Office proposed that defensive medicine and malpractice insurance drive up health care costs by between 1–2% per year, which amounts to $27 to $54 billion dollars per year (Beider & Hagen, 2004). Earlier studies have pointed out that expensive technologies also contribute to cost increases in health care. Thus, to address the escalating rise in health expenditures, all factors contributing to driving health care costs need to be addressed.

Multiple reviews and independent studies support the significant contribution of clinical lab testing to health care costs in the United States. One of the main types of unnecessary costs could be preoperative testing before routine ambulatory surgeries. Programs aimed at reducing unnecessary testing could contribute significantly to reduction in wasteful spending. In a systematic review, Carlson et al. (2012) examine the indiscriminate use of lab tests in the U.S. health care system. The authors argue that the burden posed by indiscriminate use of lab tests has not been measured. As of 2007, the costs directly associated with clinical lab testing constituted about 2–3% of health care costs (Wolcott et al., 2008). However, more than 70% of subsequent treatment decisions are based on these initial lab tests (ACLA, 2007). The reduction of the indiscriminate use of laboratory testing will involve changes in organizations' quality designs and will borrow from industrial parameters such as lean and Six Sigma concepts (Carlson et al., 2012).

Zhi et al. (2013) conducted a meta-analysis of a multi-database systemic review of articles published between 1997 and 2012. The authors examine the under- or

overutilization of laboratory testing, finding that the mean rates for overutilization was 20.6%. Zhi et al. assert that overutilization during initial testing was six times higher than during repeat testing, which explained over half (54%) of the overall variability in overutilization. The authors conclude that the overutilization of lab tests varies systematically by clinical setting (initial vs. repeat), test volume, and measurement criteria. However, the authors suggest that doctors need to further analyze the reasons for overutilization during initial evaluations. Zhi et al. assert that if correct tests and fewer tests are ordered, the result may be fewer errors and better care.

## Conclusions

The role of routine clinical laboratory blood testing is important. I found that there are multiple factors affect the ordering of clinical laboratory blood testing, including patient's clinical history, presentation, and medication. The majority of the doctors in this study feel that reducing clinical blood testing will result in sub-par care for the patients. I also found that the influence of cost, affordability, and insurance on the ordering of clinical blood tests is minimal, although the of malpractice lawsuits did influence increased ordering of clinical blood tests.

While most doctors are favorable to the guidelines established by medical organizations, they feel that these guidelines are impractical and useless to their patients without major modifications.

My recommendation is to consider the views of these doctors. At the same time, increasing guideline adherence will require a multifaceted local team approach. I conclude that the review of guidelines by a committee composed of respected local

doctors local in consultation with area doctors will help. In addition, active continuing education will have a positive effect on guideline adherence and reduce unnecessary testing. The reduction of unnecessary testing will result in increased quality of care and reduced cost burdens to the health care system.

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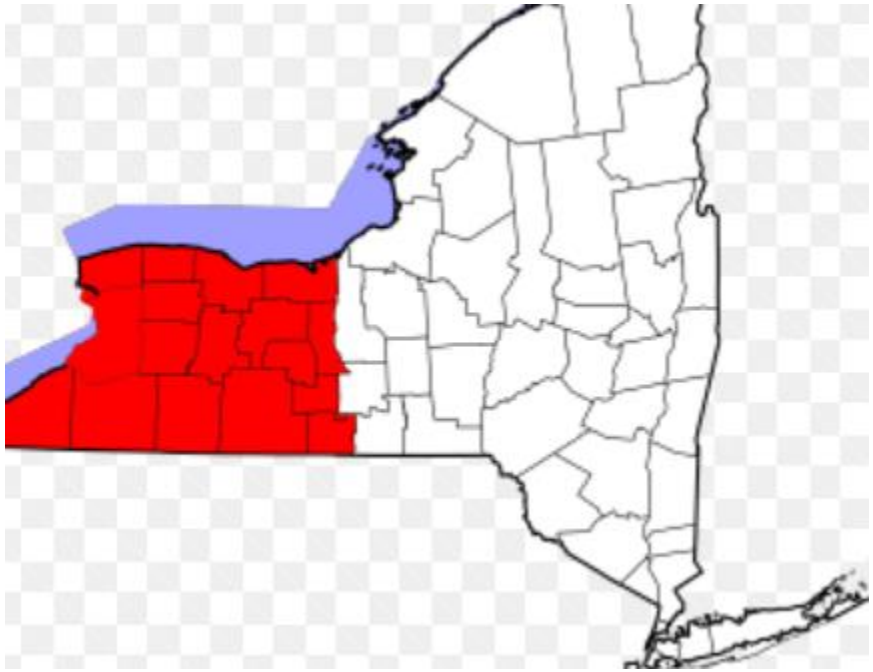
Appendix A: Map of Western New York



Legend: Western New York highlighted in red and includes Allegany, Cattaraugus, Chautauqua, Chemung, Erie, Genesee, Livingston, Monroe, Niagara, Ontario, Orleans, Schuyler, Seneca, Steuben, Wayne, Wyoming, and Yates Counties.

# Appendix B

**Literature Review: Unnecessary Testing and Cost Burden**

| Author/Date | Theoretical/ Conceptual Framework | Research Question(s)/ Hypotheses | Methodology | Analysis & Results | Conclusions | Implications for Future Research | Implications For Practice |
|---|---|---|---|---|---|---|---|
| Benarroch-Gampel et al./2012 | N/A | A study indicating that there is no need for preoperative testing in patients that are to undergo elective low risk ambulatory surgeries. | Retrospective quantitative study | In this retrospective analysis of 73,596 patients identified from National Surgical Quality Improvement Program (NSQIP) database from 2005-2010 and had undergone elective hernia repair patterns of recovery was analysis by multivariate. | More than half the patients underwent preoperative blood testing and the complication rate among these patients was 0.3%. The conclusion of the study was that the preoperative testing was overused and academies and societies of medicine should curb this practice. | Medical societies and academies role needs examining | Cost and quality implications on the health care |
| Berwick & Hackberth/2012 | N/A | N/A | Review on cost and waste in US health care | - | In their review identified six categories in which the health care waste could be cut. One of the categories identified is the overtreatment where there is a lot of unnecessary procedure and testing carried out. In theory estimate, there was between $ 158 billion and $228 billion in wasteful spending in 2011. | Waste elimination | Sustainable healthcare in USA |
| Blumenthal et al./2013 | N/A | N/A | Review | Increased growing health care cost of USA with historical perspective on why the health care costs has jumped form a small 5% of GDP in 1960 to close to 18% in 2011. | The authors provides strategies to contain the health care costs. | Factors to cut costs | Strategies to cut cost for sustainable health care |
| S. R. Brown & Brown/2011 | N/A | Interview of doctors and nurses in one hospital about pre-operative decision making | Qualitative study | Some believe pre-op testing is beneficial while most think it is wasteful | Limitation of unnecessary testing could be helpful | Detailed multicenter study to validate findings | Cost reduction |
| Card et al./2014 | N/A | This is a meta-analysis of various hospital laboratory tests and provides evidence from the literature on if certain testing are useful or not. | Meta-analysis | This is a meta-analysis of various hospital laboratory tests and provides evidence from the literature on if certain testing are useful or not. | Careful selection of testing is needed as not all procedures are necessary or useful | | Cost and quality implications |

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| Carlson et al./2012 | N/A | A systematic review of the landscape of the clinical laboratory testing and the costs that it poses to the United States health care system. | Systemic review | The review also points out that the burden posed by indiscriminate use of lab tests is not measured. As of 2007 the costs direct associated with clinical lab testing is about 2-3% of health care costs. However more than 70% of the subsequent treatment decisions are based on lab tests. | The review proposes methods in reduction of costs based on quality deigns and also utilizing industrial parameters such as lean and six sigma concepts. | The review proposes methods in reduction of costs based on quality deigns and also utilizing industrial parameters such as lean and six sigma concepts. | The review proposes methods in reduction of costs based on quality deigns and also utilizing industrial parameters such as lean and six sigma concepts. |
| Channick/2013 | N/A | N/A | Review | Increasing unsustainable growing costs of USA health care, Affordable care act and its implications | Health care costs needs to be reduced for sustaining Medicare, Medicaid and other government mandated programs | Factors to control cost | Cost control essential for a healthy long term care programs mandated by the Government |
| Chung et al./2009 | N/A | | Quantitative, randomized, single blinded, pilot study | The study concluded that there was no increase in adverse events in patients that were assigned to the no clinical testing group compared to subjects who had the clinical testing done. | There is no real value in preoperative testing in selected routine surgical patients. | Prevent unnecessary sets and cost cutting | Quality improvement and reduction in cost burden on healthcare systems |
| Feldman et al./2013 | N/A | Hypothesized that the doctors and nurses at an in-patient setting would decrease the ordering of laboratory tests of they are presented with fee schedules at the time of order entry in the lab order entry system. | The study was controlled clinical trial in a tertiary teaching hospital setting that was conducted between 2008 and 2009. | During the initial 6 month base line period of the study no fees were displayed. During the intervention period of next 6 months the fee schedule prominently was displayed while ordering the testing. A total of 61 tests were selected randomly to appear on the ordering system. The parameters that were examined were the total number of tests ordered per patients per day. In addition, the total fees/charges associated with the ordered tests were also recorded and compared between the base line and the intervention period. The rate of ordering reduced by an average of 3.72 tests per day in the intervention group where the fee schedule was displayed compared | The conclusion was that the fee schedule to the providers at the time of order entry on the screen resulted in a modest decrease in test ordering. Adoption of this method may result in a reduction of inappropriate and unnecessary testing. | Cost and quality implications | Cost and quality implications |

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| | | | | to the base line group where no fee schedules were displayed. | | | |
| Fischer /1999 | N/A | | Review | A review article that focus on guideline to eliminate unnecessary clinical lab testing. Each common tests are described and indications are also clearly described. The article also provides guidelines and cost effective methods of preoperative evaluations and address the complexity of the problem. The main focus of the article is the organizational, structural and clinical changes that are necessary for the success of the program, the merits that the program provides for the doctors, nurses, and the administrators are also discussed. | The main focus of the article is the organizational, structural and clinical changes that are necessary for the success of the program, the merits that the program provides for the doctors, nurses, and the administrators are also discussed. | Structural organizational changes need | Not only structural changes are needed there should be proper training of doctors and other staff on why changes are being made |
| Hickner et al. /2014 | N/A | The study explored the physicians on the tests ordered, and uncertainty with the ordered tests. | Randomized Questionnaire survey | A total of 1768 physicians responded to the survey. An average of 31.4% patients seen by the physicians every week had some type of clinical lab testing ordered. The physicians were uncertain about the tests that they were ordering for about 15% of the cases and had difficulty interpreting results in over 8 % of the reports received. The most important factors posing problem in ordering or not ordering test was related to costs to the patient and insurance coverage restrictions. The physician did not have tome or call clinical | The conclusions were that the physicians were uncertain about the tests order and interpretation. There are approximately n 500 million primary care patient visits per year. Taking in to the level of uncertainty reported there is a potentiall23 million patients per year who may be having incorrect testing or incorrect interpretation of test. This raises concerns about the safe and efficient use of laboratory testing. There is added concerns of incorrect management resulting in complications. All this adds to cost and lack of quality health care for the patients. | Need for physician continuing education and communication to the lab | Quality of health care and cost implications |

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| | | | | labs to find out if there are alternate testing options available. | | | |
| Johnson, & Mortimer /2002 | N/A | This is a study examining the value of routine screening of healthy patients who are admitted for routine surgeries. Anesthesia. The number of tests ordered and the costs associated with were noted | This was a prospective study of 100 patient's medical records who were undergoing selective surgical procedures under general | For the 100 patients a total of 773 tests were performed. Of the 773 tests ordered and performed 70 tests were abnormal (9.1%).The surgical management was altered with for 2 patients (0.2%). There were eight complication arising from the surgeries but none of them could have been detected based on the tests ordered before the surgery. The blood test results were present in the medical notes before the surgery in only 57% of the cases. | Based on this the conservatives estimates are that each hospitals could save over 75,000 dollars per year alone by stopping indiscriminate ordering of tests, | Methods of preventing indiscriminate tests | Cost and quality implications |
| Kelley/2009 | N/A | Review paper describing causes of waste in health care and provides strategies to cut cost | Review | There are five targeted areas for reduction in health costs. They are 1. Unwanted use 2. Reduction of fraud and abuse 3. Eliminate administrative/systematic inefficiencies 4. Eliminate clinical inefficiencies. 5.Target preventable condition and concentrate on primary care | Billions of dollars would be saved and the quality of health care will improve year on year if the targeted areas are addressed and implemented | Quality of health care impacts in implementation of programs | Cost and quality improvements |
| Khalifa and Khalid/2014 | N/A | The study utilized healthcare resources and computerized order systems to enumerate the laboratory testing over-utilization. | Retrospective study | The setting of the study was tertiary care hospital and 537,177 lab tests were ordered during the six month time period of the study from January to June 2013. | They found that more than 11% were repeated and simply not necessary as they were duplication from different departments ordering the same tests. Three tests were mainly responsible for the duplication and they were Complete Blood Count, Renal Profile and Blood Glucose. | The study recommended organizational, structural and clinical changes that are necessary for the success of the tackling of the overutilization. | The authors recommend the doctors, nurses, and the administrators need to be trained and made aware of the problem |

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| Kim et al./2011 | N/A | The study describes the utilization efforts should not be based on individual tests but as a broader management strategy. | Prospective quantitative study | They described a lab test utilization management program over a 10 year period in a large 898 bed tertiary care medical center. Some of the salient features of the program are having an institutional organizational structure to support the test utilization program, role of pathologists in leading the program and a selection tool for tests. | During the 10 year period the hospital program decreased the test utilization by 26% saving millions of dollars for the hospital system. | | Cost and quality implications |
| Krasowski et al. /2015 | N/A | simple changes to the computer ordering system and the link to electronic medical records can reduce costs | retrospective study | The study was conducted in University of Iowa a 711 bed academic medical center that serves as a tertiary/quaternary care center, starting in 2009 and completed in 2014. Test order restriction were placed on 170 send out clinical tests and required approval by pathology department. There was a reduction on ordering by 23% post implementation of this program that resulted in a direct cost savings of approximately 600,000 US dollars. | Showed that simple changes to the computer ordering system and the link to electronic medical records can reduce costs significantly to the healthcare system by preventing some of the inappropriate medical testing. | computer ordering system and the link to electronic medical records can have impact in cost reduction | computer ordering system and the link to electronic medical records can have impact in cost reduction |
| Leung et al./2015 | N/A | Cost savings from cutting preop testing and effect of training on compliance to guidelines | Quantitative study | The conclusions were that close to 70% of blood tests performed in the institution studied was not required as they did not contribute to patient care. | The preoperative tests were overused and could be reduced by training of the staff and guideline dissemination. | Replication of findings in larger institutions | Quality improvement and reduction in cost burden on healthcare systems |

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| Mancuso,1999 | N/A | | | The study by Mancuso compares the preoperative protocols followed in a hospital during elective ambulatory surgeries two years before guideline implementation and two years after the implementation. This was a quantitative pre post intervention retrospective study of 640 patients. There were 361 patients before the guideline implementation and 279 patients after the implementation. There were reduction in tests from before, (an average of 8 tests) to after implementation of guidelines (an average of 5.6). There was percentage decrease in individual tests ordered between 23-44%. More importantly there was decrease in morbidity and increase in quality of patient care. Majority of patients in the post intervention group did not suffer from any complications due to reduced testing. The new implemented guidelines were effective in reducing clinical lab testing before surgeries and did not result in increased complications for the patients. | | | |
| Maung et al./2011 | N/A | Utility of preop work up for syncope –is it needed. | Quantitative retrospective study | A total of two thousand and one hundred and seventy one patients were studied. Diagnostic work up for the patients included electrocardiograph, cardiac enzymes, echocardiogram, and carotid duplex or computed tomography angiography. Abnormal results were not common (cardiac enzymes (2.9%), echocardiogram (3.8%), and carotid imaging (4.6%)). Only 42 patients required further intervention. | The conclusion was that the diagnostic workup for syncope had a very low yield and standard testing should not be based on protocols but should be indicated from clinical information. | Routine protocols need to be revisited | Quality improvement and reduction in cost burden on healthcare systems |

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| Norbeck /2012 | N/A | | Review/White paper on factor driving up the cost | Examines the important factors in driving up the health costs in USA. Many factor that drive up the costs of healthcare are discussed such as chronic diseases, addictions, aging population, health mandates defensive medicine, and expensive technologies (lab tests, imaging studies etc.). Defensive medicine/malpractice insurances drive up the healthcare costs by between 1-2% per year ($27 - $54 billion dollars) as per the congressional budget office. Expensive technologies also contribute to a huge cost increases in health care. | To stop rising health care costs all factors need to be addressed | All aspects of health care should be examined critically | Health costs will be going down if multi factors are addressed |
| Onuoha, et al./2015 | N/A | Analyzed the incidence of unindicated preoperative testing of ambulatory low risk surgical patients. The analysis of indications for testing is based on the guidelines from American Society of Anesthesiology (ASA). | A single center retrospective cohort study | Data from 3111 patients who has ambulatory surgery at hospital over a six month period of time were analysis. The data collected included blood tests, cardiac tests, and echocardiogram. The results of the study were that more than half the patients admitted for ambulatory surgery had at least one unindicated laboratory test performed preoperatively. Up to 2/3$^{rd}$ of the blood tests (CBC, coagulation studies, and metabolic panels) were not indicated. | The conclusions form the study was that in spite of the academy guidelines from the ASA the unindicated preoperative clinical testing remained high. This is particularly troubling because the study was conducted in an academic tertiary institute. | Better studies are needed to understand the problem of overuse as this information will help in development of practical feasible solutions. | Cost and quality implications |
| Reinhardt et al./2002 | N/A | This manuscript presents and compares health and economic data from the thirty countries that constitute the organization for economic cooperation and development (OECD). One of the factors contributing to the high costs in USA health care is the technology investment in the clinical laboratory testing. | Review | USA health care is expensive and over use of technology contributes to cost | Over use but not in a prudent way as Japan has higher technology use for test but lesser cost | Cost cutting | Cost cutting |

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| Roizen/1997 | N/A | | | This is a nice editorial on the financial implications of unindicated preoperative testing and the cost savings. More importantly the editorial also touches upon the quality issues of unnecessary testing leading to unintended consequences. The complexity associated in limiting preoperative testing is also discussed. | | | |
| Schein et al./2000 | N/A | The patients who undergo cataract surgeries undergo routine preoperative medical testing. Although there have been studies showing value of preoperative testing is uncertain, this study examined the role of such testing impacted quality of care, especially intra and post-operative medical complications. | A randomized prospective quantitative study-per test and post test | A study in which 19,557 elective cataract operations in 18,819 patients in nine centers were studied. Patients were randomly assigned in to two groups: patients with clinical; tests and one without clinical tests. Medical tests performed the day of surgery and 7days on every day following the post-operative study were recorded. | The outcome was the overall complications rate (was the same in the two groups. Moreover there were also no significant differences in complication rates between the two groups indication that there is no benefit of routine clinical testing. The conclusion was that the routine medical testing does not compromise the safety or contribute to increase in safety to the patients while in surgery or 7 days after surgery. | Quality and cost implications | Quality and cost implications |
| Sethi et al./2012 | N/A | How prevalent is the practice of defensive medicine among the orthopedic surgeons across USA | Web based questionnaire survey | The study was an internet based (web based) survey of 2000 orthopedic surgeons across USA. There were 1214 respondents of which 1168 (96%) reported having practiced defensive medicine. The most common practice of defensive medicine is ordering of clinical tests that includes radiographs, CT, MRI and laboratory blood tests mainly to avoid possible malpractice liability. On average, 1/4$^{th}$ of every test ordered was for the reason of defensive medicine and had nothing to do with patient care. | The cost associated with defensive medicine per respondent was approximately $100,000 per year. This would account for over $2 billion annually for specialty of orthopedic surgery for defensive medicine. | Defensive medicine and legislation reforms needs to be assessed | Cost and quality implications on healthcare in USA |

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| Sheffield et al./2013 | N/A | There are clear guidelines from the American College of Cardiology/American Heart Association on who should be undergoing cardiac stress testing in non-elective cardiac surgery patients. The study by Sheffield et al., frequency of the cardiac stress test ordering in Medicare patients prior to non-elective cardiac surgery with no indication for cardiovascular testing. This retrospective quantitative study, the inpatient data for Medicare claims for the patient's aged over 66 years and undergoing non elective cardiac surgery and having stress tests from1996-2008 were analyzed. | This retrospective quantitative study, the inpatient data for Medicare claims for the patient's air over 66 years and undergoing non elective cardiac surgery and having stress tests from1996-2008 were analyzed. | There were a total of 211,202 patients identified and in 74,785 patients there was no diagnoses consistent with cardiac disease. | The cost of the cardiac stress test with interpretation ranges from a minimum of $92.42 for an exercise stress test with interpretation and report to $341.12 for a myocardial perfusion imaging stress test. Cardiac stress are one of the major expenses for Medicare and was 14$^{th}$ in the expenditure list in 2009 and the amount of testing is only increasing. Abnormal tests delay a surgery and further add costs to the health system. This has major cost and quality implications in management of a patients | The implications are that 4% of Medicare patients with no cardiac risk factors had a cardiac stress test prior to surgery were there were no indications. | Cost and quality implications |
| Smetana, & Macpherson/2003 | N/A | | Review | The study investigates the role all routine tests that are done before a surgery. They conclude that the routine testing is an ineffective, expensive and unnecessary before a surgery. | The patients need to be tested based on clinical history and physical findings. They also found that the physicians order the clinical lab testing because of institutional guidelines and hospital mandates. | Institutional guideline revisions and implementation | |
| Song et al./2011 | N/A | | Systemic review | | | | |
| Squires/2012 | N/A | N/A | Review | Comparison of USA health care to 13 other industrialized nations and how USA compares | USA spends the most but does not necessarily have the best health care as Japan spends the least and has the best health care | Comparison to other western countries and lessons learnt from them | Avenues to look at other country models of healthcare |

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| Vogt & Henson/1997 | N/A | | | This study examines if ordering of unindicted preoperative laboratory clinical tests are different between people who are healthy versus the people who are sick and have been scheduled to have surgery. The implications of such clinical lab testing was examined. This prospective, cross sectional study of 383 consecutive patients in a university hospital setting, and who have been scheduled for surgery. The results were that the clinical laboratory testing was not indicated in 2/3rds of the patients undergoing surgery. The cost savings for the hospital was 80,000 US dollars per year. The conclusion was that the large percentage of the clinical tests ordered is not indicated and should be eliminated it costs a lot of money to the health care system. | | | |
| Warren/2013 | N/A | UMHS is a large health care system that had 45,000 inpatient admissions, 1.8 million outpatient visits and procedures, and $4.52 billion in gross charges ibn 2012. The UMHS laboratory test program was created in 2008 with help of multidisciplinary groups including lab, pharmacy, and pathology and hospital administration. One of the critical components linking the groups was the UM-Care Link, an order entry system for inpatients, | Prospective study of lab utilization program | Reduction of costs | The overall impact of the program were that there was enormous reduction in costs and quality of health care to the health system. | Structural and organization change in cost reduction | reduction of costs |

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| Zhi et al./2013 | N/A | The inappropriate testing, which is thought to be dominated by repeat testing, is unclear. Systematic differences in initial vs. repeat testing, measurement criteria, and other factors would suggest new priorities for improving laboratory testing. | Meta-analysis | Over half (54%) of the overall variability in overutilization of clinical lab tests | The landscape of overutilization varies systematically by clinical setting (initial vs. repeat), test volume, | Underutilization is also widespread, but understudied. Avenues to understand this better | Expanding the current focus on reducing repeat testing to include ordering the right test during initial evaluation may lead to fewer errors and better care. |

# Appendix C

**Literature Review: Decision-Based Theories**

| Author/Date | Theoretical/ Conceptual Framework | Research Question(s)/ Hypotheses | Methodology | Analysis & Results | Conclusions | Implications for Future Research | Implications For Practice |
|---|---|---|---|---|---|---|---|
| Beach & Lipshitz/1993 | CDM | N/A | Review | N/A | Applications of CDM. Advantages and disadvantages. | N/A | Application of CDM |
| Dillon/1998 | Normative and descriptive theory | N/A | Review | N/A | Comparison between theory and conclusions on applicability of descriptive theory. | N/A | Practical applications. |
| Hastie & Dawes/2010 | Normative theory | N/A | Review | N/A | Relation of normative theory to clinical settings and its applicability. | N/A | Use of normative theory in practice |
| Katsikopoulous & Lan/2011 | Normative and descriptive theory | N/A | Review | N/A | Comparison between theory and conclusions on applicability of descriptive theory. | N/A | Practical applications. |
| Klein/2008 | Naturalistic decision making theory (NDM) | N/A | Review | N/A | Dynamic nature of real world and its implication on decision making and application of NDM in this context. | N/A | Dynamic nature of real world and its implication on decision making |
| Li/2009 | CDM | N/A | Review | N/A | Real life applications of CDM. Advantages, disadvantages and application. | N/A | Application of CDM |
| Lipshitz & Strauss/1997 Lipshitz et al.,/2001 | NDM | N/A | Review | N/A | Applications of NDM. Advantages and disadvantages. | N/A | Dynamic nature of real world and its implication on decision making |

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| Shabhan/2005 | Classical decision making theory (CDM) | N/A | Review | N/A | Explanation of CDM and its advantages, disadvantages and application | N/A | Application of CDM |
| Vroom & Jago/2007 | Normative theory | N/A | Review | N/A | Leadership and normative theory. | N/A | Use of normative theory in practice |
| Vroom & Yetton/1973 | Normative theory | N/A | Review | N/A | Problem solving and other characteristics associated with normative theory. | N/A | Use of normative theory in practice |
| Zsambok/1997 | CDM | N/A | Review | N/A | Applications of CDM. Advantages and disadvantages. | N/A | Application of CDM |
| Zsambok & Klein/2014 | NDM | N/A | Review | N/A | Applications of NDM. Advantages and disadvantages. | N/A | Dynamic nature of real world and its implication on decision making |

# Appendix D

**Literature Review: Prescription Theories**

| Author/Date | Theoretical/ Conceptual Framework | Research Question(s)/ Hypotheses | Methodology | Analysis & Results | Conclusions | Implications for Future Research | Implications For Practice |
|---|---|---|---|---|---|---|---|
| Bell, Raiffa & Tversky/1988 | Prescription theory | N/A | Review | N/A | Human elements, day to day problems need to be taken in to account in decision making | Validity in real world | Application in clinical settings |
| R. Brown & Vari/1992 | Prescription theory/Decision analysis | N/A | Review | N/A | Use of aids and other instruments in helping decision making | Validity in real world | Applications in clinical settings |
| French/1995 | Prescription theory | N/A | Review | N/A | Use of aids and other instruments in helping decision making | Validity in real world | Applications in clinical settings |
| French & Insua/2000 | Prescription theory/Decision analysis | N/A | Review | N/A | Structured methods of decision making | Validity in real world | Applications in clinical settings |
| Grimshaw & Russell/1993 | Prescription theory | N/A | Review | N/A | Human elements, day to day problems need to be taken in to account in decision making | Validity in real world | Application in clinical settings |
| Kahneman & Tversky/1982 | Prescription theory | N/A | Review | N/A | Deficiencies in the existing theories | New theories | Cannot use existing theories |
| Keeney/1992 | Prescription theory | N/A | Review | N/A | Human elements, day to day problems need to be taken in to account in decision making | Validity in real world | Application in clinical settings |
| Larsson/2011 | Prescription theory | N/A | Review | N/A | Human element in decision making | Validity in real world | Applications in clinical settings |
| von Winterfeldt & Edwards/ 1986 | Prescription theory/Decision analysis | N/A | Review | N/A | Use of aids and other instruments in helping decision making | Validity in real world | Applications in clinical settings |

Appendix E: Participant Interest Letter

**Factors Influencing Doctors Ordering of Clinical Lab Tests: A Qualitative Study**

Dear Doctor ……..,

You are invited to take part in a research study about factors that influence doctors in making decisions on ordering of a blood test. The researcher is inviting primary care physicians working in Western New York hospitals and practices to be in the study.

The purpose of this study is to understand the factors that influence doctors in making decisions on ordering of a blood test.

If you agree to be in this study:

- You will be asked to participate in an interview that will not last more than 20 minutes

Here are some sample questions:

- How would you describe your clinical practice?
- What is the role of clinical testing in your practice?
- How necessary is clinical testing?
- How do you feel about efforts to reduce or limit clinical testing?

This study is voluntary. If you are interested in getting more information or participation in the study please do not hesitate to contact me by phone on XXX-XXX-XXXX or email me at Lakshmanan.suresh@waldenu.edu.

Thank you for your interest.

Sincerely,

Lakshmanan Suresh DDS, MS.
Doctoral Student
School of Health Sciences
Walden University

Appendix F: Interview Guide – Possible questions

**Opening Statement: I am a doctoral student at Walden University School of Health Science, conducting research for my doctoral dissertation,**

I am performing a study on the use of clinical lab testing. I am focusing on the blood tests that are ordered.

**Questions:**

How would you describe your clinical practice?

What is the role of clinical testing in your practice?

- How do you incorporate routine testing in your practice?
- How does routine testing help your patients?
- How do you decide what test to order?
- Why do you need clinical testing on your patients?

How necessary is clinical testing?

- Do you have protocol for ordering tests? If so how did you decide this protocol?
- In protocol which of the test you will consider necessary or unnecessary?
- Is the protocol based on latest clinical guidelines and evidence based medicine?

How do you feel about efforts to reduce or limit clinical testing?

- What do you think can be done to limit clinical testing?
- Do you think limited clinical testing can be done in your practice?
- How would it benefit patients?
- How would it benefit your practice?

How do your colleagues compare with you in clinical testing?

- In your opinion, how similar or different will your views on clinical testing be compared to your colleagues?

Appendix G: Node Report 1 for All Themes

| Interview Questions | # of Documents | % of Documents |
|---|---|---|
| **Q01. Describe clinical practice** | **15** | **100%** |
| **Q02. Clinical testing your practice** | **15** | **100%** |
| a. Role of clinical testing in your practice | 15 | 100% |
| b. How incorporate routine testing | 15 | 100% |
| c. How routine testing helps patients | 15 | 100% |
| d. Factors decide what test to order | 15 | 100% |
| e. Why clinical testing on your patients | 15 | 100% |
| **Q03. Necessity of clinical testing** | **15** | **100%** |
| General necessity of clinical testing | 15 | 100% |
| How determine if test is necessary | 15 | 100% |
| Protocol or guidelines | 15 | 100% |
| Types of protocols or guidelines | 15 | 100% |
| *Based acad or evidence-based* | *115* | *1100%* |
| Yes | 12 | 80% |
| Not applicable | 3 | 20% |
| *No personal* | *9* | *60%* |
| *Formal* | *7* | *47%* |
| *Hospital protocol* | *3* | *20%* |
| *Literature and clinical experience* | *1* | *7%* |
| *National forums* | *1* | *7%* |
| Changes - adaptations | 8 | 53% |
| Review - Resources | 15 | 100% |
| Resources | 15 | 100% |
| *Conferences - Meetings* | *12* | *80%* |
| *Journals* | *11* | *73%* |
| *CME's CE's* | *5* | *33%* |
| *Hospital education lectures* | *2* | *13%* |
| *Medical update alerts* | *1* | *7%* |
| *PubMed* | *1* | *7%* |
| Physician reviews | 13 | 87% |
| Hospital committee reviews | 2 | 13% |
| **Q04. Opinion testing practices in general** | **15** | **100%** |
| Clinical guideline recommendations | 15 | 100% |
| Must modify for patients | 9 | 60% |

Appendix G Continued

| | | |
|---|---|---|
| Negative - impractical | 3 | 20% |
| Good in general | 2 | 13% |
| Neutral | 1 | 7% |
| Consequences patients face if alterations | 15 | 100% |
| Negative (Out right negative) | 7 | 47% |
| Depends (but mainly negative) | 4 | 27% |
| Not sure or unknown | 3 | 20% |
| Positive | 1 | 7% |
| Cost drives ordering of tests | 15 | 100% |
| No - cost has no effect | 6 | 40% |
| Depends | 4 | 27% |
| Yes - cost changes behavior | 4 | 27% |
| Do not know | 1 | 7% |
| Fear of malpractice | 15 | 100% |
| No additional tests | 8 | 53% |
| Yes - on occasion | 7 | 47% |
| Felt pressure to reduce or limit | 15 | 100% |
| No pressure | 12 | 80% |
| Some pressure | 3 | 20% |
| Insurance coverage and affordability | 15 | 100% |
| Coverage | 14 | 93% |
| Affordability | 5 | 33% |
| Reduction of testing in general | 15 | 100% |
| No reduction of testing | 9 | 60% |
| Some reduction of testing | 6 | 40% |

Appendix H: Node Report for Individual Case & Hospital Group Analysis

| Interview Questions | # of Documents | % of Documents | Commuity (5) | Major (5) | Private (5) |
|---|---|---|---|---|---|
| **Q01. Describe clinical practice** | **15** | **100%** | **5** | **5** | **5** |
| **Q02. Clinical testing your practice** | **15** | **100%** | **5** | **5** | **5** |
| a. Role of clinical testing in your practice | 15 | 100% | 5 | 5 | 5 |
| b. How incorporate routine testing | 15 | 100% | 5 | 5 | 5 |
| c. How routine testing helps patients | 15 | 100% | 5 | 5 | 5 |
| d. Factors decide what test to order | 15 | 100% | 5 | 5 | 5 |
| e. Why clinical testing on your patients | 15 | 100% | 5 | 5 | 5 |
| **Q03. Necessity of clinical testing** | **15** | **100%** | **5** | **5** | **5** |
| General necessity of clinical testing | 15 | 100% | 5 | 5 | 5 |
| How determine if test is necessary | 15 | 100% | 5 | 5 | 5 |
| Protocol or guidelines | 15 | 100% | 5 | 5 | 5 |
| Changes - adaptations | 8 | 53% | 3 | 2 | 3 |
| *Types of protocols or guidelines* | *15* | *100%* | *5* | *5* | *5* |
| Based acad or evidence-based | 15 | 100% | 5 | 5 | 5 |
| Not applicable | 3 | 20% | 0 | 1 | 2 |
| *Yes* | *12* | *80%* | *5* | *4* | *3* |
| *Formal* | *7* | *47%* | *3* | *2* | *2* |
| *Hospital protocol* | *3* | *20%* | *3* | *0* | *0* |
| *Literature and clinical experience* | *1* | *7%* | *0* | *1* | *0* |
| *National forums* | *1* | *7%* | *0* | *1* | *0* |
| No personal | 9 | 60% | 3 | 2 | 4 |
| Review - Resources | 15 | 100% | 5 | 5 | 5 |
| Hospital committee reviews | 2 | 13% | 2 | 0 | 0 |

Appendix H Continued

| | | | | | |
|---|---|---|---|---|---|
| *Physician reviews* | *13* | *87%* | *3* | *5* | *5* |
| *Resources* | *15* | *100%* | *5* | *5* | *5* |
| *CME's CE's* | *5* | *33%* | *1* | *1* | *3* |
| *Conferences - Meetings* | *12* | *80%* | *2* | *5* | *5* |
| *Hospital education lectures* | *2* | *13%* | *0* | *1* | *1* |
| *Journals* | *11* | *73%* | *3* | *3* | *5* |
| Medical update alerts | 1 | 7% | 1 | 0 | 0 |
| PubMed | 1 | 7% | 0 | 0 | 1 |
| **Q04. Opinion testing practices in general** | **15** | **100%** | **5** | **5** | **5** |
| Clinical guideline recommendations | 15 | 100% | 5 | 5 | 5 |
| Good in general | 2 | 13% | 0 | 1 | 1 |
| Must modify for patients | 9 | 60% | 4 | 2 | 3 |
| Negative - impractical | 3 | 20% | 1 | 1 | 1 |
| Neutral | 1 | 7% | 0 | 1 | 0 |
| Consequences patients face if alterations | 15 | 100% | 5 | 5 | 5 |
| Depends | 4 | 27% | 1 | 2 | 1 |
| Negative | 6 | 40% | 2 | 2 | 2 |
| None or unknown | 3 | 20% | 1 | 1 | 1 |
| Positive | 1 | 7% | 1 | 0 | 0 |
| Unspecified effect | 1 | 7% | 0 | 0 | 1 |
| Cost drives ordering of tests | 15 | 100% | 5 | 5 | 5 |
| Depends | 4 | 27% | 2 | 0 | 2 |
| Do not know | 1 | 7% | 1 | 0 | 0 |
| No - cost has no effect | 6 | 40% | 0 | 4 | 2 |
| Yes - cost changes behavior | 4 | 27% | 2 | 1 | 1 |
| Fear of malpractice | 15 | 100% | 5 | 5 | 5 |
| No additional tests | 8 | 53% | 1 | 4 | 3 |
| Yes - on occasion | 7 | 47% | 4 | 1 | 2 |

Appendix H Continued

| | | | | | |
|---|---|---|---|---|---|
| Felt pressure to reduce or limit | 15 | 100% | 5 | 5 | 5 |
| No pressure | 12 | 80% | 5 | 3 | 4 |
| Not asked | 1 | 7% | 0 | 0 | 1 |
| Some pressure | 2 | 13% | 0 | 2 | 0 |
| Insurance coverage and affordability | 15 | 100% | 5 | 5 | 5 |
| Affordability | 5 | 33% | 2 | 1 | 2 |
| Coverage | 14 | 93% | 4 | 5 | 5 |
| Reduction of testing in general | 15 | 100% | 5 | 5 | 5 |
| No reduction of testing | 9 | 60% | 2 | 3 | 4 |
| Some reduction of testing | 6 | 40% | 3 | 2 | 1 |