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Physician Participation in Crowdsourcing: Effect of Intrinsic and Extrinsic Motivation

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Abstract

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MBA, University of St. Thomas – Houston, 1989

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Physicians must participate in developing medical protocols to ensure that medical best practices are adopted for patients' social benefit. Healthcare leaders have struggled to gain sufficient physician participation in developing medical protocols. Using technology-based crowdsourcing to assimilate knowledge from physicians may help healthcare managers improve medical protocol development. Using self-determination theory, this quantitative causal-comparative design aimed to determine whether differences in intrinsic and extrinsic motivation existed among the 132 participating physicians who did or did not participate in developing medical protocols in a crowdsourcing environment. Participants were recruited by e-mail through an independent physician association. Motivation levels were measured by the Aspirations Index via an online survey. A total of 55.3% of respondents participated in developing medical protocols. Differences were anticipated in the levels of participation in developing medical protocols between intrinsically and extrinsically motivated physicians. Rank correlations were computed between the number of protocols completed and all of the motivation scores. *Personal growth* and *community contribution* were significantly correlated with the number of addressed protocols. Positive social change may occur through improving medical protocols and healthcare outcomes by informing healthcare leaders about physicians' motivation to participate in developing medical protocols. By understanding these motivators, leaders can highlight the benefits of protocol development to encourage physician participation. If participation is enhanced, protocol quality and healthcare effectiveness may be improved, benefitting patients and healthy individuals.

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Chapter 1: Introduction to the Study

Crowdsourcing is emerging as a model of distributed labor connected through technology, including for use in developing medical protocols. Of particular interest in these pages is the motivation among physicians to participate in designing medical protocols in a crowdsourcing environment. The lack of physician participation in developing medical protocols has been a management challenge for hospital leaders. According to Brabham (2008), crowdsourcing is an emerging model that provides a distributed approach to problem solving, design, and collaboration through using technology. Although these methods may be appropriate for physicians and healthcare leaders in developing medical protocols, research on this promising subject is lacking. This study focuses on the differences in motivation among physicians who participate and do not participate in a crowdsourcing environment. The understanding of differences in motivation among physicians may help hospital leaders develop management strategies that encourage physician participation in developing medical protocols.

Healthcare leaders use crowdsourcing to engage physicians in developing medical protocols, as evidenced by the target population of this study. Developing crowdsourced medical protocols offers healthcare leaders an alternative to traditional medical staff management approaches to medical protocol development. Additional research is necessary to determine whether crowdsourcing is a more efficient means of protocol development. A formal approach to medical protocol development is required to adapt care practices to emerging medical evidence (Balser et al., 2004). Inefficiencies in developing, distributing, and revising medical protocols have been attributed to the

fractured nature of medical protocol design and management. Indeed, practitioners find medical protocols to be "multi-interpretable, incomplete, and even inconsistent" (Balser et al., 2004, p. 104).

The prospect of using a technology-based, distributed process of protocol development through physician crowdsourcing offers an alternative to healthcare leaders seeking to improve broad participation by medical staff members. Broad participation will result in a more comprehensive review of the medical literature and develop a community standard for medical care. The management challenge faced by hospital leaders to encourage physician participation may be lessened by understanding these differences in physician motivation.

In this chapter, I provide information on the background of the study, problem statement, research questions, and hypotheses. I used a quantitative research design to examine whether differences existed in the intrinsic and extrinsic motivation among physician participants and nonparticipants in crowdsourcing medical protocols. I present self-determination theory (SDT) as the appropriate theoretical foundation for explaining physicians' intrinsic and extrinsic motivation in a crowdsourcing environment. Definitions of key concepts and terms, along with an explanation of assumptions, scope, delimitations, and limitations follow. This chapter concludes with a narrative on the significance of the study and potential for positive social change.

Background of the Study

Medical protocols guide physicians and other clinicians in providing healthcare in a manner that results in high-quality medical practices and effective patient outcomes.

Healthcare leaders must encourage physician participation in developing medical protocols. The historical ineffectiveness of healthcare leaders to guide the development of medical protocols presents a management challenge.

According to Marcos, Balser, ten Teije, van Harmelen, and Duelli (2003), medical protocols are "systematically developed statements to assist practitioners and patient decisions about appropriate healthcare for specific circumstances" (p. 132). Historically, the process of developing protocols is an informal collaboration, led by healthcare leaders, to encourage physician volunteers to create protocols resulting in ambiguous community standards of care, loosely based on the clinical evidence available at the time (Marcos et al., 2003).

If they can identify the level of intrinsic and extrinsic motivation among potential physician participants, healthcare leaders can invite, promote, and design crowdsourcing opportunities in a way that is attractive to physician participants. Increased physician participation should improve the efficiency of medical protocol development. In turn, the development of accurate and efficiently produced medical protocols should improve the delivery of healthcare and provide a significant social benefit to individuals and employers. Crowdsourcing offers the prospect of using technology as an alternative management approach to creating protocols.

However, research on using crowdsourcing among physicians for developing medical protocols is necessary. This study addresses a gap in the literature by examining levels of intrinsic and extrinsic motivation among physician participants and nonparticipants in a crowdsourcing environment.

Problem Statement

The management challenge faced by healthcare leaders in developing comprehensive, evidence-based medical protocols is magnified by the fractured nature of the medical staff organizational structure. Ten Teije et al. (2006) characterized the management approach used by healthcare leaders as informal and ineffective when managing their interactions with physicians. The authors proposed a more formal approach to assimilate the task of developing medical protocols. The prospect of using technology to assimilate knowledge from individual physicians in a cohesive manner that promotes cooperation may be possible using a crowdsourcing approach for developing medical protocols. Crowdsourcing, as a technology-based form of cooperation, may formalize the informal approach described by ten Teije et al. and address the present management deficiency of healthcare leaders related to protocol development. Crowdsourcing is an emerging business model that uses distributed labor to problem solve (Brabham, 2008) and is examined in this study as an alternative management tool. Researchers have assessed crowdsourcing related to business production efficiencies, organizational effectiveness, participant connectivity, and motivating factors (Brabham, 2008; Busarovs, 2011; Yuen, King, & Leung, 2011; Zheng, Li, & Hou, 2011). However, relevant research on a crowdsourcing model for physician development of medical protocols is lacking. I provide a review of recent crowdsourcing research in Appendix A.

Crowdsourcing uses technological connectivity to organize work and promote problem solving among individual laborers. The physician group I examined used crowdsourcing to create medical protocols. If healthcare leaders can understand

differences in intrinsic and extrinsic motivation among physician crowdsourcing participants and nonparticipants—and attract more participants through that understanding—they may increase participation in developing medical protocols. This understanding may be improved if healthcare leaders examine physician inclination to participate in the crowdsourcing of medical protocols by examining physician aspirational motivation toward *wealth*, *fame*, *image*, *meaningful relationships*, *personal growth*, *community contribution*, and *good health.* Improvements to medical protocols would have the social benefit of enhanced healthcare outcomes. I describe further the prospect of a positive social benefit later in this chapter.

Purpose of the Study

The purpose of this quantitative comparative study was to determine whether differences in intrinsic and extrinsic motivation exist between physicians who did and did not participate in the medical protocol crowdsourcing project. Specifically, I examined whether differences existed between the independent variables of intrinsic and extrinsic motivation domains, as measured by the seven categories of motivation within the aspirations index (AI), in the dependent variable of crowdsourcing participation, operationally defined as the number of crowdsourcing medical protocols worked on by an individual physician respondent (Gountas, Gountas, Reeves, & Moran, 2012). Detecting differences among physicians related to motivations may inform the management challenge faced by healthcare leaders to encourage physician participation in developing medical protocols.

The AI was used to measure intrinsic and extrinsic motivation using seven

categories of motivation. Appendices B and C contain the survey questions and scoring key. Extrinsic motivators included wealth, fame, and image. Intrinsic motivators included meaningful relationships, personal growth, community contributions, and good health. However, good health has been a subject of debate in the literature, with some researchers arguing that it can embody elements of both extrinsic (looking good) and intrinsic (being healthy) motivations (Kasser & Ryan, 1996). For this study, good health was considered an intrinsic motivation, in keeping with the original use of the AI survey (Kasser & Ryan, 1996). Respondents were asked to rate the aspirational items regarding their importance, the likelihood they would attain the aspiration, and the extent to which they had already attained the aspiration. Kasser and Ryan, as well as Vansteenkiste, Lens, and Deci (2006), presented validations of the AI tool with alphas ranging from .72 to .89.

The present study appears to be the first use of the AI related to motivation to participate in a crowdsourcing project and the first instance of the use of the AI related to a physician population. The extant literature on crowdsourcing consisted primarily of demographic investigations of crowdsourcing participants, explanations of the model, establishment of taxonomy, and case studies regarding the use of crowdsourcing, as seen in Appendix A.

Research Questions

The following research questions framed the examination of differences between intrinsic and extrinsic motivation among physician participants in developing medical protocols in a crowdsourcing environment. Responses were captured through an online survey using the AI scale. I used the following research questions to frame the research:

- Does *wealth*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *fame*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *image*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does the presence of a *meaningful relationship*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *personal growth*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *community contribution*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *good health*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?

Hypotheses

Null hypothesis (H_0): Physician motivation toward *wealth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_1): Physician motivation toward *wealth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *fame* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_2): Physician motivation toward *fame* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *image* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_3): Physician motivation toward *image* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *meaningful relationships* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_4): Physician motivation toward *meaningful relationships* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *personal growth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_5): Physician motivation toward *personal growth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *community contribution* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_6): Physician motivation toward *community contribution* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *good health* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_7): Physician motivation toward *good health* does predict the number of medical protocols worked on in a crowdsourcing environment.

Theoretical Foundation

Self-determination theory (SDT) was used as a framework to explain the intrinsic and extrinsic motivation of physician participation in the crowdsourcing of medical protocols. To date, SDT does not appear in the literature as a theory used to describe physician motivation in a crowdsourcing environment; therefore, this study appears to address a gap in the body of knowledge related to crowdsourcing participation among physicians.

SDT: Origin and Overview

Deci and Ryan are credited by researchers with the origination of SDT as an explanation of motivation (Gountas et al., 2012). Their theory distinguished between intrinsic and extrinsic motivations. Intrinsic, or self-determined, motivations were considered internal to the self, causing an individual to act out of a sense of internal reward such as enjoyment of a task, a desire to help others, personal growth, or desire for health. Extrinsic motivation emanated from a sense of external reward such as fame, status, monetary reward, or personal appearance (Gountas et al., 2012).

Intrinsic motivation has been defined in the literature as motivation from an inherent pleasure and personal satisfaction for completion of the task (Gountas et al., 2012). Extrinsic motivation has been described as a goal-focused drive resulting from an external source. Intrinsic and extrinsic motivation influence individual intentions, in turn influencing behaviors. I present a more thorough examination of intrinsic and extrinsic motivation, within the framework of SDT in Chapter 2.

SDT and Physician Crowdsourcing

I sought to identify differences among physician characteristics and levels of participation in medical protocol development using a crowdsourcing platform. As mentioned above, I used SDT to frame an explanation of physician intrinsic and extrinsic motivation related to participation in this crowdsourcing environment. SDT holds that the motivation to participate in an activity derives from intrinsic or extrinsic motivation (Deci & Ryan, 2012). Therefore, SDT was appropriate for the present study to determine whether participation in the crowdsourcing of medical protocols by physicians varied in relation to the level of intrinsic or extrinsic motivation as measured by the subscales in the AI.

I used SDT to examine the proposed research questions. Specifically, intrinsic and extrinsic motivation within SDT served as a means of examining differences in motivation between physician participants and nonparticipants in the crowdsourcing of medical protocols.

Nature of the Study

A quantitative, causal-comparative design was used to examine differences between the independent variables of motivation using seven motivations as measured by the AI. The study examined a population of physicians who had previously participated in an ongoing crowdsourcing project sponsored by a physicians' organization. A single dependent variable was measured to indicate the extent of crowdsourcing participation measured by the number of medical protocols worked on by the physician. The presence of a selected, nonmanipulated independent variable made this causal-comparative design

a suitable approach for the study (Schenker & Rumrill, 2004). Causal-comparative design is well suited for incorporating a continuous dependent measure, such as the dependent variable of the number of medical protocols worked on by physicians invited to participate in a crowdsourcing project (Schenker & Rumrill, 2004).

A survey was used to capture previous levels of participation in this crowdsourcing project. As an area lacking in previous research—and due to the nature of inquiring about past practices—a quantitative, causal-comparative design was deemed appropriate for this study than a qualitative or mixed method design. A qualitative approach was appropriate to the effort to comprehend the meaning given to a problem. The focus of this study was to understand correlations between motivations and participation, rather than the meaning of either. A case can be made for the use of a mixed methods design for future studies on crowdsourcing to strengthen the body of research. However, it was appropriate to first determine the presence—if any—of the ability for motivations to predict participation through a quantitative regression analysis. If a predictive direction is present, a mixed model may later be helpful in deepening understandings of why motivation has an influence over participation in crowdsourcing.

Methodology Description

The entire physician population of a selected Independent Practice Association (IPA; with at least 12 months of membership) was invited to participate in an online survey using the AI. This population consisted of more than 2,000 physicians with a variety of medical specialties. The 12-month parameter for participation in the study controlled for previously uninvited physicians.

Physicians were invited via e-mail by the president of the target Independent Physician Association (IPA) to participate in an online survey accessible via a hyperlink in the invitation e-mail. The hyperlink directed physicians to a SurveyMonkey® online questionnaire. The e-mail invitation asked physicians to complete the survey within 2 weeks. At the end of the first week, the president sent a reminder e-mail to the entire physician population that had received the initial invitation. This second e-mail thanked those physicians who had completed the survey and invited those who had not to complete the survey within 1week. The anonymous nature of survey participation did not allow for the reminder to go only to those who had not completed the survey after Week 1.

Multiple regression analyses were applied to the data to examine intrinsic and extrinsic motivational differences in crowdsourcing participation. This approach was in keeping with Vallerand and Bissonnette (1992), who asserted that intrinsic and extrinsic motivations serve as predictors to future behavior. In previous applications of the AI, a higher order factor analysis and regression analysis was used to determine motivational aspirations among adults (Gountas et al., 2012). This study used a regression analysis approach, in keeping with the Vansteenkiste, Duriez, Simons, and Soenens (2006) approach to researching motivation using the AI.

In the present study, the use of a regression analysis was appropriate given the desire to determine differences between the motivational factors in the AI and the dependent variable of participation. Chapter 3 presents an additional explanation of the proposed multiple linear regression approach used in this study.

Independent Variable Description

For the current investigation, seven independent variables yielded a continuous score for each motivation using the AI. The motivation subscales were wealth, fame, image, meaningful relationships, personal growth, community contributions, and good health expressed in the form of a personal aspiration (Kasser & Ryan, 1996). The AI categories of wealth, fame, and image were considered extrinsic motivators. The remaining categories—meaningful relationships, personal growth, community contribution, and good health—were considered intrinsic motivators. The AI asked participants to rate the seven motivational aspirations according to the importance of the aspiration, the respondent's belief that he or she would attain the aspiration, and the degree to which he or she had already attained the motivational aspiration (Kasser & Ryan, 1996).

Dependent Variable Description

Participation in the medical protocol crowdsourcing program served as the single dependent variable. Participation was measured by the number of medical protocols worked on, if any, by a physician in the target IPA. When examining self-determined motivation, a researcher may find confounding effects that influence levels of motivation. Such underlying effects were not examined in this causal-comparative study; however, their potential for influencing the findings is recognized in the limitations section of this chapter.

Definition of Terms and Abbreviations

Aspirations Index (*AI*)*:* Survey tool used in study to measure intrinsic and extrinsic aspirations as indicators of motivation.

Crowdsourcing: An outsourcing of an organization's internal tasks to external individuals using technology (Zheng, Li, & Hou, 2011). In the current study, the extent of crowdsourcing participation served as the dependent variable—measured by the number of medical protocols worked on, if any.

Crowdsourcing participation: Participation by a physician in the development of at least one medical protocol using the crowdsourcing methodology examined in the study. The number of medical protocols worked on, if any, served as a single dependent variable in the study.

Extrinsic motivation: Extrapersonal stimuli such as money, recognition, external threat, or promise of reward that affects a desire to work or to fulfill an aspiration. Extrinsic motivation was measured by three subscale categories of the AI, consisting of wealth, fame, and image, which served as additional independent variables for the study (Deci & Ryan, 2008).

Independent Physician Association (*IPA*): A legal entity comprised of physician members organized for the purpose of addressing quality and safety concerns, contracting financial reimbursement arrangements, and providing strategic oversight to physician network development. An IPA serves as the target population of this study.

Intrinsic motivation: A motivation to perform an activity for the reward of performing or completing the activity (Deci & Ryan, 2012). Intrinsic motivation was

measured by four subscale categories of the AI, consisting of meaningful relationships, personal growth, community contributions, and good health, which served as independent variables for this study. The seven motivational categories of the AI were used as independent variables and defined by the respondent in the survey based on his or her understanding of the survey question. For example, the respondents defined the variable of wealth through their understanding of the statement: *To be a very wealthy person.* The related questions and scoring key for the questions are in Appendix B and Appendix C. The independent variables drawn from the AI included wealth, fame, image, meaningful relationship, personal growth, community contribution, and good health.

Self-determination theory (*SDT*): The theoretical framework used in this study to describe the characteristics and relationships between intrinsic and extrinsic motivations.

Study Population: Physicians

Examining the relevant literature indicated the uniqueness of this project's study of a physician population in a crowdsourcing environment. Physicians are a particular population given their status as experts, their level of education, social status, and the relatively unexamined nature of the population within the motivation literature.

The study population was a preexisting group of physicians within an established organization, the IPA. According to Schenker and Rumrill (2004), a causal-comparative design is appropriate for the study of variables representing a preexisting group. When ethical constraints make the manipulation of variables impractical or inadvisable, the causal-comparative model serves as an appropriate nonexperimental model. In the present study, an ethical dilemma would exist if an experimental model required

unmotivated physicians to create medical protocols that may be substandard to the product of highly motivated colleagues. Additionally, the manner in which a hospital medical staff governance committee must approve medical protocols prior to implementation precluded the experimental manipulation of protocols.

In this study, the entire physician membership of a large IPA was used as the study population. The physicians represented multiple medical specialties and practiced in a major metropolitan area in the southern U.S. Physician members with greater than one year of membership in the IPA were invited to participate in the study; approximately 2,000 physicians met this criterion. An invitation was sent by the president of the IPA encouraging the target population to participate in this online study.

Assumptions

Selecting the study population from the IPA entailed the assumption that members of the IPA were representative of physicians at large. The size of the population suggested that members were representative; however, unknown factors may have existed that predisposed physicians to participate in an IPA—or, more specifically, drew physicians to membership in the selected IPA, which was associated with a specific healthcare system in a defined geographical location. No literature supported or disclaimed the potential for these confounding variables to influence IPA membership.

It was assumed that all physicians with membership in the IPA had access to technology that allowed them to participate in the crowdsourcing of medical protocols. This assumption seemed reasonable given that the health system associated with the IPA

used an electronic medical record, and physicians must have access to a computer to access their patients' records.

Scope and Delimitations

This study sought to identify differences in intrinsic and extrinsic motivation among a selected physician population related to its participation in the crowdsourcing of medical protocols. This focus was chosen to enable healthcare leaders to improve the effectiveness of medical protocol development by predicting physician participation. Crowdsourcing may present an opportunity to improve the effectiveness and quality of medical protocol development only if physicians participate. This information may enable healthcare leaders to identify potential crowdsourcing participants among a physician population for participation in future medical protocol projects as well as to frame the benefits of participation to recruit future participants.

The present study used an online survey tool to capture physician responses. SurveyMonkey® is an appropriate means of collecting data, as recommended by Allard, Dason, Lusis, and Kapoor (2012). Motivations within the framework of SDT and as measured by the AI were used to explain the differences in intrinsic and extrinsic motivation, if any, between physicians who participated in the crowdsourcing of medical protocols and physicians who did not. There was the potential for survey participation to vary among physicians who participated in the subject crowdsourcing project and those who did not; however, inviting the entire population of more than 2,000 physicians to participate reduced the risk of not having a significant level of participation from either group.

No causation was implied given the ex post facto nature of this causal-comparative study; however, the examination of relationships between independent and dependent variables was appropriate as predictive indicators to identify physicians who were inclined to participate in the crowdsourcing of medical protocols or to express the benefit of participation to attract future participants. Statements of causation were avoided in the findings so as to not make generalizations regarding physician behavior. This study established a basis for future experimental and nonexperimental studies related to crowdsourcing participation among physicians.

Limitations

The nonexperimental design of this study introduced limitations and weaknesses that would not have existed in a pure experimental approach. Specifically, the study used a causal-comparative design that did not include the manipulation of independent variables, but was well suited for the initial examination of relationships not previously examined in a significant manner (Schenker & Rumrill, 2004). A causal-comparative design facilitated the examination of variances between and within preexisting groups without depending on statements of causation to describe the relationships (Schenker & Rumrill, 2004). In keeping with that parameter, this study was limited to the examination of the levels of physician intrinsic and extrinsic motivation related to participation in a crowdsourcing project. Conclusions of causation were avoided due to potential confounding effects. For example, the use and level of familiarity a physician had with the technology employed in crowdsourcing may have presented a confounding effect that precluded a statement of causation. Additionally, inherent inefficiencies or barriers to

participation related to the subject IPA might have dissuaded physicians to participate, introducing an additional confounding factor.

To improve the causal-comparative design, Dannels (2010) cautioned that care be taken to (a) describe the data collection approach, which in this case was an online survey; (b) employ a priori theory to frame the study, which in this study was SDT; (c) be precise in the application of statistical tools; and (d) avoid statements of causality.

The use of an online survey included benefits related to convenience, controlled sampling, efficient data calculation, control of answer order, speed, global reach, and accessibility; however, some limitations must be considered (Evans & Mathur, 2006). The necessity of using a computer and software may have skewed the participant pool to a particular characteristic or reaction to the tool. The online survey may have been viewed as impersonal, thus resulting in low response rates. Privacy issues may have been of concern to a respondent, thereby influencing his or her response or participation. Finally, online survey respondents are unable to ask for clarification regarding questions (Evans & Mathur, 2006).

Significance of the Study

Developing medical protocols has been found to be an inefficient process (Marcos et al., 2003). Crowdsourcing was reported to be an appropriate model for online collaboration and problem solving (Zheng et al., 2011). This study sought to advance the body of knowledge related to the use of crowdsourcing among physicians for creating medical protocols. Improvements to efficiency and effectiveness in the development of medical protocols may occur through crowdsourcing if healthcare leaders can persuade

physicians to contribute their experience and knowledge to the development of protocols. In doing so, the quality of patient care may benefit from such collaboration among physician peers, thereby creating a positive social change.

Positive Social Change

The prospect of crowdsourcing as a venue for medical protocol development holds the possibility of creating positive social change in the healthcare industry if leaders understand what motivates physicians to participate in these efforts. To date, developing medical protocols is difficult given the fragmented nature of medical staff organizations in the hospital setting (Marcos et al., 2003). Healthcare leaders must provide oversight of medical staff credentialing and the assurance of quality medical care delivered by physician members. Traditionally, each medical staff member has operated as an independent practitioner using preferred protocols taught in his or her medical school and residency training.

It is difficult or undesirable for independent physicians to meet routinely and discuss medical protocols given the time commitment and the lack of reimbursement for such a task. The advent of technology-based, distributed labor arrangements through crowdsourcing has allowed physicians to work independently from their homes or offices at times that are convenient for their schedules. Crowdsourcing models may connect colleagues in a way not previously supported by the traditional medical staff structure.

If healthcare leaders can persuade a broad representation of physicians to use crowdsourcing to develop protocols that represent the medical consensus of a hospital staff or medical community, variations in medical treatment might be reduced.

Crowdsourcing might also promote the identification and adoption of best practices in clinical care, which could lead to improved precision in treatment and improved outcomes, and hold the prospect of minimizing waste, reducing cost, improving clinical outcomes, and improving the health status of patients. Such improvements may generate positive social change by improving the health status of communities, particularly if healthcare leaders create improvements in efficiency and delivery of healthcare in cooperation with physicians. The ability to predict physician participation in medical protocol development through crowdsourcing appears to be the first step in assisting healthcare leaders in the further exploration of the medical and social benefits of a more efficient approach to protocol development.

Summary

The challenge faced by healthcare leaders in developing comprehensive, evidence-based medical protocols is magnified by a fragmented medical staff organizational structure. The prospect of using technology-based crowdsourcing to assimilate knowledge from individual physicians—in a cohesive manner that promotes cooperation—might be possible by using a crowdsourcing approach to creating medical protocols; however, healthcare leaders must first persuade physicians to participate in these undertakings.

Crowdsourcing uses technological connectivity to organize work and problem solving among distributed pools of labor. The organization reviewed in the present study used crowdsourcing to create medical protocols. If healthcare leaders can identify physicians with a high likelihood of participating in the crowdsourcing model or express

the benefits of participation in a way that resonates with the aspirations of physicians, the development of medical protocols may be improved and accelerated.

Chapter 1 outlined the use of this causal-comparative study within the context of SDT to examine whether differences in intrinsic and extrinsic motivation among physicians predict participation in the crowdsourcing of medical protocols. This research is important to assisting healthcare leaders in persuading physicians to participate in developing medical protocols using a crowdsourcing approach and to express the benefits of participation. If healthcare leaders can promote this commitment, the development of medical protocols will demonstrate improved efficiency.

Chapter 2 expounds on the concept of crowdsourcing and the framework of SDT as an explanation for physician participation in a crowdsourcing environment. As a distributed labor model, the target physician population has used crowdsourcing to develop medical protocols. SDT appears to be a suitable framework to explain this participation as it provides an examination of why some physicians participated in the crowdsourcing or medical protocols in the target population and others did not. Chapter 2 further explicates the topics of intrinsic and extrinsic motivation within the framework of SDT.

Chapter 3 describes the study's research methodology. A causal-comparative research design was used to deploy an online survey to examine differences in intrinsic and extrinsic motivation among physician participants and nonparticipants in the crowdsourcing of medical protocols. A regression analysis was used to examine the differences among the independent variables of physician motivation against the

dependent variable of the extent of physician participation in developing medical protocols. Chapter 3 also includes a discussion of the population and sample used, the hypotheses studied, and the specific methodology relevant to the study.

Chapter 4 reports the results of the research and examines the findings as a partial explanation of medical protocol crowdsourcing participation. Given the use of a causal-comparative design, no causation was stated or implied in this study; however, differences among the independent variables of physician motivation between physician participants and nonparticipants are noted.

The dissertation concludes with Chapter 5, which presents a summary, discussion, conclusions, and recommendations. The ex post facto nature of the research design served as the basis for the initial examination of differences in motivation among physicians who participated in the crowdsourcing of medical protocols and those who did not. To address previously unexamined differences among physician motivation, recommendations for additional research are provided.

Chapter 2: Literature Review

This literature review provides an overview and explanation of three components of the research: (a) the concept of crowdsourcing, (b) the management challenge of medical protocol development, and (c) the framework of SDT with an emphasis on intrinsic and extrinsic motivation. Specifically, I address problems inherent in developing medical protocols. I also review literature on crowdsourcing applicable to developing a formalized process that improves the management practices of healthcare leaders.

Although the crowdsourcing literature in other research settings is adequate and even growing, the literature related to physician participation in the crowdsourcing of medical protocols is lacking. Only limited medical crowdsourcing references are available, primarily in the area of patient input and reporting, which is not directly applicable to the present study. The research related to other applications of crowdsourcing is noted in Appendix A.

The theoretical foundation of SDT was used in this study as a framework through which the intrinsic and extrinsic motivations of physicians were examined in relation to using crowdsourcing as a mechanism for medical protocol development. Using SDT to explain the motivation of physicians appears to be unique to this study. Foundational papers, as well as recent research related to SDT, are presented here to describe physician motivation in a crowdsourcing model. I present the rationale for selecting SDT as a foundational theory for examining this unique population, and I present the application of the theory to crowdsourcing.

Finally, I discuss the ethical and social implications of using crowdsourcing for the development of medical protocols. I present the potential for positive social change and the benefit to healthcare leaders as a means of steering the efficiency of protocol development toward improved consistency and effectiveness in the delivery of healthcare services.

Literature Search Strategy

Material in the literature review consisted of peer-reviewed scholarly research. I used recent scholarly publications from the last 5 years; however, I also included older publications containing seminal literature.

I accessed a variety of databases online through the Walden University Library database, in some cases originating with Google Scholar, but using the Walden proxy to access the documents. The sources included Business Source Complete, Academic Search Complete, arXiv, CINAHL Plus, and PubMed. Keyword searches focused on *crowdsourcing*, *crowdsource*, *crowdsourced*, *physician crowdsourcing*, *medical protocols*, *medical guidelines*, *practice guidelines*, *self-determination theory*, *evidence-based medicine*, *co-creation*, *physician motivation*, *intrinsic motivation*, and *extrinsic motivation*.

As indicated in Appendix A, the body of literature on crowdsourcing is expanding; however, the literature regarding the use of crowdsourcing for medical protocol development or the use of crowdsourcing among physicians is still minimal. As a supplementary approach, the I included in the search parameters articles regarding the motivation of individuals to participate in crowdsourcing, as well as general articles

related to definitions and uses of crowdsourcing. I uncovered no research related to using SDT to describe the motivation of physicians to participate in crowdsourcing. Therefore, I sought to address a portion of that gap in the literature. A summary of sources I used in the literature search is found in Table 1.

Table 1

Summary of Sources I Used in the Literature Review

Reference type	Total	Less than 5 years old	More than 5 years old
Peer-reviewed journals	151	140	11
Non peer-reviewed journals	1	1	0
Report of conference proceedings	4	0	4
Books	3	3	0
Total	159	144	15

Problem and Purpose: Crowdsourcing of Medical Protocols

Medical protocols have been found to be imprecise and difficult for physicians to develop with consensus and consistency (Balser, Teije, Harmelen, & Duelli, 2004). Healthcare leaders have been informal in their management approach related to protocol development, and ineffective in improving physician participation in protocol development (ten Teije et al., 2006). However, increased physician participation in developing medical protocols is necessary in the interest of improving evidence-based medicine (Balser et al., 2004). The habitually disjointed nature of medical protocol development might be redressed by distributing labor among physician experts in a crowdsourced environment.

Brabham (2008) described crowdsourcing as a distributed labor model that deploys technology to create an environment of collaboration suitable for organizing work among disparate individuals. Crowdsourcing among physicians may be an appropriate approach for creating medical protocols; however, getting physicians to participate in protocol development was found to be challenging (Balser et al., 2004). The existing literature has a gap in research related to the question of motivational differences among physicians to participate or not participate in the development of medical protocols within a crowdsourcing model. This study proposed intrinsic and extrinsic motivation as independent variables in the framework of SDT to explain physician motivation to participate, as the dependent variable, in developing crowdsourced medical protocols.

Physician participation in the crowdsourcing of medical protocols was not evident in the literature; however, Zheng et al. (2011) have examined motivation among crowdsourcing participants in general. Zheng et al. found that intrinsic motivation is more important in gaining crowdsourcing participation than extrinsic motivation. Specifically, the intrinsic motivators of autonomy and variety of tasks correlated with high levels of crowdsourcing participation. In the present study, intrinsic and extrinsic motivation among physicians was examined as a predictor of participation in a medical protocol crowdsourcing project.

Within SDT, the concepts of intrinsic and extrinsic motivation may serve as a framework for identifying physicians who are likely to participate in developing crowdsourced medical protocols. If crowdsourcing participation varies according to a

physician's intrinsic and extrinsic motivation, then healthcare leaders might be able to invite physicians in a manner that resonates with those motivations and encourages physicians to participate in the development of medical protocols. By understanding the motivations of this unique population, invitations to participate in the crowdsourcing of medical protocols might be highlighted to encourage future physician participation.

Synopsis of Relevant Literature Regarding the Problem

The limited research regarding motivation in crowdsourcing was characterized by (a) 2 × 3 experimental designs to manipulate the perceived purpose of crowdsourcing participation (Rogstadius et al., 2011), (b) experimental studies manipulating payment amounts in a crowdsourcing platform (Horton & Chilton, 2010), and (c) experiments to measure ethics as a motivation in crowdsourcing (Harris & Srinivasan, 2012).

Kaufmann, Schulze, and Viet (2011) used a similar approach to the method employed in the present study by administering the Job Diagnostic Survey (JDS), a 13-construct questionnaire, to examine the intrinsic and extrinsic motivation to participate in Amazon's Mechanical Turk crowdsourcing platform. The 13 constructs were aggregated under the motivational dimensions of *enjoyment*, *community*, *immediate payoff*, *delayed payoff*, and *social motivations*. A dependent variable in the Mechanical Turk study was used as a measure of participation and was calculated as the average hours per week spent on Mechanical Turk projects. The study reimbursed participants for completion of the survey. Cronbach's alpha reliability ratings for the questionnaire resulted in values ranging from .735 to .938, which were considered satisfactory for validation of the tool. Demographic variables such as age, nationality, employment

status, and income were also evaluated in the research. In general, intrinsic motivation was found to be the dominant motivator for participation in Mechanical Turk crowdsourcing projects.

The JDS was considered for use in the present study but was rejected due to a lack of compatibility between the survey scope and the scope of this study. The JDS is a robust format that is sensitive to work conditions, task variety, and skill levels. In this study, there is uniformity among working conditions, the task is singular in purpose, and the skill level of the unique population is at the *expert* level for all participants. AI was seen as a more suitable measure involving an expert population of physicians in an ex post facto model. Elaboration on the benefits of using the AI in the current investigation is provided in Chapter 3.

Management of Medical Protocol Literature

The management approach of healthcare leaders has been criticized as lacking formality related to managing physician involvement in the development of medical protocols (ten Teije et al., 2006). This informal management style was found to be ineffective given the complex nature of medical protocol development. However, management support was found to have a significant effect on physicians' positive attitude toward using technology-based solutions protocol and documentation solutions (Abdekhoda, Ahmadi, Gohari, & Noruzi, 2015). The use of crowdsourcing for developing medical records by physicians, as a technology-based solution, may be an effective management approach if healthcare leaders support physicians in this endeavor.

The context in which healthcare managers develop medical protocols with the assistance of the medical staff is a microcosm of the overall organizational dynamic found in healthcare. Specifically, achievements within a healthcare organization rely on the ability of managers and physicians to coordinate their efforts toward a common goal (Crainich, Leleu, & Maweon, 2011). Physicians are increasingly called upon to enter into management activities primarily related to the quality and safety of patient care (Pawlson, 2014). These quality and safety initiatives, which serve as the core concern within medical protocol development, have historically been within the primary managerial oversight of healthcare leaders. At the same time physicians are increasing their participation in these historically management activities, they are hesitant to act as managers for fear of losing their professionalism and autonomy (Moller & Kuntz, 2013). This conflict between managers and physicians adds to the management challenge of incorporating physicians within the development of medical protocols.

Balser et al. (2004) noted a reduction in medical practice variations among physicians using an agreed-on set of medical protocols within a community; however, evidence regarding the effectiveness of medical protocols was lacking. For the purposes of the present study, the evidence of reduced variations in medical treatments, as asserted by Balser et al., was considered important and supported a presumption that protocols are otherwise effective and desirable among physicians and healthcare leaders. However, the present study did not seek to establish the effectiveness of medical protocols. The definition of medical protocols in this study is in keeping with the Balser et al. guidelines using an optimal course of care and treatment as defined by physician colleagues in a

defined setting. The intent of these protocols was assumed by the researcher to be the improvement of medical outcomes.

A review of the pertinent literature indicated that a weakness in medical protocol development occurs with a physician's inability to stay current with emerging evidence related to medical practices and outcomes (Balser et al., 2004). In general, protocols were found to undergo revisions every 3 to 5 years, yet medical evidence is continually produced (Balser et al., 2004). The static nature of medical protocols was found to create difficulties in organizing physician collaboration to review and draw conclusions regarding the evidence, as well as in the inefficient means by which protocols are disseminated. Balser et al. called for the creating of "living guidelines" (p. 103) characterized by continual updates by the physician community based on emerging evidence. Balser et al. proposed changes to the protocol development process to incorporate "computer-based support" (p. 103). The crowdsourcing of medical protocols may serve as computer-based support from which physician participants can create continually revised medical practice guidelines.

Marcos et al. (2003) noted a correlation between medical protocols and high quality healthcare. They warned, however, that an increase in medical protocol production does not correlate with an increase in the quality of the protocol. They viewed a high quality protocol as one that is clear and evidence based. Marcos et al. noted ambiguity, inconsistency, and incompleteness as descriptors in the existing body of protocols. This conclusion was in agreement with the Balser et al. (2004) view that

medical protocols are often incomplete and written to inadvertently allow multiple interpretations, thus leading to inconsistency in treatments within a medical community.

Marcos et al. (2003) asserted that employing medical protocol criteria to standardize the development process is useful, but that the use of development criteria falls short of creating consistent protocols. Informal processes and inaccurate notations regarding the narrative and exchange between physician protocol developers precluded medical protocols from achieving a high degree of precision and effectiveness. Energy and attention in past efforts to manage the protocol development process focused on the difficulties of disseminating protocols at the expense of gathering evidence of the effectiveness of protocols (Marcos et al., 2003). In the present study, a formalization of the protocol development process was proposed using crowdsourcing as a suitable method for protocol development and dissemination.

Examining the differences in intrinsic and extrinsic motivation among physician participants and nonparticipants of an existing crowdsourcing project was the intent of this study. An understanding of these differences may help healthcare leaders modify their management practices to identify physicians who are likely to participate in the crowdsourcing of medical protocols, and highlight the benefits of participating in recruiting future physician participants.

Theoretical Foundation: SDT

SDT was used as an appropriate theoretical framework to describe the intrinsic and extrinsic motivation of physicians participating in a crowdsourcing environment. With a research tradition of more than 30 years, SDT was viewed as an acceptable theory

for explaining motivation, primarily in the workplace, and was well suited as a theoretical foundation for the present study (Gountas et al., 2011).

As a theory empirically based in human development and well-being, SDT explains different types of motivation using the categories *intrinsic* and *extrinsic* (Deci & Ryan, 2012). The theory asserts that differences in individual perceptions related to internal and external controls create a bias toward how those events or influences are interpreted, thereby creating a generalized trait that introduces a bias related to the individual's behavior (Hagger & Chatzisarantis, 2011).

The presence of self-determination in an individual hinges on the distinction of whether an individual acts according to his or her own volition (intrinsic motivations) or in response to an external control (extrinsic motivation) or pressure (Deci & Ryan, 2012). As an individual acts according to intrinsic or internally held motivations, he or she is believed to progress toward self-determined behavior by fulfilling the need for competence, relatedness, and autonomy (Vallerand, Pelletier, & Koestner, 2008).

Deci and Ryan (2012) described intrinsic motivation as the desire to perform an activity for no other reason than the enjoyment of performing the activity. Extrinsic motivation is seen as the desire to perform an activity based on external pressure, incentive, or reinforcement caused by external rewards such as money, status, praise, or fear of punishment. However, external forces—such as verbal praise—may encourage intrinsically motivated behavior. A continuum of motivations emerges to form SDT and establish a relationship between intrinsic and extrinsic motivation (Deci & Ryan, 2012).

Extrinsic motivation has been known to confound creativity by withholding information for competitive gain within a win-lose construct (Stuhlfaut, 2010). Extrinsic motivation values the means to an end, such as winning a competitive challenge that affords recognition and prestige. Alternatively, the intrinsically motivated individual is attracted to noncompetitive activities that present personal challenges and foster enjoyment. Through these personal challenges, individual competence increases, thereby enhancing the intrinsic enjoyment of the participant (Stuhlfaut, 2010).

Origins and Foundations of SDT

Deci and Ryan (2008) are been credited with the formation of SDT as a means of explaining motivation as intrinsic and extrinsic. Motivation has been defined within SDT as the influence to move toward the completion of a task. Intrinsic or self-determined individuals pursue goals such as community service, health, personal development, and positive affiliations (Vansteenkiste, Lens, & Deci, 2006). External forces such as achievement of fame and status, financial success, and personal appearance were found to influence extrinsic or external motivation. Amotivation was identified as a lack of intent to act (Vansteenkiste, Lens, & Deci, 2006).

External factors were found to influence intrinsic motivation. Hagger and Chatzisarantis (2011) noted that factors such as negative feedback and external rewards negatively affected intrinsic motivation. External influences shifted the locus of causality for the intrinsically oriented person, thereby creating an external control. These forces undermined the autonomous nature of intrinsic motivation as long as they were present as a controlling influence (Hagger & Chatzisarantis, 2011). Intrinsic and extrinsic

motivation were seen less as opposite poles than as a continuum whereby the two motivational types coexist at various points, suggesting a complex relatedness between the two motivational categories. For example, when an individual performed a task as motivated by an external force, but the motivation had intrinsic origins, the value of performing the task was congruent with the individual's personal or intrinsically held values. The intrinsically motivated individual internalizes the extrinsic motivation (Deci & Ryan, 2008). This internalization is compartmentalized for a set of behaviors and effectively reduces the self-determination or intrinsic motivation of the individual.

Intrinsic motivation was found to be positively influenced by constructive external events. These events increased a sense of personal agency and choice. External events were seen as informational or controlling in so far as they related to their effect on intrinsic motivation (Hagger & Chatzisarantis, 2011). Discussion of additional distinctions between intrinsic and extrinsic motivation as applicable to physicians in a crowdsourcing environment follows.

Self-Determination Metamodel

Although often referred to as a single theory, SDT is akin to a "metamodel" (Roche & Haar, 2013, p. 2) of subtheories. This metamodel includes component theories on aspirations, motivations, mindfulness, and context, which address the three basic needs of autonomy, competence, and relatedness (Deci & Ryan, 20008). SDT proposes that individuals have an innate desire to integrate a sense of self with their experiences (Leroy, Anseel, Garnder, & Sels, 2012). The theory considers competence, autonomy, and relatedness to be universal needs. However, critics have argued that the definitions

and desire to achieve autonomy, competence, and relatedness differ by culture (Church et al., 2013). In that regard, Church et al. asserted that a universal desire to fulfill competence, autonomy, and relatedness is unsubstantiated.

The SDT metamodel is comprised of four subtheories: (a) basic need theory, (b) organismic integration theory, (c) causality orientation theory, and (d) cognitive evaluation theory. I created Figure 1 to show those relationships.

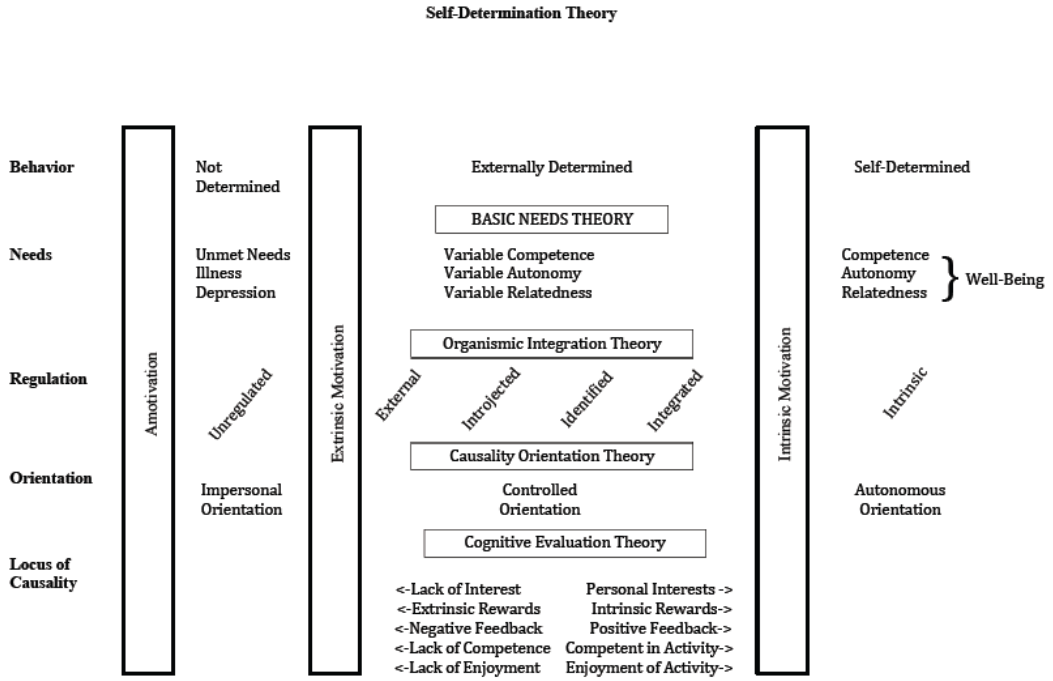

Figure 1. Four subtheories of SDT.

Each of the four subtheories is briefly described in the following sections, starting with basic needs theory as the underlying framework for the description of intrinsic and

extrinsic motivation as used in the present study. The remaining subtheories follow in the descriptions.

Basic needs theory. In SDT, a self-determined perspective develops when one seeks to gratify the psychological need for competence, relatedness, and autonomy, which Deci and Ryan (2008) considered universal needs. Autonomy is the freedom to act without coercion, competence is feeling fully capable of acting, and relatedness is a sense of connectivity with others in those actions (Deci & Ryan, 2008).

The absence of a sense of competence, relatedness, or autonomy was found to result in a lack of wellbeing or in illness (Deci & Ryan, 2008). This illness can progress from mental depression to physical illness correlated with a state of amotivation, or absence of motivation. As an individual gains a sense of competence, relatedness, and autonomy, extrinsic motivations are replaced by increasing levels of intrinsic motivation. When these three needs are fulfilled, individuals are able to achieve a sense of well-being.

Organismic integration theory. The second subtheory that forms the metamodel of SDT is organismic integration theory (OIT). In OIT, a continuum of extrinsic motivations ranges from amotivation, or the lack of an intention to act, to integrated regulation, an external motivation with some intrinsic personal values—yet not fully intrinsic due to a desire for an external reward (Vansteenkiste et al., 2006). Integrated regulation was found to occur in response to an internal pressure caused by an external reward or punishment rather than by intrinsic motivation. According to OIT, extrinsic motivation does not derive from an inherent interest in performing a task, but rather

comes from the value of respect or praise by another or an external reward or punishment (Vansteenkiste et al., 2006).

Causality orientation theory. The third SDT subtheory is causality orientation theory (COT), which relates most directly to the application of SDT in a crowdsourced environment to explain physician motivation. Within SDT, a person's motivations, experiences, and behaviors are viewed through a lens of social context and the inner abilities and determinations that he or she develops over a lifetime. COT is used to describe these inner resources, which are believed to be relatively stable over time and serve as an indication of the origin of regulation and initiation of action (Vansteenkiste et al., 2006).

An individual with a causality orientation views behavior within the social context in three broad categories that provide a description of self-determination: (a) autonomy or intrinsically motivated behavior based on self-interest or internally held values such that the value of the activity and self is integrated; (b) controlled or extrinsically motivated behavior that results from external controls or directives; and (c) impersonal orientation, also called amotivation, which is a lack motivation or intention to pursue an activity. Hagger and Chatzisarantis (2011) found that a causality orientation is "an interpersonal bias that moderates the effects of environmental factors that support or thwart intrinsic motivation" (p. 487).

Cognitive evaluation theory. The fourth subtheory within SDT is cognitive evaluation theory (CET), which holds that events, activities, or interactions that produce feelings of competence in an individual satisfy the need for competence and thereby

increase intrinsic motivation (Hagger & Chatzisarantis, 2011). Interesting challenges, supportive feedback, and the absence of demeaning comments facilitate the promotion of competence, and subsequently, increase intrinsic motivation. As a caveat, competence was not found to increase intrinsic motivation unless accompanied by a sense of autonomy defined as the ability and desire to choose (Hagger & Chatzisarantis, 2011). Therefore, deadlines, threats, and narrow directives diminished a sense of competence and intrinsic motivation.

If motivation predicts physician participation in the crowdsourcing of medical protocols, CET may explain why physicians with a personal interest in medical protocol development—as well as a sense of competence and enjoyment about protocol development—may be more suited to participation in a crowdsourcing environment. Alternatively, extrinsic rewards may detract from intrinsically motivated participation in medical protocol development (Hagger & Chatzisarantis, 2011).

SDT and the Workplace

Rogstadius et al. (2011) proposed that management theories and other measures of work motivation should be examined through the lens of intrinsic and extrinsic motivation. Extrinsic motivation was found to influence an individual through forces or things of value external to the person, such as money or verbal praise. When a work activity was undertaken to obtain an external goal or value, the motivation was considered extrinsic. Alternatively, intrinsic motivation emanated from a sense of personal satisfaction or reward derived from the work itself rather than from an externally held value or external reward.

When compared with employees with an intrinsic work motivation, extrinsically motivated employees were found to be less satisfied, dedicated, and energetic regarding their work (Vansteenkiste et al., 2010). Extrinsically motivated workers were less happy with their overall lives than intrinsically motivated workers (Deci & Ryan, 2008). An extrinsically motivated perspective of work correlated with low levels of job dedication, low vitality toward work, and low job satisfaction. A positive correlation existed between extrinsic motivation and conflict between work and family, emotional stress, and high turnover (Vansteenkiste et al., 2010). Intrinsically motivated workers demonstrated more innovative behavior than did primarily extrinsically motivated employees (Chen, Wu, & Chen, 2010). Job satisfaction among intrinsically motivated workers improved with positive feedback and the ability to use a variety of skills (Ramalingam & Adil, 2010). Raising the status of the worker's role and the provision of positive feedback improved job satisfaction among extrinsically motivated workers.

Sheldon and Kasser (2008) found that extrinsically motivated workers reported more frequent experiences of negative moods than did intrinsically motivated individuals, and were less satisfied with their lives and not as well adjusted psychologically. An extrinsic orientation in life, according to Sheldon and Kasser, was prompted by the presence of "consumerism, status seeking, and appearance" (p. 37) in modern society. They proposed that individuals were drawn to an extrinsic point of view when faced with psychological threats causing feelings of anxiety, threats to safety, medical disorders, lack of control, and mental stress. Sheldon and Kasser added:

> What stands out across these studies, then, is that when people are threatened existentially, economically, or interpersonally, they orient more towards goals such as financial success, popularity, and image and less towards goals such as personal growth, affiliation, and community contribution. (p. 43)

Research by Parker, Jimmieson, and Amiot (2010) noted that intrinsically motivated workers, when given extensive control over their work environment and efforts, experienced high levels of work engagement defined as dedication to their work. Extrinsically motivated workers experienced more health complaints and less work engagement than did intrinsically motivated workers.

Intrinsic and extrinsic motivations were found to have a dependent relationship such that extrinsic elements of motivation influenced intrinsic motivations and vice-versa. For example, according to Deci and Ryan (2008) monetary incentives offered to intrinsically motivated individuals reduced their motivation to perform the task compared to motivation levels without monetary incentives. The presence of extrinsic incentives or threats, such as money or deadlines, shifted the individual from an intrinsic base of motivation to an extrinsic base, thereby undermining the outcomes of the intrinsically motivated. Other sources of extrinsic motivation with a detrimental effect on the intrinsically motivated individual included supervisory directives, competition, and the threat of job loss (Deci & Ryan, 2008).

SDT in Healthcare

Although research regarding SDT in a healthcare environment was, the available research focused on applications related to work, education, sports, and parenting (Leroy

et al., 2012). Current SDT research was primarily focused on the motivation of patients to enter into—and remain compliant with—prescribed healthcare routines (Deci & Ryan, 2012). Patient compliance was high for patients with a high degree of intrinsic motivation (Ng et al., 2012).

A focus on psychological needs—versus an approach that viewed behavior as a result of environmental forces—distinguished the SDT literature from other motivational theories and improved the ability for SDT to be applied in a wide variety of applications (Vallerand, Pelletier, & Koestner, 2008). SDT was used as a theoretical framework in research regarding clinical trials, survey research, and experimental studies (Ng et al., 2012). Additionally, examples of research on SDT training for physicians reported improved physician support of patient autonomy and control (Deci & Ryan, 2012). SDT was found to be relevant to the physician and patient relationship as a means of addressing the ethical obligation perceived among practitioners to support patient autonomy and choice (Deci & Ryan, 2012).

Haivas, Hofmans, and Pepermans (2012) reported that volunteering, in general, was associated with intrinsic motivation and the development of a positive social self-concept and a strong motivation to serve. Creating choice in volunteer assignments increased feelings of autonomy among volunteers. Additionally, the concept of relatedness, in the context of SDT, was effective in increasing the wellbeing of volunteers (Haivas et al., 2012). These findings may inform the intrinsic motivation of physicians to voluntarily participate in developing medical protocols.

Although not directly related to physicians, self-determination research involving experts may be relevant. As a unique population, physicians accumulate high levels of expertise in a narrow body of knowledge. Experts display unique decision-making processes and constructs compared to nonexperts. Specifically, experts were found to make similar decisions over the course of training and practice that improved their recall and problem-solving abilities, thereby developing a strong uniform pattern of behavior (Markland, Ryan, Tobin, & Rollnick, 2005). This pattern of decision making tended to make it difficult for experts to change behavior even in the presence of evidence supporting change.

Research has indicated that experts were inflexible with respect to knowledge in their domain and unwilling to easily accept and act on new knowledge (Markland et al., 2005). The more frequently an expert used his or her knowledge, the more pronounced the correlation was between the development of habits and hesitancy to risk professional reputation for being inaccurate. As a result, experts remained in a fixed pattern of decision making. These research findings may be relevant to physicians as medical experts in a crowdsourcing environment in which they are asked to evaluate and use emerging evidence-based medical research to develop protocols. An unwillingness to participate in medical protocol development may be, in actuality, an unwillingness to depart from an entrenched expert opinion. The findings of this research recognized that cautionary possibility.

Nature of Motivation

Distinct from other theories of motivation, SDT does not see motivation as a universal force to be measured in intensity along a continuum of no motivation to maximum motivation. Instead, the theory contends that a categorization of motivation is driven by an individual's sense or desire for relatedness, autonomy, and competency (Hagger & Chatzisarantis, 2011). Extending beyond what might be measured as the quantity of motivation, SDT focuses on the quality of the motivation (Vallerand et al., 2008). In this sense, individuals with a high degree of intrinsic motivation were more adaptive in their ability to integrate with work and society. According to Deci and Ryan (2008), the presence of intrinsic motivation was found to correlate with higher levels of employee satisfaction, dedication, and energy. A distinction was made in SDT between motivation and behavior. Motivation was considered a psychological predisposition within an individual that determined the behavior of the individual (Vallerand et al., 2008). Motivation influenced behavior but was not an outcome measured by a performance indicator.

SDT proposes that intrinsically motivated or self-directed individuals hold the prospect of achieving higher levels of motivation as well as gaining a deeper sense of well-being (Roche & Haar, 2013). The intrinsically motivated individual regulated a sense of self in a manner that increased competency for a task. This finding is in keeping with Deci and Ryan (2008), who supported the corollary condition that extrinsically motivated individuals have lower levels of wellbeing.

Physician Motivation and Clinical Practices

Having healthcare leaders understand physician motivation helps them manage physician impact on the cost and quality of healthcare (Majmudar, Jain, Chaudry, & Schwartz, 2010). Some commonalities in motivation among physicians were demonstrated in the literature. Physicians were motivated by their desire to provide high quality medical care to their patients. Physicians not only hoped to be excellent for their patients, but also manifested a competitive drive to be the best physician compared to their physician peers. For a change in behavior to occur, physicians wanted personal control over the change process. Sanctions and punishment enacted by a nonphysician healthcare leader were ineffective in promoting change in behavior among physicians. Financial incentives to change behavior were ineffective when the desired outcome was contrary to what the physician deemed to be high quality healthcare. During periods in which physicians considered changing practice patterns, retaining personal autonomy was their primary concern, thereby thwarting many outside change efforts (Majmudar et al., 2010).

The research to date regarding physician motivation was limited to the observation of external change factors. Furthermore, research that examined internal physician motivations to participate in the development of medical protocols was lacking. The present study sought to examine those differences in motivation in a crowdsourcing environment.

Physician Motivation and Computer Use

Crowdsourcing, as a technologically-based model for problem solving, is dependent upon the use of computers. Computer use by physicians is relevant to the proposed use of crowdsourcing to develop medical protocols. Mitchell, Gagne, Beaudry, and Dyer (2012) noted that SDT is an appropriate construct for explaining a physician's perceived ease of using computers. Information technology (IT) use was found to influence a physician's belief and attitude toward computer technology and the purpose of using the technology. Technology acceptance among physicians increased relative to the perceived usefulness of the information obtainable online and the speed at which the physician was able to navigate the online resource.

Higher degrees of perceived autonomy within the SDT construct positively correlated to the use of IT among physicians. The extent to which IT utilization was enjoyed and willingly used positively correlated with high levels of intrinsic motivation and negatively correlated with high levels of external regulation (Mitchell et al., 2012). This finding was in keeping with SDT, which holds that enjoyment and willing participation in an activity is the result of a participant fulfilling his or her universal need for autonomy, relatedness, and competence (Deci & Ryan, 2008).

Personal acceptance of an IT system was reported as a necessary condition for the successful application of IT solutions within an organization (Mitchell et al., 2012). The "pleasurable experience" (Hassenzahl, Diefenbach, & Goritz, 2010, p. 353) of IT use correlated with fulfilling the three universal needs of SDT: autonomy, relatedness, and competence. The present study expands on the findings of Mitchell et al. to examine

differences among physician levels of self-determined motivation and their participation in the crowdsourcing of medical protocols.

Specific to physician utilization of IT, the use of an electronic medical record was the subject of significant research. Although not directly related to physician participation in crowdsourcing medical protocols, some of the research insights were applicable. Egea and Gonzalez (2011) reported a correlation between the acceptance and use of IT by physicians and the perceived reliability and integrity of the IT system to produce accurate information. This perceived trust and ability to mitigate the risk of incorrect information influenced the physician use of IT applications for patient care.

Physician acceptance of technology was deterred by an aversion to computer use if it required a change in practice patterns—without sufficient evidence as to the benefits of incorporating the computer-driven change (Holden, 2010). No difference in computer use was seen among physicians regarding demographic factors such as age, gender, years in practice, or medical specialty (Walsh, Kefi, & Baskerville, 2010).

Braun (2013) reported that computer and Internet use among adults was encouraged by several factors: (a) the user's perception regarding ease of use, (b) the usefulness of information or outcome of the computer use to the participant, (c) the participant's level of trust in the Internet site being accessed, (d) the positive occasions of previous use of the technology or Internet site, and (e) the frequency of technology or Internet site use. Regardless of age, the intention to use IT was higher among individuals with high expectations of IT performance than among those with low expectations (Braun, 2013).

Hsia, Chang, and Tseng (2012) found ease of use to have a positive effect on computer use. The measure of "computer self-efficacy" (p. 6)—in other words, an individual's self-assessment of his or her computer skills and ability to accomplish a technology-based task—was positively correlated with computer use. Positive self-efficacy had a positive effect on perceived ease of use of computers.

The current research literature noted several barriers to IT use among physicians. Specifically, perceived limitations of hardware and software capability, slow processing speed, limited typing skills, and insufficient training were cited as barriers to physician use of computer technology (Holden, 2010).

Significant improvements in computer use among the general populous resulted in improvements in the ease of use of computers as well as the availability of technology (Braun, 2013). Given the more universal appeal and prevalence of computer technology, the present study considered physicians to be part of the general populous of computer users and assumed that independent variables—such as a physician's familiarity, ease of use, availability, and proficiency—were not applicable for this broad examination through a causal-comparative model. Physicians routinely used computer technology to enter information into patient records and order medical tests for their patients in the IPA under study. For that reason, as well as the supporting literature, variables related to computer use were not considered in this study.

SDT and Crowdsourcing

The study of intrinsic and extrinsic motivation related to crowdsourcing was lacking in the body of research. Kaufman, Schulze, and Veit (2011) found that extrinsic

motivation in the form of financial remuneration and social status were present in technology-based crowdsourcing, and influenced the time spent among users of popular crowdsourcing platforms such as Amazon's Mechanical Turk. Their research focused on paid crowdsourcing tasks and evaluated extrinsic motivators. Financial rewards motivated crowdsourcing participation more so than did securing social status. The entertainment value of the crowdsourcing task followed financial gain and produced a positive motivation to participate (Kaufman, Schulze, & Veit, 2011).

Applicable Objections to SDT

Caution is advised in defining intrinsic motivation as internally motivated and extrinsic motivation as externally motivated without allowing for interaction between the categories. Kaufman, Schulze, and Veit (2011) noted that only intrinsic motivation was found to be purely internally motivated. This caution supports OIT, which holds that a continuum of motivation exists between intrinsic and extrinsic motivation such that some extrinsic motivations derive from internal or intrinsic influences.

A natural inclination to be self-determined or intrinsically motivated may create conflicts when individuals experience external forces and attempt to balance their sense of self with their actions in relation to external integration in a social setting (Kaufman et al., 2011). Conflict results when, faced with extrinsic pressures, an individual seeks to (a) fulfill a sense of competence toward work-related activities; (b) fulfill a sense of relatedness, or a feeling of being supported by coworkers; and (c) creates a sense of autonomy that one is able to initiate his or her own work from an internal motivation (Leroy et al., 2012). As intrinsic needs are met through work, employees perceive

work-related behavior to be congruent with their sense of self, even in the presence of extrinsic motivators.

According to Leroy et al. (2012), SDT has been criticized in the literature for stating that intrinsically motivated individuals are prone to withdrawal from social environments. On the contrary, intrinsically motivated individuals were found to be effective at personal interactions with others as well as adept at processing information with openness and a sense of tolerance (Leroy et al., 2012). When presented with the underlying need for task completion, SDT held that intrinsically motivated workers demonstrated higher levels of motivation and engagement. Context fostered an internalization of the attractiveness and value of performing the task, according to Morgan and Robinson (2013). This internalization improved when a worker was granted the autonomy to perform the task as desired. When an organizational habit of providing information, context, and autonomy was a routine organizing principle of work, individuals were "harmoniously passionate" (Liu, Chen, & Yao, 2011, p. 295) about the work and experienced a sense of integration between the purpose of their work, the manner in which they accomplished their work, and self-identity.

Justification of SDT

The intent of this study was to determine differences among the levels of intrinsic and extrinsic motivation and the extent of crowdsourcing participation among physicians in developing medical protocols. In keeping with research conducted by Kasser and Ryan (1996), the AI was used to determine differences in intrinsic and extrinsic motivation among participants and nonparticipants in a crowdsourced medical protocol project.

The findings of this study may be useful in assisting healthcare leaders to identify motivations contributing to physician participation in medical protocol development. An intrinsically motivated physician's ability to influence the creating of protocols, thereby improving medical care in a manner in which his or her contribution to the cause as a competent physician is accepted by colleagues, may hold the promise of promoting acceptance of the protocols. However, the perception of competence and acceptance by colleagues of the completed protocols were outside the scope of this study and are suggested as topics for future study.

Literature Review Related to Key Variables and Concepts

A literature review related to crowdsourcing and the development of medical protocols was conducted in relation to the theoretical concept of SDT. What follows is a summary of the availability of the literature and a conceptual overview related to the key concepts and variables of this study.

Crowdsourcing

Growing evidence has indicated that Internet technology is proving to be an effective means of distributing labor on a global basis (Zheng, 2011). This technology-enabled distribution of labor is referred to as crowdsourcing. The construct of crowdsourcing of medical protocols was used as an application of this technological distribution of labor in this study.

The term *crowdsourcing* was coined by Jeff Howe (2006) in an article for *Wired* magazine to identify an economical labor pool with the ability to create content, offer solutions, and research questions through the distribution of labor using a technological

means. Since the publication of the *Wired* article, the increasing ability for technology to connect disparate individuals has dramatically expanded.

In the crowdsourcing model, the traditional distinction between producer and consumer blends (Ye, Pingping, Jia, & Jiang, 2012). Integrating customer feedback and redesign as a process of cocreation between consumer and producer adds value to the innovation process and eventual economic exchange (Wexler, 2011). Sites related to Internet crowdsourcing are abundant. Table 2 shows a sample of popular crowdsourcing sites categorized by the nature of the crowdsourced task.

Table 2

Crowdsourcing Platform Examples

Crowdsourcing site	Emphasis	Website address
iStock Photo	Photographers upload and sell photos, illustrations, and videos for a range of fees dependent on use of media.	www.istockphoto.com
99designs	Independent graphic designers are paired with customers to design web elements, logos, and apparel for a fee.	www.99designs.com
Amazon Mechanical Turks	Individuals are paired with requestors of human intelligence tasks for a per-task fee. Tasks include categorization of terms, ranking of data, data search, and proofreading.	www.mturk.com
Waze	Participants provide real-time information on traffic and road conditions that are integrated with a mapping system to alert other drivers.	www.waze.com
Kickstarter	Crowdfunding site that hosts projects for individuals to make donations toward the completion of inventions, movies, musical recordings, and civic projects.	www.kickstarter.com

Common traits among crowdsourcing sites include problem solving as an alternative method to traditional approaches that rely on internally generated organizational solutions. This shift to externally informed solutions was considered a significant contribution of crowdsourcing (Afuah & Tucci, 2012).

Artificial intelligence is an area that may be disrupted by crowdsourcing. For Corney et al. (2010), crowdsourced technology held the prospect of creating a "black-box" (p. 243) for human reasoning that could replace current efforts to program technology to think like and for humans. As a perpetual source of information and judgment, crowdsourcing was described as a repository of thought that is always available. Although Corney et al. recognized instances in which artificial intelligence was more efficient, they viewed crowdsourcing as a supplement to artificial intelligence for difficult or complex decisions. The expansion of crowdsourced resources of artificial intelligence could positively influence the design of medical protocols in the future, but was outside the scope of this study.

Components of crowdsourcing. The success of crowdsourcing as an external source of solutions and creative production was reported to be predicated on (a) the clarity of the problem or goal definition; (b) the extent to which external problem solvers or contributors had access to the crowdsourcing site; and (c) the degree to which the problem or goal could be organized in modules, allowing for a collaboration of solutions (Afuah & Tucci, 2012). Corney et al. (2010) described the intent of crowdsourcing as an effort to (a) improve products or services; (b) evaluate data, products, or services; or (c) organize data, objects, narrative, and information. The reimbursement models for

crowdsourcing included status recognition, membership access, monetary reward, the earning of points, or ownership rights in products or services.

Definitions of crowdsourcing. Definitions of crowdsourcing in the research literature varied in scope and audience. The definitions encompassed external contributors, such as interested parties, customers, or clients, or a company using crowdsourcing as an internal mechanism for distributed labor to solve problems, complete tasks, or create and improve products and services (Zheng, 2011).

A key issue among the definitions of crowdsourcing was evident in the debate over whether *open-source* projects (Corney et al., 2010) are considered crowdsourcing. Open-source projects organize disparate individuals to collaborate on a defined project; however, participants are self-organized, forming an online community that does not profit a business enterprise (Brabham, 2008). The presence of a self-organized effort was the distinguishing characteristic of an open-source project versus a crowdsourced effort under the direction of a sponsor organization. The development of Linux software code is an example of an open-source project (Estelles-Arolas & Gonzalez-Ladron-de-Guevara, 2012). In the present study, crowdsourcing was defined as an effort organized by a sponsoring organization rather than one self-directed by participants.

In Howe's (2006) original use of the term crowdsourcing, he referred to initiatives prompted by organizations—generally for-profit—inviting individuals to participate in an activity. For example, Howe pointed to istockphoto.com as a crowdsourced effort. In the case of iStockphoto, individuals upload photographs, which are then sold by iStockphoto. Participants are reimbursed with points that are converted to cash. Compared to an

open-source project, this crowdsourced supply of photographs is not self-organized by individuals, but rather organized by a company that invited individuals to participate under the guidelines set by iStockphoto.

For the purposes of the present research, Howe's (2006) definition of crowdsourcing as an effort created by an organization, rather than self-organized, was used. Although a uniform definition and taxonomy of crowdsourcing was not available, some common characteristics included the presence of diverse contributors and online technology (Estelles-Arolas & Gonzalez-Ladron-de-Guevara, 2012). Table 3 shows examples of definitions of crowdsourcing from the literature.

Table 3

Crowdsourcing Definitions

Definition	Reference
"Crowdsourcing is the act of outsourcing a task to a crowd, rather than to a designated agent."	Afuah, A., & Tucci, C., 2012, p. 12
"Crowdsourcing is an online, distributed problem-solving and production model."	Brabham, D. C., 2008, p. 76
"Crowdsourcing is an online, distributed problem-solving and production model.	Busarovs, A., 2012, p. 53
Crowdsourcing is "a specific mechanism that businesses use to engage with consumers. Tasks such as problem-solving and quality control, which were once either performed internally or contracted to external employees, are now outsourced to the general public or specific target groups (the crowd) via the web."	Rogstadius et al., 2011, p. 1069

Literature review related to crowdsourcing. Researchers have identified crowdsourcing as including the inherent ability of consumers or outside participants to respond to problems and create improvements from their personal use of a product or service (Zheng et al., 2011). Exposing internal product developers to recommendations by consumers was found to reduce limitations that developers had in perceiving alternatives (Zheng et al., 2011).

Brabham (2008) viewed crowdsourcing as an opportunity for a crowd to participate in an economic exchange. However, other research findings indicated that the quality of innovative ideas presented by the consumer base was not of a quality warranting immediate production, and required additional development by internal staff (Schuurman, Baccarne, & De Marez, 2012).

The findings of Rogstadius et al. (2011) confirmed a similar pattern of diminished quality in that monetary rewards in crowdsourcing increased a participant's willingness to accept a task and complete the task with greater speed—however, the quality of work was decreased. By framing the task as a benefit to others, Rogstadius et al. held that the quality of task performance improved without a monetary reward. This task completion for the benefit of others is seen as an intrinsic motivation.

The research demonstrated that extrinsic rewards, such as monetary payment, diminished otherwise intrinsic motivations, creating a "crowding out" (Rogstadius et al., 2011, p. 2) effect, thereby replacing intrinsic motivations with extrinsic motivations. The crowding effect alienated intrinsically motivated individuals from the task. The best outcomes are achieved by attracting intrinsically motivated participants to the crowdsourcing environment and then striving to make the work interesting and engaging (Rogstadius et al., 2011). Intrinsically motivated crowdsourcing participants were more accurate in their output in the absence of monetary rewards. This concept of making crowdsourcing interesting and engaging may inform healthcare leaders about how to encourage physicians to participate in medical protocol development to achieve a high quality outcome and accuracy. The present study examined differences in motivation to assist healthcare leaders in improving levels of engagement and participation in medical protocol development by physicians.

Other findings in the crowdsourcing research indicated that under the right circumstances—such as clarity of the problem, isolation of crowdsourcing participants to produce independent responses, diversity among participants, and a technology-based

mechanism for aggregating participant solutions—the wisdom generated by the crowd could exceed the wisdom of the individual participant (Schuurman et al., 2012). Opening the innovation process to external participants reduced an internal organizational bias (Poetz & Schreier, 2012). Poetz and Schreier (2012) asserted that crowdsourced ideas "score significantly higher in terms of novelty and customer benefit, and somewhat lower in terms of feasibility" (p. 246). A lack of technical expertise among crowdsourcing participants reduced the frequency of implementation or manufacturing of crowdsourced ideas. Collaboration among crowdsourced participants and internal experts was proposed to evaluate and develop innovations prior to production for a commercial market (Poetz & Schreier, 2012).

Other researchers corroborated Poetz and Schreier's (2012) findings, stating that the aspirations of crowdsourcing participants were motivating factors in participation. Specifically, the goals that individuals set for themselves, their beliefs regarding the ease of attaining that goal, and the time believed to be necessary for the completion of that goal served as decision criteria for participation in crowdsourcing (Tokarchuk, Cuel, & Zamarian, 2012). Tokarchuk et al. (2012) asserted that challenging goals appeal to an intrinsically motivated participant's desire for personal learning and skill development. Tokarchuk et al. (2012) cautioned that the altruism of acting for the benefit of others might be driven by extrinsic motivation such as gains in prestige and reputation directed toward contributors by those benefiting from the contribution. A broad summary of recent research related to crowdsourcing appears in Appendix A.

Further research has corroborated the influence of intrinsic motivations on participation in crowdsourcing. In a study of an online question-and-answer site, 70% of unpaid volunteers answered questions out of a sense of intrinsic motivation (Lee, Kim, Yi, Sung, & Gerla, 2013). Additionally, Chandler and Kapelner (2012) found that intrinsic motivation—defined as the meaningfulness of the crowdsourcing task to the participant—increased participation in the task. The meaningfulness of a medical protocol to physicians' ability to deliver excellent patient care as an intrinsic motivation was a specific area of interest in this study. Similar aspirational components are captured in the AI in this study.

Challenges to crowdsourcing research. As the use of crowdsourcing as a tool for innovation and development has expanded, improvements to crowdsourcing models have become necessary to address existing criticisms. Crowdsourcing has been criticized for producing low quality outcomes, being open to fraud and manipulation of votes, and exploiting workers (Busarovs, 2012). As a new business paradigm, crowdsourcing has posed challenges for existing labor laws and regulations designed around physical proximity and direct employment by an employer (Felstiner, 2011). The judicial system faces new questions regarding crowdsourcing—such as intellectual property rights, data ownership, copyrights, employment taxation, securities regulation, patent rights, and the legal protection of workers (Felstiner, 2011; Wolfson & Lease, 2011).

Some proponents of crowdsourcing have viewed the model as an emerging democratic process, whereas others have criticized the model as engaging a limited demographic (Bojin, Shaw, & Toner, 2011). However, crowdsourcing participants were

found to be young, technologically-oriented adults that did not represent a broad enough population to characterize a democratic process (Horton & Chilton, 2010). With continued exposure to the model and advancements in technological connectivity, the crowdsourcing model may broaden in appeal and move closer to representing the general populous (Horton & Chilton, 2010).

Literature Review Related to Crowdsourcing in Healthcare

Physician or healthcare crowdsourcing research was limited in the literature. Healthcare crowdsourcing research was primarily related to categorizing medical information and the creation of a medical database of symptoms and medical outcomes (Adams, 2011; McCoy et al., 2012; Swan, 2012). Research regarding physician participation in crowdsourcing medical protocols was lacking in the current body of knowledge.

Literature Review Related to Crowdsourcing and SDT

Research related to motivation among crowdsourcing participants and mechanisms used by companies to engage with potential crowdsourcing participants was limited but expanding (Zheng et al., 2011). The examination of extrinsic rewards, such as monetary gain or status, was a strong predictor of participation in the submission of photos or the creation of designs in a crowdsourcing environment (Kaufmann, Schulze, & Veit, 2011). Conveyed status was a more significant motivator of participation in crowdsourcing than were monetary rewards.

The intrinsic motivation of personal enjoyment among participants of crowdsourcing websites prompted the submission of creative projects (Kaufmann,

Schulze, & Veit, 2011). Zheng et al. (2011) found intrinsic motivation to be high among participants in crowdsourcing competitions involving creative submissions. Intrinsic motivation was more significant as a motivator of crowdsourcing participation for creative submissions than was extrinsic motivation. The degree to which the work was interesting and personally satisfying to the participant strengthened the intrinsic desire to participate in crowdsourcing (Zheng et al., 2011).

The extent to which both intrinsic and extrinsic motivation was present was influenced by monetary rewards, public recognition, appreciation, and competition in the crowdsourcing of design projects. Afuah and Tucci (2012) found that crowdsourcing participants were motivated by the prospect of building an online reputation, the potential to make a contribution to a perceived area of importance, the personal challenge of problem solving, the ability to learn or master a new skill, and the prospect of securing a job through their demonstrated abilities.

Review and Synthesis of Research Related to Research Questions

In keeping with Afuah and Tucci (2012), creating a crowdsourcing environment for developing medical protocols may be appropriate as an external source of solutions to problems using associated, but not employed, individuals. To examine the intrinsic and extrinsic motivation of crowdsourcing participation, a crowdsourced approach as defined in this study fulfilled the three requirements of crowdsourcing facilitation noted by Afuah and Tucci: (a) problem clarity—in this case, physician participation in the creation of medical protocols; (b) participant access to the internal database—in this case, access to medical protocol development online software by participating physicians; and (c)

compartmentalizing the problem—in this case, organizing the medical protocols around a specific medical diagnoses.

Future Prospects of Crowdsourcing

Crowdsourcing has been recognized as an affordable mechanism for providing an open call among a general populous or a targeted group of experts using technologically based connectivity (Zheng et al., 2011). Crowdsourcing introduced the idea of companies creating an open system of consumer or user input, critique, and evaluation that supplements the product development process (Schweitzer, Buchinger, Gassmann, & Obrist, 2012). The time and effort required of healthcare leaders to create a physician team within the traditional organizational paradigm may be reduced in the crowdsourced environment. Opinions are obtained without the complexity of social interactions and hierarchies of traditional organizational models. However, critics have raised concerns that crowdsourcing increases the risk of innovation failure due to the lack of ownership and accountability for innovation among participants and a lack of quality assurances among designers (Marjanovic, Fry, & Chataway, 2012).

SDT and Crowdsourcing: Considerations and Justification

The application of SDT as a framework for intrinsic and extrinsic motivation appears to propose a suitable explanation for the participation of physicians in a crowdsourcing environment. As a theory explaining basic psychological needs, SDT may oversimplify the relationship between intrinsic and extrinsic motivation and a resultant activity; however, the causal-comparative design employed in this study allowed a wide-lens examination, which is beneficial in examining differences.

SDT holds that motivation is influenced by three basic psychological needs (autonomy, competence, relatedness), which may control external system influences in the environment in which the participant is motivated (Sheldon & Kasser, 2008). For example, in the present study, the degree to which a physician was motivated to participate in the design of medical protocols may have extended beyond the fulfillment of basic psychological needs and may have been influenced by past instances of patient care. If a physician previously experienced a suboptimal medical outcome with a patient, he or she may have been motivated to improve protocols as a precautionary measure. However, the pursuit of competence, as a motivating factor, could also drive this desire to right past failures in patient care.

Crowdsourcing and SDT: Strengths and Weaknesses

SDT holds that the need for competence, autonomy, and relatedness as motivating factors is universal (Deci & Ryan, 2008). A claim of universality may inappropriately influence the findings within a research study, leading the researcher to surmise that relationships among the variables may be universal, when in fact underlying confounding variables may be at work. The causal-comparative design of this study, however, inherently included the cautionary lens of not interpreting differences as causality. This cautious approach may control for these confounding effects and maintain a broad examination of the relationships between variables.

The scope of SDT appears to be applicable to a causal-comparative study as a design adept at exploring relationships among independent variables that are not manipulated (Vansteenkiste et al., 2006). This exploration appears appropriate for use

with a self-determination theoretical basis to explore ex post facto participation among physicians in a crowdsourcing environment.

The examination and testing of a broad spectrum of motivation, as well as SDT findings in other legacy motivational theories and models, is an effective use of SDT (Roche & Haar, 2013). SDT proposes a positive correlation between intrinsic motivation and work engagement (Roche & Haar, 2013). The strength of SDT to identify correlations between motivation and work engagement was applicable to the present study as a useful tool for physicians who may be motivated to participate in medical protocol development as part of their overall work engagement.

The versatility of SDT created an additional strength. Leroy et al. (2012) have noted that SDT is well suited for explaining behavioral patterns across a broad spectrum of domains including sports, health, parenting, education, and work. SDT brought the strength of a broad experience of applications to the present study. The uniqueness of the physician population in a crowdsourced environment may benefit from this wide spectrum of applicability.

The SDT proposition that individuals have a tendency to incorporate new experiences into a sense of self served as a valuable explanation for a physician's desire to incorporate the new experience of crowdsourced protocols into his or her ability to contribute to the science of medicine (Deci & Ryan, 2008). The comprehensive nature of SDT to recognize the influence of environmental factors and incorporate new experiences into the self-determined perspective, added to the theory's strength in a causal-comparative model.

Leroy et al. (2012) viewed SDT as a model from which "optimal human functioning" (p. 7) can result by the understanding and nurturing of motivation. In that light, SDT offered the prospect of improving the fractured nature of medical protocol development and the individual roles that physicians play in improving that process. This optimal functioning was assumed to occur when an individual integrates him- or herself into a broader social environment (Leroy et al., 2012). Therefore, the ability of intrinsic and extrinsic motivations within the framework of SDT to examine and guide this social integration among physicians posed a key strength to utilizing the theory in this research. Proponents of SDT have viewed this integration as the interplay between individual and environment to motivate behavior (Deci & Ryan, 2008). The manner in which these interactions occurred facilitated or impeded motivation within an individual.

Justification of Intrinsic and Extrinsic Motivation as Variables

The present research sought to understand whether differences in intrinsic and extrinsic motivation existed among physician participants and nonparticipants related to the crowdsourcing of medical protocols. The presence of intrinsic and extrinsic motivation—as independent variables among physicians—was viewed as a possible explanation for the dependent variable of physician participation in a crowdsourcing environment. If participation in crowdsourcing by physicians is caused by intrinsic and extrinsic motivations, the manner in which physicians are encouraged and selected to participate may be better understood.

Rejected Alternative Independent Variables

Other independent variables were examined for consideration in the present study but were rejected based on the literature. Specifically, the influence of physician demographics—such as age, gender, and medical specialty—on computer use was considered. Research related to demographic variations in computer use among physicians was not evident in the body of research. For the present study, the necessity of using computers in a physician's daily work was considered a requirement that did not allow preferences as to computer use. Regardless of the demographic classification, physicians were required to use computers; therefore, these alternative variables were not used in the regression analysis. However, basic demographic variables were captured to guide replication of this study in the future to select a similar population.

Summary and Conclusions

Crowdsourcing appeared to be an alternative model as an organizing concept with the potential for improving and accelerating the development of medical protocols. Crowdsourcing was shown to (a) effectively organize disparate laborers, (b) use technology to improve problem solving and task completion, (c) expand and organize participation among content experts, and (d) be responsive to specific types of motivation among individuals. However, for crowdsourcing to serve as an effective model for medical protocol development, healthcare leaders must encourage physicians to participate. To advance physician participation in the crowdsourcing of medical protocols, the purpose of the present study was to examine differences in intrinsic and extrinsic motivation on the extent of participation in crowdsourcing among physician

participants and nonparticipants who were invited to participate in a crowdsourcing environment.

The relative infancy of crowdsourcing research was reflected by the limited literature from which to draw conclusions. Researchers offered definitions and parameters of crowdsourcing and provided a cursory examination of motivational and demographic factors related to participants of crowdsourcing.

As it related to the present study, the current literature was lacking with regard to the participation of physicians in the crowdsourcing of medical protocols. Therefore, this study set out to address a portion of that gap in the literature by using SDT as an explanation for physician participation in the crowdsourcing of medical protocols. In doing so, healthcare leaders may be able to predict physician participation in developing medical protocols using a crowdsourcing model. By understanding physician motivation to participate, leaders may be able promote participation in ways that attract more physician participants. This understanding of motivation may assist leaders in highlighting the benefits to physicians in a manner that resonates with their motivations. Chapter 3 expands on the methodology used to examine those relationships through the use of regression analysis.

Chapter 3: Research Method

The purpose of this study was to examine physician motivations to participate in crowdsourcing for developing medical protocols. Crowdsourcing is a distributed labor model using technology to connect otherwise disparate individuals. I used the theoretical framework of SDT to describe the intrinsic and extrinsic motivations of physicians participating in a crowdsourcing environment. Specifically, this quantitative, causal-comparative design examined differences in seven categories of motivation (independent variables) as measured by the AI against participation in the development of medical protocols (dependent variable) as part of a crowdsourcing program (Kasser & Ryan, 1996). The AI was developed by Kasser and Ryan (1996), and it is divided between three extrinsic categories of motivation (wealth, fame, and image) and four intrinsic categories of motivation (meaningful relationships, personal growth, community contribution, and good health) measured using a Likert-type scale.

This chapter begins with a description of the research design within a quantitative, causal-comparative framework. The research population consisted of physicians currently participating in a crowdsourcing project to develop medical protocols. Physicians in the populations had greater than a 12-month membership in the IPA. This chapter addresses sampling methodology and procedures for the roughly 2,000 physician participants in the study. A description of the recruitment approach and tools, as well as the proposed instrumentation, follows. The chapter concludes with a discussion of the threats to validity and procedures to control for ethical issues.

Research Design and Rationale

I used a quantitative, causal-comparative design to examine differences in seven motivation categories (independent variables) on participation in developing medical protocols (dependent variable) among physician members of an IPA invited to participate in the crowdsourcing of medical protocols. Independent variables included the seven categories of intrinsic and extrinsic motivation as measured by the AI. I used a single dependent variable related to participation in the crowdsourcing of medical protocols. The dependent variable was operationally defined as the number of medical protocols worked on by an individual physician through the crowdsourcing structure. The continuous variable of number of protocols worked on was necessary for a regression analysis model; however, by using the number worked on, ranges could be developed retroactively if other quantitative analysis models were indicated. The number of protocols worked on, if any, was a self-reported response by the physicians. Because the survey was anonymous, confirmation of this self-reported data was not possible. The rationale for operationalizing the study in this manner was drawn from the use of the AI with additional dependent variables by Vansteenkiste et al. (2006) in studying motivational values among business students. The present study, however, appeared to be the first use of the AI among a physician population.

Because the independent variables were nonmanipulated and considered selected, a nonexperimental, causal-comparative (ex post facto) design was used. Given that the independent variables could not be manipulated, a true experimental design was not possible. However, the exploratory nature of the current nonexperimental approach was

suitable to examine previously unexamined relationships (Hough & Schmitt, 2011). I created the research questions in response to the lack of scholarly research related to the intrinsic and extrinsic motivation of physicians to participate in a crowdsourcing environment. The questions examined the presence of domains of intrinsic and extrinsic motivation using the AI correlated with physician participation (the number of medical protocols worked on) to assist healthcare leaders to improve levels of medical protocol development participation among physicians.

Time and Resource Constraints

Developing medical protocols is an iterative process that evolves as additional medical evidence is produced. The nature of this study does not depend on managing confounding research effects caused by the continual introduction of new medical evidence regarding protocols. The ex post facto nature of causal-comparative design allows for uniformity in the process and examination of historical conditions of participation that may be more readily identified later.

Time and cost constraints precluded using an experimental model as a means of preliminarily examining relationships. Developing medical protocols is a costly endeavor in light of the expense of procuring evidence-based literature, the time expended by physician developers, and the liability risk in the experimental manipulation of medical treatments. A causal-comparative design was well suited to examining variables among preexisting groups in situations where variables cannot be easily manipulated (Schenker & Rumrill, 2004).

Methodology

Target Population

An IPA served as the target population for the study. At the time of the study, more than 2,000 physicians were members of the IPA. All IPA physician members with at least 12 months of membership were invited by e-mail to participate in the study. The 12-month experience parameter allowed new member physicians to be invited to participate in the ongoing medical protocol crowdsourcing effort and to provide time for participation if the physician desired to do so.

Members in the IPA included physician staff members of a large multifacility healthcare system in the southern U.S.. Physician members were located in a nine–ZIP code market serving a population of more than five million people. IPA membership represented a variety of medical specialties. Inclusion in the IPA required that member physicians routinely submitted quality data and participated in a medical specialty-based clinical practice committee. This committee reviewed quality data and made recommendations to the governing board regarding clinical practices. The affiliated health system used an electronic health record that required some level of computer proficiency among physicians to enter patient data and order patient diagnostic tests and treatments.

Sampling and Sampling Procedures

All 2,000 physician members of the IPA were invited to participate in the study as a convenience sample. New physician members typically received an invitation to participate in medical protocol development within the first 30 days of membership.

Orientation meetings to begin participation in medical protocol development were held quarterly.

The development of medical protocols in the IPA had been an ongoing project for more than 10 years. All physician members received an open invitation to participate in the IPA's crowdsourcing project to develop medical protocols using technological connectivity. Given the routine nature by which the IPA administrators communicated with their members via e-mail, minimal effort and cost were expended to include the eligible physician population of the IPA in the sample.

The president of the IPA sent an invitation to all IPA physician members with greater than 12 months membership to participate in an online survey. The online survey included the AI, a measure of intrinsic and extrinsic motivation, as the independent variables. A dependent variable was captured, namely, the number of medical protocols worked on by the physician. According to Schenker and Rumrill (2004), this scenario was well suited for a causal-comparative design drawing from a preexisting group or a group defined as sharing independent variables. This approach recognized several opportunities for self-selection, such as career decisions to be a physician, decisions to locate in the target market, decisions to participate in an IPA, and decisions to participate in this specific IPA. In keeping with the recognized constraints of a causal-comparative design, causation was not asserted, as this physician population may not have been representative of a broad physician population. However, the exploratory nature of the causal-comparative design benefits scholarly exploration of this gap in the literature related to physician participation in the crowdsourcing of medical protocols.

Sample Recruiting Procedures

The president of the target IPA invited members with greater than 12 months of membership to participate in an online survey. The invitation was in the form of an e-mail (see Appendix D) containing a brief description of the research project, an informed consent statement, and a hyperlink to the online survey. Participants were asked to indicate their review and consent to the informed consent statement in the introduction e-mail by initiating completion of the survey. A time allotment of two weeks, in December 2014, was given for completion of the online survey.

One week after the initial e-mail invitation, the president sent an e-mail reminder (see Appendix E) to the previously invited physicians asking those who had not completed the survey to consider doing so. The initial e-mail and the reminder e-mail were sent to all eligible physicians as no physician identifiers were included in the survey to know which physicians had completed the survey prior to the reminder e-mail. The president of the IPA provided prior permission to include IPA physician members in the research project before the e-mail invitation was sent to physician members. The letter of cooperation is included in Appendix F.

Sample Size

All physician members of the IPA with 12 months or more membership served as the study population and were invited to participate in the survey. This convenience sample constituted more than 2,000 physicians. As a comparison, a G-Power analysis indicated that a minimum sample size of 89 physicians from the 2,000 physicians in the IPA population was required for the study design. The G-Power analysis is included in

Appendix G. The minimum sample size was exceeded with 132 useable responses captured by the survey.

Recruiting Procedures

The president of the IPA sent an initial e-mail invitation providing a brief description of the study and informed consent procedures, the use of information, as well as an Internet link to the online study. The study was hosted on SurveyMonkey® allowing for the anonymous capture of data. The invitation and the survey questions are provided in Appendices A, B, and C. One week after the initial e-mail invitation was sent from the IPA president, a reminder e-mail was sent to all IPA members initially invited to participate in the survey.

Physician participation in the online survey was anonymous, as recommended by Walden University Institutional Review Board (IRB) guidelines related to research conducted in a researcher's own professional setting, as was the indirect case for this research. The online survey did not collect participant identifiers to protect the anonymous nature of the survey. The researcher held a leadership position in an affiliated organization but was not a member of the IPA organization. The consent form was included in the initial and follow-up invitation (available in Appendix D and E) and used the Walden University IRB recommended definition of *anonymous* as a preferred participant category by which the identity of participants and nonparticipants were not known to anyone. Completion of the online survey was deemed consent by the participant according to this IRB directive. Non-agreement with the terms of the research was allowed prior to the completion of the online survey by exiting the survey before

clicking the final survey submission button. Failure to complete the survey was considered non-agreement, and the results for the incomplete survey were not included in the final data. Anonymity of survey participants required that all physicians receive a reminder to complete the survey; not just those who had previously completed the survey. Physician members of the IPA were given two weeks to complete the survey.

It was anticipated that members of the IPA leadership, inclusive of the board of directors, were interested in the results of the study. However, the results were initially only shared with the president of the IPA. IPA leaders may use the research findings to more effectively recruit and retain physicians to develop medical protocols through the use of crowdsourcing.

Demographic Data

Physician participants were asked to complete the AI to garner information about the study's independent variables as well as to indicate the number of medical protocols they worked on, which served as the dependent variable. Whereas the independent and dependent variables were the subject of the study, basic demographic information was captured to establish sample characteristics for post hoc analyses for replication purposes, if so desired. Broad demographic descriptors were used to avoid participant identification in this anonymous survey. Age, gender, and ethnicity information were requested from the participants as demographic data questions within the survey; these data were not used in this study but allowed for duplication of the study population in future studies.

Informed Consent and Confidentiality

No confidential information was requested in the online survey. Additionally, no information was requested that was considered to be federally protected patient information. All members of the IPA with 12 months or more of membership were invited to participate; however, participation was voluntary. The invitation included a statement of informed consent, found in Appendices D and E. This statement of informed consent provided disclosure related to the research study procedures as well as efforts to mitigate risks involved in the survey. The study was subject to review and approval by the Walden University IRB prior to use.

The present study was conducted to examine differences in intrinsic and extrinsic motivation levels, as measured by the AI on the dependent variable of participation in the crowdsourcing of medical protocols. Individual responses regarding these variables were confidential. Physician names were not requested. No personal identifiers were requested in the survey. Given the nature of causal-comparative, nonexperimental research, statements of causation were avoided in the findings and conclusions of this study.

Data Collection Limitations

All physician members of the target physician IPA with 12 months or more of membership were invited to participate in the online survey. Data was collected using an online survey created and hosted by SurveyMonkey® (www.surveymonkey.com). Wright (2005) has noted that online surveys hold an advantage over paper surveys in ease of use, lower cost, expedited collection, and facilitated integration with statistical analysis tools. Increased computer access among many research populations as well the presence of

virtual communities also improve the effectiveness of online research. Disadvantages of online surveys include uncertainty regarding respondent identity and the potential for self-selection bias (Wright, 2005).

Nonresponse bias, or failure to complete a survey, was managed through the SurveyMonkey® survey design tool, which allows survey developers to require a respondent to complete a data field prior to moving to the next question. However, respondents could exit the survey and not complete the survey when faced with a required question. Incomplete surveys were not included in the data analyses.

Stapleton (2010) has asserted that online surveys do not provide the benefit of a face-to-face interviewer who can prompt a respondent to complete the survey. Stapleton (2010) also noted that some respondents might not be familiar with online surveys, which may deter them from completing the survey. The targeted IPA physicians used an electronic medical record, which required familiarity with computers. Therefore, nonresponse bias due to a lack of familiarity with computer use was not presumed to be a detrimental factor in this study.

For the purposes of this study, response to the online survey in entirety by a physician respondent completed the participation requirements in the research protocols. No additional follow up or debriefing was required of physician participants for this causal-comparative model. Upon completion of the survey, physician respondents received an immediate note of appreciation on the survey site.

Instrumentation

The AI was used as the measure for the domains of intrinsic and extrinsic motivation to evaluate seven subscales of motivation (Kasser & Ryan, 1996). Four categories were attributed to intrinsic motivation (meaningful relationships, personal growth, community contributions, and good health), and three categories were attributed to extrinsic motivation (wealth, fame, and image). Permission to use the AI tool in research was granted online at www.selfdeterminationtheory.org by creators Kasser and Ryan (1996). Additional permission for the use and publication of the survey was granted for the study by the author of the survey and is included in Appendix H.

The AI instructs respondents to rate the seven motivation subscales, referred to as *aspirations*, according to the respondent's perceived likelihood of attaining the aspiration, the importance of the aspiration, and the degree to which the aspiration has already been attained. Previous uses of the AI included higher order factor analysis applications to measure motivation among adults, the examination of health risk behaviors in adolescents, correlations of parenting styles and student motivations, and well-being status among college students (Kasser & Ryan, 2008; Vansteenkiste et al., 2006).

In the original use of the AI by Kasser and Ryan (1996), testing demonstrated a mean alpha coefficient for all categories of .76 among a sample of 100 adults (24 male, 76 female) using a mail survey. Vansteenkiste et al. (2006) used the AI in a validation study among business and education students (119 business, 129 education) in a Belgian college. The Belgian study reported an average alpha of .86 for the intrinsic subscales and an average alpha of .94 for the extrinsic subscales (Vansteenkiste et al., 2006).

The seven intrinsic and extrinsic motivations, as measured by the AI, served as the independent variables in this study. Therefore, the measure was appropriate for addressing the research questions, which reflected the AI categories:

- Does *wealth*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *fame*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *image*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does the presence of a *meaningful relationship*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *personal growth*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *community contribution*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *good health*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?

Limitations

It was recognized that some self-selection was inherent in this convenience sample. It was uncertain, based on the absence of literature, whether physicians who chose to join an IPA were different from physicians who did not. Uncertainty existed as to whether there were meaningful differences between physicians who selected this

particular IPA, which was affiliated with a nonprofit health system in the southern U.S., and physicians in other IPAs or not in an IPA at all. Finally, those physicians who were willing to complete the online survey used in this study may be more or less inclined to participate in crowdsourcing thereby creating a potential variation in the expected dependent variable resulting in a less significant statistical finding.

Operationalization of Constructs

Motivation. Seven independent variables were used in keeping with the seven motivations measured by the AI. The AI assessed the importance placed on an intrinsic or extrinsic value as an indication of a motivating factor for the respondent (Kasser & Ryan, 1996; Vansteenkiste, 2006). A 7-point Likert-type scale was used to measure the value of the seven motivational categories to the respondent. Respondents replied to a value statement for each of the seven categories of aspirations with five goals stated within each category. The AI survey tool measured 35 statements of motivation along the dimensions of importance, likelihood, and achievement. Four of the categories were considered intrinsic motivations (meaningful relationships, personal growth, community contributions, and good health), with the three remaining categories comprising the extrinsic motivations (wealth, fame, and image). An example of an aspirational goal and the survey structure followed, using the measurement of 7-point Likert-type scale, ranging from *not at all* as a score of 1, *moderately* as a score of 4, and *very* as a score of 7, thus yielding a score for each of the seven motivational categories or 135 total survey questions:

Aspirational Goal: *To be famous*.

How important is this to you?

How likely is it that this will happen in your future?

How much have you already attained this goal?

The survey questions are listed in Appendix B and the scoring key is found in Appendix C. The operational definitions for the seven independent variables and five subscale questions from the AI are in Appendix I. The AI questions and scoring key are printed here by permission of the author. Permission statements are included in Appendix H.

Medical protocol participation. Medical protocol participation served as the single dependent variable and was defined as the number of medical protocols worked on by the respondent in the subject crowdsourcing project. The online survey asked respondents to self-report the number of protocols worked on since becoming a member of the IPA.

Statistical Software

Data analysis was performed using the Statistical Product and Service Solutions (SPSS) software. The software was appropriate for application of a multiple linear regression analysis to determine whether differences existed among the seven motivations, as measured by the AI, and participation in developing medical protocols in a crowdsourcing environment.

Data Cleaning and Screening

Physicians were invited to complete the survey using the online survey tool SurveyMonkey® that required data completion prior to allowing respondents to proceed

to the next question. Data from respondents who terminated completion of the survey before fully finishing it were not included in the final dataset. Issues related to legibility were not an issue when using an online survey tool. No further data cleaning was necessary given the precise and customized control afforded by the SurveyMonkey® tool.

Research Questions and Hypotheses

The following research questions framed the examinations of differences, if any, between physician motivation and participation in the development of medical protocols in a crowdsourcing environment. The variables were captured through the use of an online survey using the AI. The following research questions and hypotheses were used:

- Does *wealth*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *fame*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *image*, as an extrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does the presence of a *meaningful relationship*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *personal growth*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?
- Does *community contribution*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?

- Does *good health*, as an intrinsic motivation, predict physician participation in a crowdsourcing environment?

Hypotheses.

Null hypothesis (H_0): Physician motivation toward *wealth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_1): Physician motivation toward *wealth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *fame* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_2): Physician motivation toward *fame* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *image* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_3): Physician motivation toward *image* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *meaningful relationships* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_4): Physician motivation toward *meaningful relationships* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *personal growth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_5): Physician motivation toward *personal growth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *community contribution* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_6): Physician motivation toward *community contribution* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *good health* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_7): Physician motivation toward *good health* does predict the number of medical protocols worked on in a crowdsourcing environment.

Data Analysis: Statistical Tests

A variety of regression analyses were performed on the survey data. Multiple regression analysis is appropriate for nonexperimental examination of social science conditions such as that proposed in the present study (Berry & Feldman, 1985). When examining a single dependent variable with multiple independent variables, multiple regression is an appropriate statistical tool to determine relationships or serve as a predictor. Changes to the single dependent variable occur in relation to a change in a single independent variable, whereas other independent variables are held constant. A regression function occurs between changes in the independent variables and the expected condition of the dependent variable (Berry & Feldman, 1985). A test for goodness of fit was used in relation to the observations and the regression model. A

multiple regression analysis was used at a 95% confidence interval (.05 significance level), in keeping with previous research that used the AI (Kasser & Ryan, 1996).

Covariates and Confounding Variables

Because of the nonexperimental, causal-comparative design, covariates defined as continuous, controlled variables were not a subject of the present research. The ex post facto design of the research precluded the presence of controlled variables. Whereas confounding variables—such as familiarity with computers and time limitations of potential participants—may have existed, they were not measured in this study. A narrow focus was retained in this causal-comparative study to examine differences among physician participants and nonparticipants in this preexisting group. Further examination of confounding variables may benefit from future experimental and nonexperimental research related to physician participation in crowdsourcing projects.

Threats to External, Internal, and Construct Validity

By virtue of the causal-comparative design, no conclusions regarding causation were made. The external validity of whether the findings were inferred to a broader population of physicians was not established. Rather, the present study was designed as an introductory research step to determine whether differences existed between physician participants in the crowdsourcing of medical protocols and physicians who did not participate.

The exploratory nature of this causal-comparative study recognized that threats to external validity existed and posed restrictions to the generalization of the findings to a

broader physician population. The narrow selection of the study sample of one IPA may pose selection threats when broadening the findings to a larger body of physicians.

The nature of the causal-comparative nonexperimental design does not involve treatments or experimental procedures that could pose internal threats to validity. By including the entire eligible population of the IPA in the study sample, internal threats to validity posed by selection were avoided (Maxim, 1999). The ex post facto nature of the design precluded threats to internal validity through participant mortality or diffusion of treatment caused by internal communication among participants.

Threats to construct validity may have existed with the use of the AI as a measure of intrinsic and extrinsic motivation among physicians. Previous applications of the AI used populations of working adults and college students. No prior use of the AI among physicians was evident in the literature. As a unique population, physicians may possess motivational traits that are different from other populations. For example, questions on the AI related to personal health may hold a different construct for physicians, as experts in health, than for previously surveyed college students. In addition, AI questions related to working for the betterment of society are considered a unique element of a physicians' career, resulting in a different construct for the physician than for the previously surveyed working adults.

Institutional Permissions

The IPA president approved the use of the survey prior to forwarding to IPA physicians, and no further permissions were necessary from the IPA. Permission for use

was requested and received from the Walden University IRB for the submission of the online survey to physician members of the IPA.

Ethical Concerns and Procedures

No confidential information was requested from participating physicians. The survey was anonymous. The online survey did not identify physician participants. No confidential or protected patient identification was requested in the survey. Informed consent was provided in the invitation to IPA physicians to participate, as seen in Appendix D. The informed consent described the nature of the research as well as the procedures of participation. The scope and potential use of the survey data was described to the participants in the informed consent. The study and consent were reviewed and approved by the IRB prior to use.

Treatment of data. Data were collected and stored on the SurveyMonkey® site with password protections known only by the researcher. Data were confidential and did not include physician respondent identifiers. The raw data are to be kept for five years in a secure location under the researcher's control and will not be available to others. The raw data will be destroyed after the five-year holding period.

Summary

A causal-comparative research design was conducted to determine whether differences existed in the domains of intrinsic and extrinsic motivation among physician participants and nonparticipants in the crowdsourcing of medical protocols. A sufficient physician population of more than 2,000 sample physicians was used in the study. The AI, as designed by Kasser and Ryan (1996), served as the research tool to categorize

physician motivation among seven intrinsic and extrinsic motivations. Various regression analyses were performed on the seven independent variables, and one dependent variable, represented as the number of medical protocols worked on by the physician. Chapter 4 provides an overview of the methodology deployed and the results from the online survey of physicians from an IPA in the southern U.S..

Chapter 4: Results

The purpose of this study was to examine the predictive relationship between physician motivation and participation in developing medical protocols in a crowdsourcing environment. The research questions framed an examination of differences between intrinsic and extrinsic motivations among physicians and their participation in developing medical protocols in a crowdsourcing environment.

I operationally defined the dependent variable of physician participation as the number of medical protocols worked on by physicians invited to participate in a crowdsourcing project. The study population consisted of physician members of one large IPA with an ongoing crowdsourcing project. I collected the data via an anonymous survey administered online. The online survey used the AI (Kasser & Ryan, 1993) to capture the physician responses.

I used the following research questions in this study:

- Does *wealth* (extrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?
- Does *fame* (extrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?
- Does *image* (extrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?
- Does *meaningful relationships* (intrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?

- Does *personal growth* (intrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?
- Does *community contributions* (intrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?
- Does *good health* (intrinsic), as a physician motivation, predict the number of medical protocols worked on in a crowdsourcing environment?

This study included the following hypotheses:

Null hypothesis (H_0): Physician motivation toward *wealth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_1): Physician motivation toward *wealth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *fame* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_2): Physician motivation toward *fame* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *image* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_3): Physician motivation toward *image* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *meaningful relationships* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_4): Physician motivation toward *meaningful relationships* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *personal growth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_5): Physician motivation toward *personal growth* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *community contribution* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_6): Physician motivation toward *community contribution* does predict the number of medical protocols worked on in a crowdsourcing environment.

Null hypothesis (H_0): Physician motivation toward *good health* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Hypothesis (H_7): Physician motivation toward *good health* does predict the number of medical protocols worked on in a crowdsourcing environment.

This chapter provides an overview of the data screening procedures and the sample size. I describe the demographic characteristics of the sample, followed by a review of the descriptive characteristics of the AI (Kasser & Ryan, 1996) scores. Internal consistency estimates, factor analyses, descriptive statistics, graphical analysis of score distributions, and the relationships between the variables follow in the chapter section. The chapter's descriptive section concludes with an explanation of the statistics and the distribution of the dependent variable, defined as the number of medical protocols worked on by the responding physician.

The next section of the chapter provides an evaluation of the hypotheses. First, the statistical methods used to evaluate the hypotheses are briefly reviewed. Relevant details pertaining to data manipulations, analysis specifications, and assumptions are noted. The results of statistical analyses are then discussed, accompanied by tables and figures to facilitate interpretation. The chapter concludes with a brief summary of findings in the context of the hypotheses.

Data Collection

The target population for this study consisted of all physician members with at least 12 months of membership in a large IPA with approximately 2,000 physician members. Online responses, using SurveyMonkey®, were obtained from 149 individuals over a two-week period in December 2014, yielding a response rate of 7.5%. Of the sample, 138 (92.6%) complete surveys were received. The remaining 11 cases had between 1 and 85 (all) items missing, and were excluded from the sample for statistical analyses. The revised response rate was 138 of approximately 2,000 invited physician respondents, or 6.9%.

Survey responses were examined to ensure accuracy and completeness and to screen for unusual or out-of-range values. All AI items were presented in closed-ended rating formats, restricting the possible responses to valid values. Demographic questions were presented in a multiple-choice format to restrict responses to only valid values. The dependent variable, or number of medical protocols worked on, was presented to respondents as a drop-down menu with possible response values from 0 to greater than 100. The majority of obtained responses ranged from 0 to 30; however, six respondents

stated that they worked on greater than 100 protocols. The researcher consulted with the IPA president to determine the feasibility of such extreme responses. The IPA president noted that these respondents were likely members of a medical protocol review committee that approved all completed protocols, but did not create protocols. He indicated that it would be implausible for any respondent to have worked on more than approximately 30 protocols. As members of the IPA, these review committee members would have received the invitation to participate in the study since they were included in the e-mail distribution list used for the sample. As such, the IPA president recommended that these six respondents be excluded as they were not part of the population from which sampling was intended (i.e., physicians who actually worked on protocols). Following this recommendation, the six cases were excluded, and the final sample consisted of 132 respondents, which was greater than the indicated G-Power parameter of 89, as noted in Appendix G.

Assuming a simple random sample, a response percentage of 50%, which yielded the most conservative estimate, and a 95% confidence level, the confidence interval was determined to be ± 8.25%. This constitutes the margin of error in the survey responses when generalizing the interpretation to reflect the opinions of the entire target population.

Statistical analyses were conducted using SPSS v.20.0 for all main analyses, the R Essentials for Statistics programmability extension for SPSS for zero-inflated models, and Minitab v.16.1.1 for preparation of figures. An alpha level of .05 was used as a decision point for statistical significance.

Description of the Sample

The gender of the respondents was approximately 60% male and 40% female. The majority of respondents (79.5%) were between 36 and 65 years. Approximately two-thirds of respondents identified their ethnicity as White (67.4%). Asian was the next most frequent ethnic category (17.4%). Six participants identified their ethnicity as *other*, with five of them specifying South Asian (Indian) descent. Table 4 provides a detailed description of the demographic characteristics.

Table 4

Demographic Characteristics of the Sample

Variable		*n*	%
Gender			
	Male	78	59.1
	Female	54	39.9
Age (years)			
	24 to 35	13	9.8
	36 to 45	40	30.3
	46 to 55	35	26.5
	56 to 65	30	22.7
	66 to 75	14	10.6
Ethnicity			
	White	89	67.4
	Black	4	3.0
	Hispanic	10	7.6
	Asian	23	17.4
	Other	6	4.5

Note. $N = 132$.

Aspirations Index Coding and Scoring

The version of the AI used in this study consisted of seven categories of aspirations or motivations, with five specific items within each category, for a total of 35 items. The AI survey items are presented in Appendix B, and the scoring procedures identifying the items within each category are reported in Appendix C. Survey respondents were asked to rate each of the 35 goals, or aspirations, on three dimensions: (a) the importance of the aspiration, (b) the likelihood it will happen in the future, and (c) the extent to which the aspiration has already been attained. Each item was rated on a 7-point scale from 1 (*not at all*) to 7 (*very*). Scores were calculated by averaging item responses within each category and dimension to yield importance, likelihood, and attainment subscales for each of the seven motivations. Motivation scale scores were also calculated by averaging across the 15 items within each category.

The motivations were categorized into extrinsic and intrinsic domains. The extrinsic domain consists of the motivations of wealth, fame, and image; and the four intrinsic aspirations are personal growth, meaningful relationships, community contributions, and good health. Higher-order extrinsic and intrinsic domain scores were calculated by averaging the constituent subscale and scale scores. Finally, overall dimension scores (importance, likelihood, and attainment) were calculated by averaging ratings across all seven domains.

In summary, the variables in this study consisted of two higher-order domains (extrinsic and intrinsic), comprised of three and four motivations, respectively. Each

motivation contained three dimensions (importance, likelihood, and attainment). Dimension scores were calculated at the level of the motivation or the higher-order domain. Table 5 shows the scores from the AI that were investigated in this study.

Table 5

Hierarchical Structure of Domain, Dimension, and Motivation Scores

	Dimensions			
	Importance (Import)	Likelihood (Likely)	Attainment (Attain)	Overall
Domains	Motivations			
Extrinsic	Wealth Fame Image			
Intrinsic	Personal growth (Pers. gr.) Meaningful relationships (Relations) Community contributions (Community) Good health (Health)			

Note. Abbreviations used in subsequent tables and figures are provided in parentheses.

Results

A number of descriptive analyses were conducted to evaluate the structure of motivation, dimension, and domain scores calculated from the AI. A Cronbach's alpha was calculated as an indication of internal consistency reliability between the various scores. That calculation is provided in Table 6. In keeping with George and Mallery (2003), all coefficients were in the range of acceptability at ≥ .7, to excellent at ≥ .9 ranges. Because Cronbach's alpha increases with the number of items, the overall motivation, domain, and dimension scores tended to have the highest reliability estimates.

Table 6

Cronbach's Alpha Reliability Coefficients for Motivation, Domain, and Dimension Scores

Variable		Import		Likely		Attain		Overall	
	Wealth	.852	(5)	.829	(5)	.840	(5)	.904	(15)
	Fame	.863	(5)	.855	(5)	.853	(5)	.927	(15)
	Image	.866	(5)	.844	(5)	.841	(5)	.942	(15)
Extrinsic		.915	(15)	.903	(15)	.897	(15)	.957	(45)
	Pers. gr.	.766	(5)	.720	(5)	.751	(5)	.876	(15)
	Relations	.804	(5)	.796	(5)	.798	(5)	.922	(15)
	Community	.900	(5)	.896	(5)	.852	(5)	.945	(15)
	Health	.889	(5)	.917	(5)	.926	(5)	.947	(15)
Intrinsic		.926	(20)	.926	(20)	.915	(20)	.965	(60)
Overall		.917	(35)	.925	(35)	.927	(35)	.966	(105)

Note. The number of items in each scale is provided in parentheses (subscripts).

Secondly, principal components analysis was used to explore possible correlations among the dimensions with the motivation scores to establish component scores. A separate analysis was conducted on the importance, likelihood, attainment, and overall scores within the AI. The analyses included an oblique rotation at delta = 0 to examine the amount or strength of correlation between the factors. The component correlations were .21 for importance, .31 for likelihood, .34 for attainment, and .28 for the overall scores. Factor correlations of .32 or above indicated 10% or more overlapping variance among the examined factors, suggesting that oblique rotation may have been warranted (Tabachnick & Fidell, 2007).

With the exception of attainment, at .34, the correlation values indicated little overlapping variance (< 10%) among factors. Given minimal overlapping variance, a simpler method using orthogonal rotation was indicated. The correlation between

attainment factors of .34 represented about 12% overlap in variance between the other two factors. Inspection of a plot of the component values found that personal growth—and to a lesser extent community and health—correlated with the extrinsic motivation factor. However, given a relatively small correlation, and the desire to use factor-like scores in the analyses, an orthogonal rotation was determined to be the best approach to analyzing the subscales (Tabachnick & Fidell, 2007).

Using principal components analysis with orthogonal rotation, a two-factor approach was indicated by the eigenvalues, as a measure of magnitude appropriate for a linear equation, along with the use of screen plots for each analysis. The total variance explained by the analyses on the importance, likelihood, attainment, and overall scores was 69.7%, 69.3%, 66.0%, and 69.1%, respectively. The rotated component loadings are indicated in Table 7. After orthogonal rotation, loadings represented the correlations between the variables and the factors. Loadings exceeding .71 (representing 50% overlapping variance) were considered excellent, whereas loadings less than .32 (≤ 10% variance) were generally not interpreted (Tabachnick & Fidell, 2007). All analyses supported a straightforward distinction between intrinsic aspirations on the first factor and extrinsic aspirations on the second factor, with all primary loadings above .71. There was little to no cross-loading of variables as defined by loadings ≥ .32, with the exception of personal growth in the analysis of attainment scores (.40). Community and health attainment scores had cross-loadings of approximately .3 on the extrinsic factor. These cross-loadings suggested that self-reported attainment of intrinsic and extrinsic values may have been more interrelated than either their importance or future likelihood of

achievement. These analyses supported the distinctions between extrinsic and intrinsic motivations that have been reported extensively in the literature.

Table 7

Components Analysis of Motivation Scores Within Each Dimension and Overall

Motivations	Import		Likely		Attain		All	
	1	2	1	2	1	2	1	2
Wealth	.011	**.861**	.023	**.842**	.164	**.767**	.041	**.847**
Fame	.104	**.826**	.165	**.814**	.128	**.830**	.127	**.818**
Image	.172	**.824**	.241	**.792**	.193	**.772**	.215	**.803**
Pers. gr.	**.855**	.157	**.839**	.248	**.738**	.399	**.838**	.237
Relations	**.812**	.063	**.817**	.013	**.784**	-.108	**.797**	.001
Community	**.849**	-.047	**.844**	.071	**.811**	.274	**.855**	.045
Health	**.738**	.219	**.727**	.293	**.708**	.313	**.724**	.297
Rotated % of variance	38.6%	31.2%	38.6%	30.7%	34.3%	31.7%	38.0%	31.1%

Note. Loadings ≥ .71 are in bold font. Cross loadings ≥ .32 are italicized.

The intercorrelations between motivation scores within each dimension are shown in Table 8. As expected, intercorrelations between motivations were higher within a domain than across domains. In other words, the extrinsic motivations were more highly correlated with one another than with the intrinsic motivation scores, and vice versa. Correlations within a domain ranged from approximately .4 to .7, whereas cross-domain correlations were in the range of 0 to .3. Cross-domain correlations were larger in magnitude for attainment scores than for the dimensions of importance or likelihood. The large magnitudes of some intercorrelations, such as personal growth and relationships, indicated that multicollinearity may have posed an issue when all motivations were analyzed simultaneously in the same equation. This multicollinearity may have affected

calculations at the individual predictor level but the predictive characteristics remained reliable at the level of the entire data set (Tabachnick & Fidell, 2007).

Table 8

Intercorrelation Matrix of Motivation Scores Within Each Dimension

Variable		Wealth	Fame	Image	PG	Rel.	Com.	(Ext-Int)
Import								(.224)
	Fame	.570						
	Image	.570	.572					
	Pers. gr.	.189	.210	.230				
	Relations	.056	.110	.236	.570			
	Community	-.048	.144	.103	.705	.551		
	Health	.221	.176	.272	.558	.548	.450	
Likely								(.355)
	Fame	.536						
	Image	.514	.560					
	Pers. gr.	.263	.317	.344				
	Relations	.073	.139	.248	.570			
	Community	.085	.278	.212	.689	.562		
	Health	.246	.273	.409	.609	.496	.491	
Attain								(.451)
	Fame	.488						
	Image	.441	.569					
	Pers. gr.	.467	.389	.334				
	Relations	.080	.100	.173	.410			
	Community	.327	.337	.305	.688	.444		
	Health	.286	.294	.414	.530	.372	.575	
Overall								(.326)
	Fame	.546						
	Image	.544	.555					
	Pers. gr.	.275	.290	.306				
	Relations	.060	.102	.226	.544			
	Community	.072	.219	.186	.705	.533		
	Health	.262	.252	.391	.582	.476	.505	

Note. Correlations between extrinsic and intrinsic domain scores within each dimension are reported in the last column in parentheses.

Correlations between the three dimension scores were also calculated within each motivation and domain, and are shown in Table 9. A similar pattern of intercorrelation between dimensions was observed for the motivations and domains. The highest correlations were observed between the likelihood and attainment dimensions, followed by likelihood and importance. The intercorrelations between importance and attainment represented the lowest of the three values.

Table 9

Intercorrelation Matrix of Dimension Scores Within Motivations and Domains

Variable		Dimension	Import	Likely
Motivations	Wealth	Likely	.539	
		Attain	.317	.791
	Fame	Likely	.654	
		Attain	.473	.879
	Image	Likely	.825	
		Attain	.711	.928
	Pers. gr.	Likely	.704	
		Attain	.418	.711
	Relations	Likely	.810	
		Attain	.672	.913
	Community	Likely	.816	
		Attain	.610	.806
	Health	Likely	.643	
		Attain	.507	.836
Domains	Extrinsic	Likely	.702	
		Attain	.509	.883
	Intrinsic	Likely	.758	
		Attain	.570	.841
	Overall	Likely	.715	
		Attain	.593	.870

Descriptive Statistics of Scores

Descriptive statistics of the importance, likelihood, attainment, and overall scores are provided in Table 10 to Table 13. Distribution histograms of scores are also provided in Figure 2 to Figure 4.

For each dimension, the average importance ratings for the three extrinsic motivations were considerably lower than the means for the intrinsic motivations. Fame received the lowest mean rating within each dimension, and meaningful relationships received the highest average rating. A distribution of the scores indicates that extrinsic motivations tended to be skewed to the right, as seen in Figure 2. This was most evident in the fame and image scores in the importance and likelihood dimensions. In contrast, the four intrinsic motivations were skewed to the left, as seen in Figure 3. Scores were particularly skewed for the importance ratings. The intrinsic domain scores were also skewed, as noted in Figure 4.

Paired samples t-tests showed that intrinsic domain scores were significantly higher than extrinsic domain scores across all dimensions. The t-tests resulted in the following scores: Importance: $t(131) = 30.62$, $p < .001$; Likelihood: $t(131) = 24.57$, $p < .001$; Attainment: $t(131) = 22.4$, $p < .001$; Overall: $t(131) = 28.60$, $p < .001$.

Various data transformations were used to modify the measurement scales to change the data to address failures of normality, linearity, and homoscedasticity, and to reduce the influence of outliers. Use of data transformation was appropriate to improve the analysis of the skewed variables, as recommended by Tabachnick and Fidell (2007). In particular, the Box-Cox family of power transformations was used to assess multiple

values of lambda to find the optimal normalizing transformation (Osborne, 2010). However, the results of the data transformations were unsatisfactory. The score distributions were not normalized for the majority of variables. Additionally, the optimal lambda values differed by motivation and dimension, such that a motivation score in one dimension would be subjected to a different data transformation than the motivation score in a different dimension. Finally, preliminary analyses of the hypotheses indicated that the transformed data values were not well suited for prediction of the dependent variable than were the originally proposed variables. Therefore, original variables were used in the analysis. The descriptive statistics for the various motivation dimensions are shown in Tables 10 through 13.

Table 10

Descriptive Statistics of Motivation Scores for the Importance Dimension

Importance	*M*	*SD*	*Mdn*	Min	Max
Wealth	3.82	(1.19)	3.80	1.40	6.60
Fame	2.64	(1.18)	2.40	1.00	7.00
Image	2.83	(1.30)	2.70	1.00	6.00
Extrinsic	3.09	(1.04)	3.03	1.13	6.27
Pers. gr.	6.10	(.88)	6.20	3.00	7.00
Relations	6.31	(.85)	6.60	3.00	7.00
Community	5.88	(1.08)	6.00	2.00	7.00
Health	6.22	(.90)	6.60	2.00	7.00
Intrinsic	6.13	(.76)	6.28	2.55	7.00
Overall	4.83	(.69)	4.89	2.29	6.69

Table 11

Descriptive Statistics of Motivation Scores for the Likelihood Dimension

Likelihood	*M*	*SD*	*Mdn*	Min	Max
Wealth	4.08	(1.22)	4.00	1.20	6.60
Fame	3.00	(1.19)	2.90	1.00	6.80
Image	3.05	(1.26)	3.20	1.00	6.20
Extrinsic	3.37	(1.02)	3.40	1.13	6.20
Pers. gr.	5.67	(.87)	5.80	2.80	7.00
Relations	6.02	(.97)	6.30	2.40	7.00
Community	5.55	(1.09)	5.80	1.60	7.00
Health	5.42	(1.22)	5.50	1.20	7.00
Intrinsic	5.66	(.85)	5.78	2.30	7.00
Overall	4.68	(.76)	4.84	2.09	6.66

Table 12

Descriptive Statistics of Motivation Scores for the Attainment Dimension

Attainment	*M*	*SD*	*Mdn*	Min	Max
Wealth	3.86	(1.19)	3.70	1.20	6.40
Fame	3.02	(1.17)	3.00	1.00	6.20
Image	3.17	(1.31)	3.20	1.00	6.20
Extrinsic	3.35	(1.00)	3.33	1.33	5.87
Pers. gr.	5.18	(.94)	5.20	2.80	7.00
Relations	5.85	(1.08)	6.20	2.20	7.00
Community	5.08	(1.04)	5.20	1.40	7.00
Health	4.96	(1.30)	5.00	1.00	7.00
Intrinsic	5.27	(.86)	5.28	2.10	7.00
All	4.62	(.73)	4.70	2.03	6.40

Table 13

Descriptive Statistics of Motivation Scores Overall (Averaged Over Dimensions)

Overall	*M*	*SD*	*Mdn*	Min	Max
Wealth	3.92	(1.01)	3.83	1.47	6.20
Fame	2.88	(1.04)	2.73	1.00	6.27
Image	3.01	(1.21)	3.07	1.00	6.00
Extrinsic	3.27	(.91)	3.37	1.27	5.73
Pers. Gr.	5.65	(.77)	5.73	3.00	7.00
Relations	6.06	(.90)	6.33	2.53	7.00
Community	5.50	(.97)	5.67	1.67	7.00
Health	5.54	(1.01)	5.60	1.87	7.00
Intrinsic	5.69	(.75)	5.78	2.32	6.97
Overall	4.71	(.66)	4.82	2.13	6.30

Histograms of the distribution of scores are indicated in Figure 2 through Figure 4 to further demonstrate the skewing of the scores.

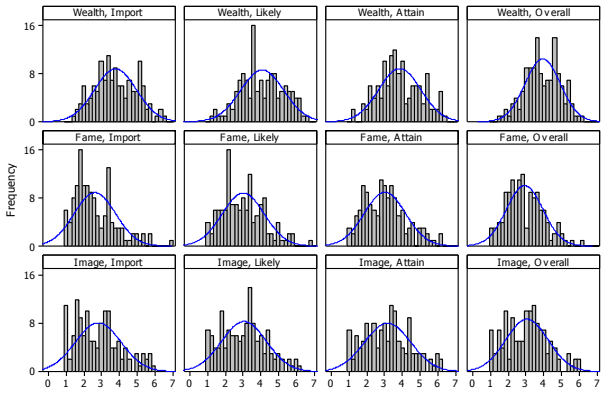

Figure 2. Distribution histograms of the three extrinsic motivations, wealth, fame, image, by dimension and overall.

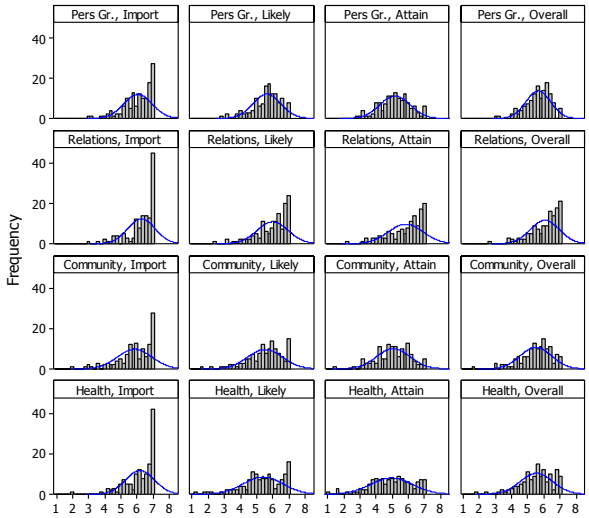

Figure 3. Distribution histograms of the four intrinsic motivations, personal growth, relationships, community, and health, by dimension and overall.

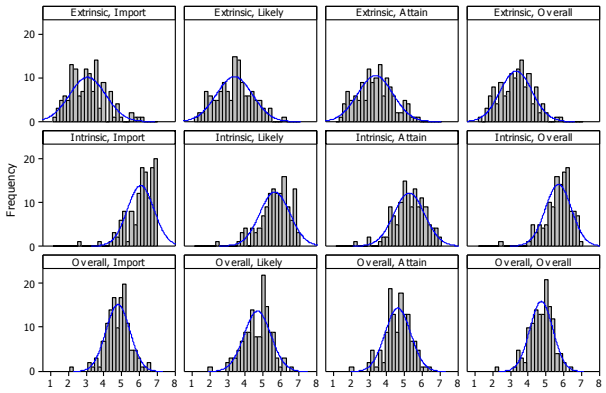

Figure 4. Distribution histograms of the domain and dimension scores averaged across motivations.

Description of Dependent Variable

The dependent variable in this study was physician participation in a crowdsourcing environment, as measured by participation in the development of medical protocols. Physician responses are provided in Table 14. The number of medical protocols worked on in the sample ranged from 0 to 30. The distribution of responses was severely J-shaped with the majority of responses at the lower extreme, as seen in

Figure Almost half of the physician respondents (44.7%) had not worked on any medical protocols, and three-quarters of the sample had worked on four or fewer protocols. At the high end of the range, eight respondents (6.1%) reported working on 15 or more medical protocols.

The mean number of medical protocols was 3.43 with a standard deviation of 5.75 (variance = 33.04). These data showed significant evidence of overdispersion—the situation when the variance of count data exceeds the mean. Specific methods to analyze

data with overdispersion were examined in the evaluation of the hypotheses as presented in the next section.

Table 14

Number of Medical Protocols (Order Sets) Worked On

Number of medical protocols	*n*	%	Cumulative %
0	59	44.7	44.7
1	11	8.3	53.0
2	13	9.8	62.9
3	11	8.3	71.2
4	6	4.5	75.8
5	7	5.3	81.1
6	3	2.3	83.3
7	1	.8	84.1
8	2	1.5	85.6
10	9	6.8	92.4
11	1	.8	93.2
12	1	.8	93.9
15	4	3.0	97.0
20	1	.8	97.7
30	3	2.3	100.0
M ± *SD*	3.432 ± 5.748		
S^2	33.041		

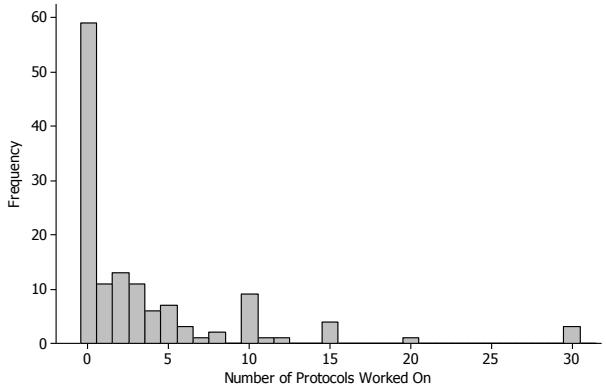

Figure 5. Distribution histogram of the number of medical protocols worked on.

Analysis of Hypotheses: Summary of Methodology

Because the dependent variable consisted of count data, the generalized linear model (GLIM) was used to evaluate the relationships between the number of protocols and the motivation scores. The generalized linear model is an extension of the general linear model that allows for response variables to have nonnormally distributed error distributions (Kroese & Chan, 2013). Specifically, the random component is assumed to belong to the exponential family of distributions. Examples of response variables evaluated using the GLIM might consist of binary, count, censored, or ordinal data. The GLIM consists of three components: an exponential probability distribution, a linear predictor, and a link function that associates the mean of the distribution function to the linear predictor. Probability distributions in the GLIM are typically parameterized in terms of the mean and exponential dispersion parameter. Two models are of particular relevance to count data, the Poisson model and the negative binomial model, both using

the log link function. The Poisson distribution has variance equal to the mean, therefore yielding underestimates of standard error estimates when there is overdispersion (Hayat & Higgins, 2014). The negative binomial model is similar to the Poisson model, but includes a dispersion parameter to account for the additional variance. This dispersion parameter is used to adjust the standard errors of the parameter estimates.

Excess zeros, or zero-inflated distributions, are a common cause of overdispersion. The Poisson and negative binomial models assume that only one process generates the data. More zeros than expected by the model may be due to more than one process generating the data. In these circumstances, zero-inflated Poisson or negative binomial models are appropriate (Hayat & Higgins, 2014).

The Poisson, negative binomial (NB), zero-inflated Poisson (ZIP), and zero-inflated negative binomial (ZINB) models were each applied to the prediction of the number of medical protocols. Comparisons were made among the goodness-of-fit statistics to determine which model was able to accommodate the conditional distribution of the dependent variable. The predictors consisted of the seven motivation scores within each dimension. For the zero-inflated models, the same set of predictors was used to model the count and zero-inflation coefficients. Analyses were conducted separately for the importance, likelihood, attainment, and overall motivations. GLIM models were also conducted using the explicit and implicit scores (within each dimension and overall) to predict the number of medical protocols.

In addition, the NB model was applied to the analysis of mean-corrected scores. To calculate mean-corrected scores, the dimension score (or overall score) was subtracted

from every participant's score within that dimension. The goal was to obtain an estimate of relative importance and to correct for response style, or the tendency of respondents to answer items in a certain way regardless of content. However, because one of the parameters becomes redundant with this transformation, the motivations were examined in separate bivariate equations. These analyses were only computed on the overall scores to minimize the excessive type I error.

Due to the intercorrelations between predictors, Spearman's rho (ρ) was also calculated between the number of protocols worked on and the AI scores to obtain an estimate of the zero-order relationship between variables. Finally, cases were divided into two groups according to the number of protocols worked on: nonparticipants (0 protocols) and participants (1 or more protocols). Due to the highly skewed nature of the DV, and the low frequency counts for many of the values, it was hypothesized that a dichotomous coding scheme may have yielded a more satisfactory model. Logistic regression under the umbrella of the GLIM was used to evaluate whether the motivations were predictive of participation in medical protocol development.

Generalized Linear Model Results

First the NB and Poisson model were fit to the unconditional distribution of Y to examine which distribution would provide a better approximation to the data. As seen in Figure 6, the NB distribution closely matched the observed data. In contrast, the Poisson distribution underestimated the frequencies at 0, and overestimated the probabilities for between 3 and 6 protocols. Therefore, it was expected that the NB model would provide a

better fit than the Poisson regression. Nonetheless, a Poisson regression was calculated for comparison purposes.

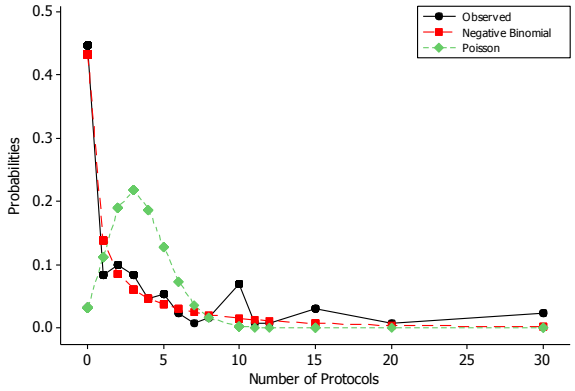

Figure 6. Observed and theoretical probabilities for number of protocols according to the negative binomial and Poisson distributions.

Various fit indices of the models are shown in Table 15. The Poisson model was counter indicated, with dispersion estimates exceeding the model-expected value of 1. The NB model had log-likelihood (-2LL) estimates and Akaike's information criterion (AIC) that were approximately half that of the Poisson model, recognizing that smaller was better in this case. Therefore, the NB model was a better fit than the Poisson model. The ZINB model also had lower information criteria than the ZIP, indicating that the ZINB was a better fit. Comparison of the NB and ZINB models indicated very similar goodness-of-fit statistics. However, the ZINB required an additional 8 degrees of freedom over the NB. Even though the models were not nested, the -2LL values were not evidently lower in the ZINB model to warrant the additional *df*. Furthermore, AIC was slightly smaller in the NB than the ZINB models. Thus, the NB appeared to provide the

most parsimonious model fit of the four models tested. The same pattern of results was obtained for each dimension and overall.

The results of the NB regressions are shown in Table 15 through Table 18 for the dimensions of importance, likelihood, attainment, and overall scores, respectively. The omnibus likelihood ratio chi-square tests are presented as footnotes to the tables. None of the omnibus tests approached statistical significance, and none of the individual parameters were significant in any of the models. The personal growth likelihood score had the largest Wald chi-square value, and a *p* value of .066.

Table 15

Fit Indices for Count Models

Dimension	-2LL	*LL df*	AIC	Dispersion estimate	NB Parameter (*SE*)
Importance					
Poisson	-529.813	8	1075.625	6.607	--
NB	-287.024	9	592.048	1.062	2.537 (.431)
ZIP	-364.262	16	760.525	--	--
ZINB	-282.261	17	598.523	--	.002 (.408)
Likely					
Poisson	-519.118	8	1054.236	6.435	--
NB	-286.773	9	591.545	1.065	2.512 (.429)
ZIP	-357.948	16	747.896	--	--
ZINB	-279.949	17	593.897	--	-.041 (.328)
Attain					
Poisson	-542.772	8	1101.543	6.816	--
NB	-287.519	9	593.038	1.058	2.581 (.43)
ZIP	-383.656	16	799.312	--	--
ZINB	-281.360	17	596.719	--	-.746 (.181)
Overall					
Poisson	-525.631	8	1067.263	6.540	--
NB	-286.972	9	591.944	1.063	2.531 (.43)
ZIP	-366.118	16	764.237	--	--
ZINB	-281.176	17	596.355	--	-.035 (.328)

Table 16

Negative Binomial Regression Predicting Number of Medical Protocols From Importance Scores

Importance parameter	B	seB	95% Wald CI		Wald χ^2	*p*	Exp(B)
(Intercept)	-.637	1.4737	-3.525	2.252	.187	.666	.529
Wealth	-.158	.1593	-.471	.154	.990	.320	.853
Fame	.092	.1746	-.250	.434	.278	.598	1.096
Image	-.092	.1607	-.406	.223	.325	.569	.912
Pers. gr.	.104	.2654	-.416	.624	.153	.696	1.109
Relations	-.046	.2620	-.559	.468	.030	.861	.955
Community	.320	.2330	-.137	.776	1.882	.170	1.377
Health	.027	.2338	-.432	.485	.013	.909	1.027
(NB param.)	2.537	.4306	1.819	3.539			

Note. LRχ^2 (7) = 8.725, p = .273.

Table 17

Negative Binomial Regression Predicting Number of Medical Protocols From Likelihood Scores

Likelihood parameter	B	seB	95%	Wald CI	Wald χ^2	*p*	Exp(B)
(Intercept)	.771	1.1684	-1.519	3.061	.435	.509	2.162
Wealth	-.149	.1463	-.435	.138	1.031	.310	.862
Fame	.010	.1619	-.307	.327	.004	.951	1.010
Image	-.057	.1685	-.387	.274	.113	.737	.945
Pers. gr.	.482	.2617	-.031	.995	3.391	.066	1.619
Relations	-.360	.2335	-.817	.098	2.373	.123	.698
Community	.150	.2160	-.274	.573	.480	.489	1.161
Health	-.053	.1755	-.397	.291	.093	.761	.948
(NB param.)	2.512	.4287	1.798	3.510			

Note. LRχ^2 (7) = 9.228, p = .237.

Table 18

Negative Binomial Regression Predicting Number of Medical Protocols From Attainment Scores

Attainment parameter	B	seB	95% Wald CI		Wald χ^2	*p*	Exp(B)
(Intercept)	.704	1.0606	-1.375	2.782	.440	.507	2.021
Wealth	.109	.1493	-.184	.402	.534	.465	1.115
Fame	-.018	.1600	-.331	.296	.012	.912	.982
Image	-.196	.1515	-.493	.101	1.676	.195	.822
Pers. gr.	.245	.2434	-.232	.722	1.010	.315	1.277
Relations	-.338	.1997	-.729	.053	2.864	.091	.713
Community	.306	.2428	-.170	.782	1.588	.208	1.358
Health	-.030	.1810	-.385	.325	.027	.869	.971
(NB param.)	2.581	.4340	1.856	3.588			

Note. LRχ^2 (7) = 7.735, p = .357.

Table 19

Negative Binomial Regression Predicting Number of Medical Protocols From Overall Scores

Overall parameter	B	seB	95%	Wald CI	Wald χ^2	*p*	Exp(B)
(Intercept)	.176	1.3802	-2.530	2.881	.016	.899	1.192
Wealth	-.077	.1792	-.428	.274	.184	.668	.926
Fame	-.011	.1748	-.354	.332	.004	.949	.989
Image	-.121	.1705	-.455	.213	.502	.478	.886
Pers. gr.	.428	.2971	-.154	1.010	2.075	.150	1.534
Relations	-.342	.2516	-.835	.151	1.849	.174	.710
Community	.278	.2478	-.208	.764	1.260	.262	1.321
Health	-.040	.2114	-.454	.375	.035	.851	.961
(NB param.)	2.531	.4302	1.814	3.531			

Note. LRχ^2 (7) = 8.829, p = .265.

Table shows the results of the negative binomial regressions to predict extrinsic and intrinsic scores. Only the intrinsic importance score reached statistical significance, although a pattern was evident in the table where the extrinsic scores were negative, predicting lower scores, and the intrinsic scores were positive, predicting higher scores.

Table 20

Negative Binomial Regression Predicting Number of Medical Protocols From Extrinsic and Intrinsic Domain Scores

Parameter	B	seB	95% Wald CI		Wald χ^2	*p*	Exp(B)
Importance							
Extrinsic	-.203	.1410	-.479	.074	2.062	.151	.817
Intrinsic	.435	.2192	.005	.865	3.939	.047	1.545
(NB param.)	2.646	.4437	1.905	3.675			
Likelihood							
Extrinsic	-.154	.1474	-.443	.135	1.090	.297	.857
Intrinsic	.191	.1930	-.187	.569	.982	.322	1.211
(NB param.)	2.762	.4575	1.996	3.821			
Attainment							
Extrinsic	-.067	.1685	-.397	.263	.158	.691	.935
Intrinsic	.191	.1781	-.158	.540	1.154	.283	1.211
(NB param.)	2.785	.4601	2.014	3.849			
Overall							
Extrinsic	-.172	.1659	-.498	.153	1.080	.299	.842
Intrinsic	.336	.2274	-.110	.782	2.184	.139	1.399
(NB param.)	2.724	.4530	1.966	3.773			

Note. Intercepts were included in the models but are not reported in the table. LRχ^2 (2) Importance: 5.339, $p = .069$; Likely: 1.841, $p = .398$; Attain: 1.191, $p = .551$; Overall: 2.976, $p = .226$

Finally, mean corrected scores were examined. Only the overall scores were analyzed to keep the familywise error rate low. Results are shown in Table . A bivariate approach was used for each analysis. The results indicated a significant effect of personal growth and of community. Recalling the correlation table between AI scores, these two motivations were the most intercorrelated (~.7). Thus, it is not surprising that they were not both significant when entered into a regression equation simultaneously. No other scores were significant predictors of medical protocol development. Mean-corrected extrinsic and intrinsic scores were also not correlated to the number of protocols.

Table 21

Separate Negative-Binomial Bivariate Models Predicting Number of Protocols From Overall Mean-Corrected Scores

Mean-corrected overall score	B	seB	95% Wald CI		Wald χ^2	*p*	Exp(B)
Wealth	-.269	.1782	-.619	.080	2.284	.131	.764
Fame	-.068	.1672	-.396	.260	.164	.685	.934
Image	-.228	.1597	-.541	.085	2.038	.153	.796
Pers. gr.	.626	.2791	.079	1.173	5.027	**.025**	1.870
Relations	-.025	.2133	-.443	.393	.013	.908	.976
Community	.450	.1980	.062	.838	5.169	**.023**	1.568
Health	.099	.2165	-.325	.523	.210	.647	1.104
Extrinsic	-.411	.2536	-.908	.087	2.620	.106	.663
Intrinsic	.493	.3171	-.128	1.115	2.418	.120	1.637

Note. Analysis of each predictor conducted separately. Scores were mean-corrected by subtracting overall score from each value.

Summary Correlations Between Protocols and AI Scores

Spearman rank correlation coefficients were computed as an additional check of the relationship between number of medical protocols and the motivation scores. Interestingly, only personal growth significantly correlated with number of protocols. The rank correlations between number of protocols and personal growth motivation scores for the dimensions were *importance* .181 ($p = .037$), *likelihood* .232 ($p = .007$), *attainment* .187 ($p = .032$), and *overall* .234 ($p = .007$). The number of protocols was not correlated with any other AI scores at $p < .05$. This result was consistent with the multiple regression results presented above.

Participant vs. Nonparticipant Physicians

The survey results were divided into nonparticipants, those who had not worked on any protocols, and participants, those who had worked on at least one protocol. Logistic regression analyses were conducted using the seven motivation scores, and repeated separately for each of the dimensions and overall score. The omnibus test was not statistically significant for *importance* ($\chi^2[7] = 5.189$, $p = .637$), *likelihood* ($\chi^2[7] = 7.843$, $p = .347$), *attainment* ($\chi^2[7] = 8.141$, $p = .320$), or *overall* ($\chi^2[(7] = 7.894$, $p = .342$). None of the variables had significant parameter coefficients in any of the logistic models. Furthermore, there were no statistically significant correlations, such as Spearman's ρ, between participant and nonparticipant and any of the AI scores. Categorizing physicians into participants and nonparticipants did not yield any meaningful insights into possible relationships between motivations and participation in medical protocol development.

Summary

In summary, the purpose of this study was to examine physician motivations to participate in crowdsourcing for the development of medical protocols. Valid data were obtained from 132 physicians as part of a large IPA. The number of medical protocols worked on in this sample of physicians ranged from 0 to 30, but the distribution was severely skewed toward 0. Motivations were assessed with the AI in the dimensions of importance, likelihood, attainment, and overall.

All scores were internally consistent. Factor analyses supported the distinction between extrinsic and intrinsic domains. The intercorrelations among motivations were almost universally positive, even between the extrinsic and intrinsic scores. This finding indicated the presence of some method or response style variance in the scores. Across dimensions, the three extrinsic motivations of wealth, fame, and image were consistently given lower mean ratings than the four intrinsic motivations of personal growth, relationships, community, and health. Overall, fame was the lowest-rated motivation, and relationships had the highest mean scores.

Model estimation of the number of protocols according to the seven motivation scores, analyzed separately by dimension and overall, indicated that the NB model was the best suited of the four models examined. However, none of the regressions was statistically significant, nor were any of the parameters for the individual motivations in any of the models. Rank correlations were also computed between the number of protocols completed and all of the motivation scores. Personal growth was significantly

correlated with number of protocols. Therefore, there is evidence that the null hypothesis for H_5 can be rejected:

$H5_0$: Physician motivation toward *personal growth* does not predict the number of medical protocols worked on in a crowdsourcing environment.

Additionally, the null hypothesis for H_6 can be rejected, along with H_5 when examining the mean corrected scores using a bivariate approach. This is in keeping with indications that personal growth and community contribution are the most intercorrelated scores.

$H6_0$: Physician motivation toward *community contribution* does not predict the number of medical protocols worked on in a crowdsourcing environment.

The rejection of the null for $H5_0$ and $H6_0$ is based on evidence that personal growth and community contribution was related to the number of protocols, in each dimension and overall, with higher level of personal growth and community contribution predicting higher number of medical protocols. Nonetheless, in the presence of correlated factors, the effect of personal growth and community contribution was diminished and frequently not significant.

There was insufficient evidence to reject the null hypotheses for any of the other hypotheses. This set of physician motivations did not significantly predict the participation or extent of crowdsourcing medical protocols. The lack of significance, conclusive remarks, and recommendations for further research our outlined in the final chapter.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to determine whether differences existed in motivation among physicians who did and did not participate in developing medical protocols in a crowdsourcing environment. Healthcare leaders face a management challenge of encouraging physician participation in developing medical protocols. An understanding of differences among physicians related to motivation is important to healthcare leaders to revise their management practices and improve physician participation.

I used the independent variables of intrinsic and extrinsic motivation, as measured by the AI (Kasser & Ryan, 1993), to measure seven categories of motivation. The number of medical protocols worked on by a physician, if any, served as the dependent variable. I obtained valid data from 132 physician members of an IPA related to the seven motivational subscales of the AI and the dependent variable. The number of protocols worked on ranged from 0 to 30 with a distribution skewed toward 0. I assessed the seven subscale motivations within the AI across the dimensions of the importance of the aspiration, the likelihood of attaining the aspiration, the degree to which the aspiration had been attained, and an overall aggregate score.

Interpretation of the Findings

I found all scores within the AI to be internally consistent, and a factor analysis supported a distinction between intrinsic and extrinsic motivation. I found a positive intercorrelation between intrinsic and extrinsic scores. Across the dimensions, the extrinsic motivations of wealth, fame, and image were consistently lower in the scoring

than the four intrinsic motivations. Overall, fame received the lowest rating of the seven motivations, and relationships received the highest mean score.

I performed a series of model estimations of the number of protocols. The negative binomial model emerged as the most appropriate model. However, no regression was found to be statistically significant, nor were the parameters for the individual motivations significant in any of the tested models. In addition, I computed rank correlations between the number of protocols worked on and the motivation scores. *Personal growth* and *community contribution* were significantly correlated with the number of protocols worked on, thereby offering partial evidence that null hypotheses H_5 and H_6, physician motivation toward personal growth and community contribution do not predict the number of medical protocols worked on in a crowdsourcing environment, may be rejected. However, when viewed among correlated factors, the effect of personal growth was frequently found to be insignificant. There was insufficient evidence to reject the remaining six hypotheses. The physician motivations did not significantly predict participation, or the extent of that participation, in the crowdsourcing of medical protocols.

Although SDT continues to appear to hold validity for explaining physician motivation, the predictive nature of the AI motivations, against the dependent variable of protocol participation, did not show significance as a predictive model. The significant correlation of motivations toward *personal growth*, *community comtribution* and protocol development offers an indication of topics for future studies. *Personal growth*, within the construct of SDT, fulfills the universal need of competence, which may be of significant

importance in the role of a physician and the affect that competence may have on the outcomes of patient care.

The findings, however, do not support the predictive nature of intrinsic motivation to determine crowdsourcing participation in medical protocol development. It is acknowledged, nevertheless, that the present study appears to be the first use of the AI among physicians. As found by Markland et al. (2005), the nature of a physician as expert makes it difficult for experts to entertain change in practices, even when that change is supported by evidence. It is possible that the extent of physician participation in the crowdsourcing of medical protocols is influenced by this unwillingness to readily accept or act on new knowledge. The tendency for experts to remain in a fixed pattern of decision making may explain the high occurrence of nonparticipation among the physician sample.

Additionally, the findings of Haivas, Hofmans, and Pepermans (2012) indicating that intrinsically motivated individuals were more prone to participation in volunteer projects were not supported in this study. As a voluntary project, the creation of medical protocols within a crowdsourcing environment does not appear to be a factor of influence. Again, the tendencies attributed to experts to remain within their existing framework of knowledge may have impeded the voluntarism necessary to participate in the crowdsourcing project under review in this study.

Limitations of the Study

As a causal-comparative study, there are limitations to the extent to which correlations can be presumed. As a new area of study, this ex post facto approach was chosen to establish a platform from which additional research may emerge.

The study used a convenience sample of approximately 2,000 physicians who were members of a physician organization. Transference of the findings to a broad physician population is limited. Self-selection may exist among the subject physicians related to their participation in the target IPA organization. Survey participants may be more or less likely to participate in crowdsourcing, which may affect the findings. Uncertainty exists as to whether these findings would yield similar results among physicians who did not participate in a physician organization such as the one under study.

By using a single physician organization that is geographically restricted to a local metropolitan area in the southern U.S., the study may have produced results that would vary for physicians who practice in other parts of the United States or internationally. Therefore, these causal-comparative findings cannot be reliably conveyed to be indicative of a broader physician population.

Given the nature of a physician as an expert, and the fact that the AI was used primarily on students in past research, there may be unknown limitations to the research tool related to expertise and medical protocols. As indicated in the literature review, changing the behavior and beliefs of an expert is difficult given the prolonged immersion and acculturation of those beliefs. If physicians, as experts, are resistant to change, this

resistance may prevent them from participating in developing a community standard of care through protocols, thereby skewing the results toward nonparticipation. Aspirations involving change, as measured within the AI tool, may find differing results among physicians compared to the previously surveyed students. As the first apparent use of the AI tool among physicians, this study's confounding factor of expertise may be an area of future study related to the use of this tool.

Recommendations

Physician motivation is of interest to healthcare leaders to improve physician participation in the development of medical protocols. Medical protocols may hold the prospect of improving the efficiency and cost effectiveness of medical care if physicians participate in the process of developing protocols. This study examined the predictive relationships between intrinsic and extrinsic physician motivations and the resultant level of participation in developing medical protocols. This study did not consider the quality of the resultant protocols within this target IPA, or the manner in which participation in protocol development was viewed by the physicians. Additional research is recommended to examine distinctions between participation in protocol development and the degree to which the physicians' perceptions related to the efficiency of the process, meaningfulness of the task, and degree of positive clinical outcomes achieved.

Research regarding the efficiency and effectiveness of the protocol development process may serve as a more appropriate initial step prior to examining motivations to participate. In other words, if participation is difficult and unorganized—thereby yielding

suboptimal medical protocols—physicians may be dissuaded to participate regardless of their motivation to participate in an ideal environment.

What remains unclear from the present study is the degree to which familiarity with the protocol development process encourages physicians to work on additional protocols or the degree to which experience improves the outcomes. This research did not examine whether previous protocol development work encouraged additional work. Additional research is suggested to examine whether the quality of the protocol improves with practice and whether the frequency of protocol development increases with practice.

The body of knowledge related to physician motivation and developing medical protocols was broadened by this study. Indeed, little previous research exists related to the topic. The research agenda for this area of interest is open and holds many possibilities for research focus and design, particularly using experimental research designs. The present study served to examine the broad predictive relationships between physician motivation and developing medical protocols as a basis from which future research can emerge.

Additional variations and extensions of this study are proposed to include:

- Replicate the study among other similar physician organizations with broader geographic coverage to include national and international locations.
- Integrate a measure of protocol quality grade, as established by a peer review board of physicians, to expand the study to examine physician motivations among participants that develop protocols deemed to be of the highest quality.

- Construct experimental models to establish an empirical correlation between a motivation for *personal development*, *community contribution* and participation in the development of medical protocols. For example, offer subject physicians the ability to choose between various projects, one of which is developing medical protocol. Experimental manipulation of the project choices can be used to determine the degree to which the motivation of personal development entices participants to select the protocol development option.
- Examine the extent to which familiarity with protocol development through previous experiences motivates physicians to participate in future protocol development efforts.

Implications: Positive Social Change

This study is a step forward in the examination of what appears to have been a previously unexamined research topic. The continued examination of physician motivation to participate in developing medical protocols is important.

For this study, participation in developing medical protocols was assumed to be a beneficial contribution to medical care as a means of improving medical outcomes and lowering the cost of care, as suggested by Balser et al. (2004). If, indeed, protocols are beneficial to medical care for individuals and—as an extension—to society at large, encouraging physician participation is critical to realizing a societal benefit. To continue the line of research begun in this study, it is imperative to explore the many aspects of this topic.

If physicians can be persuaded to participate in the development of medical protocols and protocols are beneficial to patient outcomes, positive social change is likely at the individual, family, and societal level. Improved health outcomes affect individuals and their families, as well as reducing the overall societal burden of an unhealthy populous. If healthcare outcomes are improved and the cost of care is reduced, individual, family, and societal financial obligations may be reduced.

Furthermore, if a relationship is established between the participation of physicians in developing medical protocols and improved health outcomes for patients—and the individual and societal cost for healthcare is reduced—policy changes may be in order. Policies at the healthcare organizational level, as well as state and federal requirements, may facilitate the participation of physicians in the development of medical protocols. Requirements by employers and insurance companies that physician-developed medical protocols be used for their covered employees may also facilitate physician participation.

Prior to calling upon healthcare organizations, employers, and regulatory agencies to establish requirements related to physician participation in developing medical protocols, additional research is needed. Based on the extant research, this study offers an early examination of the relationship between physician motivation and medical protocol development. The study did not examine the effectiveness of medical protocols related to health outcomes or the associated cost implication of those outcomes. Additional empirical research is required to examine those factors. As an ex post facto study, the results do not provide a tested model of experimental design to further examine the

relationship between physician participation and medical protocol development. Additional research is required to fully understand the potential for positive social change.

Conclusion

The presence of a consensus among physicians related to approaches to medical care, as well as the consistent use of community standards for care, demonstrate the need to use medical protocols developed by physicians (Balser et al., 2004). In the past, physicians have been reluctant to participate in the development of medical protocols (Balser et al., 2004; Jenicek, 2006). This study advanced the examination of motivations to participate in developing medical protocols in a crowdsourcing environment. By examining the nature of physician motivations to predict participation in the crowdsourcing of medical protocols, healthcare leaders may be able to encourage physician participation. By understanding the nature of motivation among physicians related to the development of medical protocols, the benefits of medical protocol participation can be communicated to physicians to encourage participation. It is important that the exploratory research of this study continues toward that end.

The present study served to initiate empirical analysis of the crowdsourcing model as an effective organizing approach for developing medical protocols by physicians. Additional research is recommended to further explore the relationship between physician motivation and medical protocol participation. This study, as an expansion of the existing body of knowledge, can serve as a platform for additional research related to physician motivations to participate, the degrees of effectiveness

among physicians related to protocol development, and the efficiency and effectiveness of the resultant protocols.

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Appendix A: Recent Crowdsourcing Research Applications

Research topic	Description	Reference
Democratization of information in crowdsourcing.	Examination of the ability for crowdsourcing to create a balanced and broad exchange of health information.	Adams, S.A., 2014
Use of crowdsourcing as alternative to relevance assessment tracking tools in the legal profession.	Experimentation demonstrates crowdsourcing to be an effective and cost efficient method as an alternative to relevance assessment tools to validate legal research and its relevance to a specific case.	Alonso, O., & Mizzaro, S., 2012
Interjecting technological expertise in contracting for innovation development.	Proposal and testing of crowdsourcing to management intellectual property rights while providing technical expertise to innovators.	Avenali, A., Battistella, C., Matteucci, G., & Nonino, F., 2013
Use of crowdsourcing to detect election fraud.	Examination of crowdsourcing as an effective tool to detect election fraud in Russia was substantiated.	Bader, M., 2013
Use of crowdsourced volunteer community in geographical mapping.	Examination of intentions among crowdsourced volunteers to participate in a mapping exercise.	Basiouka, S., & Potsiou, C., 2014
Quality of consumer product ideas generated by crowdsourced community.	Examination of Dell's ideation program found serial contributors of product ideas have higher rates of adoption compared to consumer-generated ideas. Serial contributors, however, proposed previously submitted ideas after their initial successful submission.	Bayus, B.L., 2013
Financial benefit of the use of crowdsourcing for the development of digital content.	A comparative study of the use of international crowdsourcing of IT content using the Apple company business model to	Bergvall-Kareborn, B., & Howcroft, D., 2013

	determine cost effectiveness.	
Comparison of crowdsourced smokers and problem drinkers related to attitudes toward the future.	Examination of problem drinkers compared to smokers, using a crowdsource sample, proved suitable to determining smokers discounted the perceived effect of future changes in behavior related to smoking more so than problem drinkers do for drinking.	Bickel, W.K., Jarmolowicz, D.P., Mueller, E.T., Franck, C.T., Carrin, C., & Gatchin, K.M., 2012
Expertise of crowdsourced participants related to labor rights.	Examination of crowdsourcing participants points to contrary data related to their skill level. The myth of amateur participant is corrected showing higher levels of expertise. These skill levels may bring forth labor rights issues.	Brabham, D.C., 2012
Supplementing computerized vision with crowdsourced human identification capabilities.	Experimentation of the use of computer vision in bird watching supplemented by human identification to improve accuracy.	Branson, S., Van Horn, G., Wah, C., Perona, P., & Belongie, S., 2014
Evaluation of academic literature using a crowdsourced population.	Evaluation of a crowdsourced population to review and categorize academic literature was found to have high levels of reliability and cost efficiency.	Brown, A.W., & Allison, D.B., 2014
Crowdsourced populations provide data regarding awareness of medical risk of cancer.	Comparative analysis of knowledge regarding ovarian cancer and breast cancer used a crowdsourced population to measure lack of knowledge related to ovarian cancer.	Carter, R.C., DiFeo, A., Bogie, K., Zhang, G.Q., & Sun, J., 2014
Meaningfulness in a crowdsourcing environment.	Experimentation indicates the manipulation of meaning as a context for a crowdsourced task has implications for performance and accuracy.	Chandler, D., & Kapelner, A., 2013
Longitudinal data collection and prescreening methods for crowdsourcing.	Study tests the ability for crowdsourced populations to participate in longitudinal studies to minimize previous drawbacks of crowdsourced populations.	Chandler, J., Mueller, P., & Gabriele, P., 2014
Managerial decision-making in a	Investigation of managerial	Chiu, C.M., Liang, T.P., & Turban,

crowdsourcing environment.	decision-making models related to the task completion and outcomes	E., 2014
Crowdsourced identification of Egyptian sarcophagi ethnicity.	Comparative study found crowdsourced matching of eye color from sarcophagi art with known acquaintance of participant accurately classified ethnicity.	Coulombe, P., Qualls, C., Kruszynski, R., Nerlich, A., Bianucci, R., Harris, R. . . . Appenzeller, O., 2012
Accuracy of crowdsourced earthquake data.	Comparative analysis indicates crowdsourced earthquake data is reliable compared to traditional sensor generated data.	Crooks, A., Croitoru, A., Stefanidis, A., & Radzikowski, J., 2013
Customer participation in product design.	Comparative study found that customer participants in product design demonstrated feelings of exploitation.	Djelassi, S., & Decoopman, I., 2013
Determination of fairness expectations in crowdsourced transactions.	Experimental manipulation of levels of fairness in a crowdsourced transaction for IT development found fairness significantly impacts identification with the project and future transactions.	Franke, N., Keinz, P., & Klausberger, K., 2013
Crowdsourcing of television sitcom scripts.	Evaluation of crowdsourcing to catalog and generate script for television sitcom using previous sitcom material.	Friedland, G., Gottlieb, L., & Janin, A., 2013
Effect of opinion leaders within the construct of crowdsourcing.	Analysis demonstrates opinion managers within a crowdsourced group have significant effect on innovation and decision-making.	Garrigos-Simon, F.J., Alcami, R.L., & Ribera, T.B., 2012
Introduction of a socio-technical crowdsourcing model.	Evaluating ability of crowdsourcing to improve the fit of task to participating interest	Geiger, D., & Schader, M., 2014
Crowdsourcing of artificial intelligence.	Reliability of crowdsourcing forum to create artificial intelligence software for legal knowledge.	Getman, A.P., & Karasiuk, V.V., 2014
Categorization of dialects using crowdsourcing.	Evaluation of dialect categorization using crowdsourced micro-blogging platform proved to create reliable geographical dispersion	Goncalves, B., & Sanchez, D., 2014

	of dialects.	
Rapid-response isotope monitoring by geographically distributed crowdsourced population.	Examination of the predictive value of weather data gathered by crowdsourced participants to predict hurricane evolution.	Good, S.P., Mallia, D.V., Derek, V., Lin, J.C., & Bowen, G.J. (2014).
Crowdsourcing a solar system mapping.	Evaluation of crowdsourcing of dark matter mapping was found to create significant advancement in the creation of astronomical algorithms using citizen-scientist.	Harvey, D., Kitching, T.D., Noah-Vanhoucke, J., Hamner, B., Salimans, T., & Pires, A.M., 2014
Creation of new product ideas using crowdsourcing.	Measurement of a crowdsourcing participant's ability to learn how to create new product ideas.	Huang, Y., Singh, P.V., & Srinivasan, K., 2014
Participant dissatisfaction with a crowdsourcing task.	Crowdsource worker satisfaction with the task and the employer is examined.	Irani, L., & Silberman, M.S., 2014
Crowdsourcing role in cyber attack on national infrastructures.	Mapping of crowdsourcing role in the organization of cyber attacks on national assets and identification of defense mechanisms.	Johnson, C.W., 2014
Examining intent to participate using a crowdsourced population.	An experiment to study intent to participate was conducted using a crowdsourced population related to park signage. Signage recommendations were made from the research findings.	Kaczynski, A.T., Stanis, S.A., & Hipp, J.A., 2014
Uses of crowdsourcing to monitor economic behavior.	Examination of modern barter systems in money theory using crowdsourcing.	Kaikati, A.M., & Kaikati, J.G., 2013
Controlling for reliability of crowdsourcing participants under budget constraints.	Comparison of crowdsourcing task allocation algorithms to optimize budgetary spending.	Karger, D.R., Oh, S., & Shah, D., 2014
Crowdsourced adult gaming used to increase engagement in citizenship activities.	The use of adult games to involve and educate citizens related to civic governance was found to be an effective use of crowdsourcing.	Kelley, T.M., & Johnston, E., 2012
Using citizen-journalist through	Evaluation of crowdsourcing	Kim, J.Y., 2014

crowdsourcing platforms to report news events.	platforms to engage citizen-journalists to report news events was found to hold promise but is unpredictable.	
Crowdsourcing of retina research.	Examination of the effectiveness of crowdsourcing to organize citizen scientist to study motion detection in the retina.	Kim, J.S., Greene, M.J., Zlateski, A., Lee, K., Richardson, M., Turaga, S.C., . . . Seung, H.S., 2014
Reliability of cancer detection comparison.	Comparison of skin cancer detection between self-examination and crowdsourcing examination found higher reliability among multi-participant examination.	King, A.J., Gehl, R.W., Grossman, D., & Jensen, J.D., 2013
Assisting disabled stenographers through crowdsourcing.	Evaluation of human support of stenographers with disabilities to use common sense for corrections versus reliance on computer intelligence.	Lasecki, W.S., & Bigham, J.P., 2014
Effectiveness of crowdsourcing for idea generation.	Crowdsourcing was found to be an effective means to generating innovative ideas with the potential for high sales growth.	Lauto, G., Valentin, F., Hatzack, F., & Carlsen, M., 2013
Support for erraticism in career experience visible in crowdsourced career data.	Comparison of career data between crowdsourced population and internal employer records indicate erraticism in career movements more valuable that previously documented.	Leung, M.D., 2014
Crowdsourcing used to construct theory related to meteor storm.	A theory, related to the meteor storm of 1833 in which 72,000 meteors fell to earth, was developed by using crowdsourcing to coalesce proposed theories.	Littman, M., & Suomela, T., 2014
Effect of incentives in crowdsourcing.	Manipulation of rewards in crowdsourcing contest to measure quality of submission.	Liu, T.X., Yiang, J., Adamic, L.A., & Chen, Y., 2014
Online gaming to produce gene-disease annotations.	Crowdsourcing found to produce valid gene-disease annotations in previously unrealized quantities through online gaming.	Loguercio, S., Salvatore, G., Benjamin, M., & Su, A.I., 2013
Using crowdsourcing data to verify the religion of fandom.	Analysis of crowdsourced production materials and	Lynden, J.C., 2012

	relationships among fans of Star Wars served to classify the content and interactions as those behaviors associated with a religion.	
Generation of solutions in crowdsourcing innovation challenge.	Evaluation of quality of innovation in a crowdsourcing contest to generate innovative outcomes.	Malhotra, A., & Majchrzak, A., 2014
Examination of Big Data in a commercial setting.	Examination of ability for crowdsourced analysis of Big Data via online tool Kaggle to predict shopper behavior.	Martinez, M.G., & Walton, B., 2014
Globally extended learning using crowdsourcing.	Investigation of crowdsourcing as a source of geographically and relationally remote learning.	Maskell, P., 2014
Crowdsourced identification of eye disease.	Examination of crowdsourced identification of retinal disease images found high reliability with minimal training.	Mitry, D., Peto, T., Hayat, S., Morgan, J.E., Khaw, K., & Foster, P.J., 2013
Improving inter-annotator agreement in the association of emotions within a lexicon.	Experimentation using crowdsourcing found higher reliability in annotations by determining emotional associations within a lexicon.	Mohammad, S. M., Saif, M., & Turney, P.D., 2013
Crowdsourcing in democracy.	Evaluation of crowdsourcing in the United Kingdom as form of e-democracy.	Moss, G., & Coleman, S., 2014
Crowdsourcing transcription of ancient text.	Effectiveness of human transcription of ancient text using crowdsourcing platform.	Munyaradzi, N., & Suleman, H., 2014
Management models for crowdsourcing efficiency.	Analysis of vendor capability to manage the special needs of crowdsourcing populations.	Nevo, D., & Kotlarsky, J., 2014
Categorization of film scenes using crowdsourcing.	Experiment to evaluate the ability of crowdsourcing participants to interpret and categorize film scenes.	Patterson, G., Xu, C., Su, H., & Hays, J., 2014
Role of crowdsourcing in managing public transit disruptions.	Crowdsourcing is evaluated as a disaster management model to compensate for the high demand of information requirements during public services	Pender, B., Currie, G., Delbosc, A., & Shiwakoti, N., 2014

disruptions.

Affect of travel distance on use of after hours clinics.	Examination of new method using crowdsourced technology placement to determine affect of travel distance on the use of after hours medical services.	Raknes, G., & Hunskaar, S., 2014
Modification of advertising using crowdsourcing.	Effectiveness of modification of advertising by crowdsourcing population for increased ad production	Ren, J., Nickerson, J.V., Mason, W., Sakamoto, Y., & Graber, B., 2014
Errors among crowdsourced annotators.	Measurement of annotation errors among crowdsourcing participants and evaluation of alternative models.	Rodriquez, F., Pereira, F., & Ribeiro, B., 2014
The role of crowdsourcing in sustaining cultural practices.	A crowdsourcing platform is evaluated to capture cultural artifacts in digital media resources.	Rosner, D., Roccetti, M., & Marfia, G., 2014
Discovery of protein structures through crowdsourcing.	Validation that amateur crowdsourcing participants are able to suggest protein structures using online gaming with a high degree of reliability.	Savage, N., 2012
Accuracy of crowdsourced participants to pick winner in horse race.	Analysis of computer generated algorithms compared to ability of crowdsourced population to pick winner in a horse rate found computer algorithms to be more accurate.	Schumaker, R.P., 2013
Comparison of effectiveness of crowdsourcing versus focus groups.	Analysis found that crowdsourcing provides higher quality of ideas than traditional focus groups.	Schweitzer, F.M., Buchinger, W., Gassmann, O., & Obrist, M., 2012
Comparison of crowdsourced non-experts to expert results.	Analysis of crowdsourced non-expert results found high reliability in their ability to participate in remote sensing projects related to land use compared to expert input.	See, L., Comber, A., Salk, C., Fritz, S., Velde, M., Perger, C. . . . Obersteiner, M., 2013

Crowdsourced mapping of croplands used in undocumented areas.	Analysis of comparative accuracy between crowdsourced cropland mapping and government sponsored mapping found higher accuracy among crowdsourced maps.	See, L., McCallum, I, Fritz, S., Perger, C., Kraxner, F., Obersteiner, M. . . . Nripen, R., 2013
Effect of difficulty, duration, and competiveness on crowdsourcing participation.	Correlation study found that longer duration and reduced competition in crowdsourcing competitions increases participation.	Shao, B., Shi, L., Xu, B., & Lui, L., 2012
Using crowdsourcing toward democratic consensus among scientist.	To approach consensus regarding a disputed definition of molecular complexity, crowdsourcing is evaluated as an alternative solution.	Sheridan, R.P., Zorn, N., Sherer, E.C., Campeu, L.C., Chang, C.Z., Cumming, J., . . . O'Shea, D., 2014
Experimentation using online crowdsourcing.	Study expands the ability of crowdsourcing to move beyond anonymous surveys to experimental design using responsive technology.	Simcox, T., & Fiez, J.A., 2014
Use of crowdsourcing in industrial firms to foster innovation.	Evaluation of crowdsourcing models related to idea generation and innovation in industrial settings.	Simula, H., Y Ahola, T., 2014
Role of crowdsourcing in the efficient sharing of ideas among businesses.	Crowdsourcing of ideas shared between business entities was found to be problematic and lack effectiveness.	Simula, H., & Vuori, M., 2012
Enhancing the ability of individuals to learn about their environment through crowdsourcing.	Review of the ability of participatory sensing as an emerging field to monitor environmental conditions and inquiries through crowd technologies.	Sprake, J., & Rogers, P., 2014
Name ambiguity in bibliographic search addressed through crowdsourcing.	Analysis of crowdsourcing demonstrated high reliability in resolving name ambiguity in bibliographic searches.	Sun, X., Kaur, J., Possamai, L., & Menczer, F., 2013
Reliability of crowdsourced translations during a crisis.	Examination of translations performed by crowdsourced population during a natural disaster were found to be inadequate.	Sutherlin, G., 2013

Use of crowdsourcing to semi-automatically set privacy settings.	Evaluation of privacy preference determination among disabled and senior citizen adults using crowdsourcing location preferences.	Toch, E., 2014
Integration of crowdsourcing in public surveillance.	Evaluation of effectiveness of public monitoring of surveillance camera to identify suspicious behavior.	Trottier, D., 2014
Challenges in using crowdsourcing to test computer software.	Evaluation of algorithms used to distribute software testing in a crowdsourcing environment proved to produce acceptable quality in an acceptable timeframe.	Tung, Y., & Tseng, S., 2013
Monitoring of sea life by crowdsourced participants.	Previously un-monitored presence of rare sea turtles were found to effectively utilize crowdsourcing diving reports to study the sea life.	Van Houtan, K.S., Kittinger, J.N., Lawrence, A.L., Yoshinaga, C., Born, V.R., & Fox, A., 2012
Willingness of crowdsourcing participants to provide knowledge.	Analysis of crowdsourcing contest participants demonstrates reluctance to provide knowledge for free beyond certain limits.	Villarroel, J.A., Taylor, J.E., & Tucci, C.L., 2013
Effectiveness of micro-tasking in crowdsourcing environment.	Comparative study of micro-tasking versus expert macro-tasking of video annotation to study cognitive load and effectiveness in crowdsourcing. Non-skilled micro-tasking found to be suboptimal.	Vondrick, C., Patterson, D., & Ramanan, D., 2013
Collective problem solving behavior within a crowdsourcing environment.	Examination of the behavior of crowds regarding participation and frequency of use in a computer-based innovation contest.	Vuculescu, O., & Bergenholtz, C., 2014
Scientific applications of crowdsourcing.	Examination of research models using citizen scientist within a crowdsourcing framework.	Wechsler, D., 2014

Understanding shared rationales in crowdsourcing.	Experimentation of how context and rationale is shared among participants in a crowdsourcing community.	Xiao, L., 2014
Using crowdsourcing to self-monitor inappropriate tasks.	Evaluation of using non-expert participants to monitor the posting of illegal or inappropriate tasks was found to improve the ability to detect these infractions.	Yukino, B., Hisashi, K., Kei, K., Goushi, Y., & Yosuke, A., 2014
Identification of Arabic dialects within written resources.	Examination of the ability of a crowdsourced dialect specialist to identify variances among Arabic dialects within online newspaper reports.	Zaidan, O.F., & Callison-Burch, C., 2014
Understanding emergent urban qualities through social endorsement.	Evaluation of location-aware crowdsourced technology to create a theoretical model of urban design.	Zimmerman, C., Hansen, K., & Vatrapu, R., 2014

Appendix B: Online Survey Questions

Instructions:

Thank you for agreeing to participate in this study among Universal Physician Network (pseudonym) physicians. Your responses will be anonymous. By completing the survey you are indicating your consent to participate as outlined in the Informed Consent Notification.

It is important that you answer all questions. You will not be allowed to proceed in the survey until each question is answered. This information will help Universal Physician Network understand the aspirations and motivations of their members to improve communication and better organize work to improve patient outcomes and provide a meaningful experience for you and your colleagues. If there are questions you do not want to answer, you may discontinue participation at any time.

Survey Questions:

Everyone has long-term goals or aspirations. These are the things that individuals hope to accomplish over the course of their lives. In this survey, you will find 35 life goals, presented one at a time. You will be asked three questions about each life goal: (a) How important is this goal to you? (b) How likely is it that you will attain this goal in your future? and (c) How much have you already achieved this goal thus far?

Please use the following scale in answering each of the three questions about each life goal.

1 – not at all

2 –

3 –

4 – moderately

5 –

6 –

7 - very

Life-goal #1: To be a very wealthy person.
1. How important is this to you?
2. How likely is it that this will happen in your future?
3. How much have you already attained this goal?

Life-goal #2: To grow and learn new things.
4. How important is this to you?
5. How likely is it that this will happen in your future?
6. How much have you already attained this goal?

Life-goal #3: To have my name known by many people.
7. How important is this to you?
8. How likely is it that this will happen in your future?
9. How much have you already attained this goal?

Life-goal #4: To have good friends that I can count on.
10. How important is this to you?
11. How likely is it that this will happen in your future?
12. How much have you already attained this goal?

Life-goal #5: To successfully hide the signs of aging.
13. How important is this to you?
14. How likely is it that this will happen in your future?
15. How much have you already attained this goal?

Life-goal #6: To work for the betterment of society.
16. How important is this to you?
17. How likely is it that this will happen in your future?
18. How much have you already attained this goal?

Life-goal #7: To be physically healthy.
19. How important is this to you?
20. How likely is it that this will happen in your future?
21. How much have you already attained this goal?

Life-goal #8: To have many expensive possessions.
22. How important is this to you?
23. How likely is it that this will happen in your future?
24. How much have you already attained this goal?

Life-goal #9: At the end of my life, to be able to look back on my life as meaningful

and complete.
25. How important is this to you?
26. How likely is it that this will happen in your future?
27. How much have you already attained this goal?

Life-goal #10: To be admired by many people.
28. How important is this to you?
29. How likely is it that this will happen in your future?
30. How much have you already attained this goal?

Life-goal #11: To share my life with someone I love.
31. How important is this to you?
32. How likely is it that this will happen in your future?
33. How much have you already attained this goal?

Life-goal #12: To have people comment often about how attractive I look.
34. How important is this to you?
35. How likely is it that this will happen in your future?
36. How much have you already attained this goal?

Life-goal #13: To assist people who need it, asking nothing in return.
37. How important is this to you?
38. How likely is it that this will happen in your future?
39. How much have you already attained this goal?

Life-goal #14: To feel good about my level of physical fitness.
40. How important is this to you?
41. How likely is it that this will happen in your future?
42. How much have you already attained this goal?

Life-goal #15: To be financially successful.
43. How important is this to you?
44. How likely is it that this will happen in your future?
45. How much is this satisfied currently?

Life-goal #16: To choose what I do, instead of being pushed along by life.
46. How important is this to you?
47. How likely is it that this will happen in your future?
48. How much is this satisfied currently?

Life-goal #17: To be famous.
49. How important is this to you?
50. How likely is it that this will happen in your future?
51. How much have you already attained this goal?

Life-goal #18: To have committed, intimate relationships.
52. How important is this to you?
53. How likely is it that this will happen in your future?
54. How much have you already attained this goal?

Life-goal #19: To keep up with fashions in hair and clothing.
55. How important is this to you?
56. How likely is it that this will happen in your future?

57. How much have you already attained this goal?
Life-goal #20: To work to make the world a better place.
58. How important is this to you?
59. How likely is it that this will happen in your future?
60. How much have you already attained this goal?
Life-goal #21: To keep myself healthy and well.
61. How important is this to you?
62. How likely is it that this will happen in your future?
63. How much have you already attained this goal?
Life-goal #22: To be rich.
64. How important is this to you?
65. How likely is it that this will happen in your future?
66. How much have you already attained this goal?
Life-goal #23: To know and accept who I really am.
67. How important is this to you?
68. How likely is it that this will happen in your future?
69. How much have you already attained this goal?
Life-goal #24: To have my name appear frequently in the media.
70. How important is this to you?
71. How likely is it that this will happen in your future?
72. How much have you already attained this goal?
Life-goal #25: To feel that there are people who really love me, and whom I love.
73. How important is this to you?
74. How likely is it that this will happen in your future?
75. How much have you already attained this goal?
Life-goal #26: To achieve the "look" I've been after.
76. How important is this to you?
77. How likely is it that this will happen in your future?
78. How much have you already attained this goal?
Life-goal #27: To help others improve their lives.
79. How important is this to you?
80. How likely is it that this will happen in your future?
81. How much have you already attained this goal?
Life-goal #28: To be relatively free from sickness.
82. How important is this to you?
83. How likely is it that this will happen in your future?
84. How much have you already attained this goal?
Life-goal #29: To have enough money to buy everything I want.
85. How important is this to you?
86. How likely is it that this will happen in your future?
87. How much have you already attained this goal?
Life-goal #30: To gain increasing insight into why I do the things I do.
88. How important is this to you?

89. How likely is it that this will happen in your future?
90. How much have you already attained this goal?

Life-goal #31: To be admired by lots of different people.

91. How important is this to you?
92. How likely is it that this will happen in your future?
93. How much have you already attained this goal?

Life-goal #32: To have deep enduring relationships.

94. How important is this to you?
95. How likely is it that this will happen in your future?
96. How much have you already attained this goal?

Life-goal #33: To have an image that others find appealing.

97. How important is this to you?
98. How likely is it that this will happen in your future?
99. How much have you already attained this goal?

Life-goal #34: To help people in need.

100. How important is this to you?
101. How likely is it that this will happen in your future?
102. How much have you already attained this goal?

Life-goal #35: To have a physically healthy life style.

103. How important is this to you?
104. How likely is it that this will happen in your future?
105. How much have you already attained this goal?

Additional Information:

How many medical protocols (order sets) do you estimate you have worked on while a member of Universal Physician Network? (Please enter 0 if you have not worked on any.)

Please provide some additional information to provide a general description of research participants for comparative sampling purposes in the future if additional research is undertaken:

Age:
less than 24 years
24-35 years
36-45 years
46-55 years
56-65 years
66-75 years
greater than 75 years

Gender:
Male
Female
Ethnicity:
White
Black
Hispanic
Asian
American Indian
Other

Thank you for your participation in this survey.

Appendix C: Survey Scoring Key

Directions for scoring provided by the authors of the tool: There are seven categories of aspirations or life goals, with 5 specific goals within each category. Further, there are three questions about each specific goal: namely, how important is it; how likely it is that you will attain it; and how much have you already attained it. To score this scale, you calculate three subscale scores for each of the several aspiration categories: the importance score; the likelihood score; and the attainment score. To do this, average the items responses in that subscale. Below is a list of question numbers that related to each variable:

Wealth:
importance
1, 22, 43, 64, 85
likelihood
2, 23, 44, 65, 86
attainment
3, 24, 45, 66, 87
Fame:
importance
7, 28, 49, 70, 91
likelihood
8, 29, 50, 71, 92
attainment
9, 30, 51, 72, 93
Image:
importance
13, 34, 55, 76, 97
likelihood
14, 35, 56, 77, 98
attainment
15, 36, 57, 78, 99
Meaningful Relationships:
importance
10, 31, 52, 73, 94
likelihood
11, 32, 53, 74, 95
attainment
12, 33, 54, 75, 96

Personal Growth:
importance
4, 25, 46, 67, 88
likelihood
5, 26, 47, 68, 89
attainment
6, 27, 48, 69, 90
Community Contribution:
importance
16, 37, 58, 79, 100
likelihood
17, 38, 59, 80, 101
attainment
18, 39, 60, 81, 102
Good Health:
importance
19, 40, 61, 82, 103
likelihood
20, 41, 62, 83, 104
attainment
21, 42, 63, 84, 105

Appendix D: Initial Survey Invitation and Consent

Dear Physician Member,

As a member of the Universal Physician Network (pseudonym) you are invited to participate in a research survey created by Rod Brace, a PhD candidate in Management as part of a doctoral dissertation. In full disclosure, please note Mr. Brace is the Executive Position (pseudonym) of Universal Health System (pseudonym). He is interested in using the findings to understand the motivational characteristics of our physician members, specifically related to the completion of medical protocols (order sets) within Universal Health System. All Universal Physician Network members with greater than one year of membership are invited to participate in this online survey. Your participation will be anonymous and strictly voluntary. No identifiers will be collected as part of the research.

The survey should take about 15 minutes or less to complete. If you agree to participate, please access the online survey within two weeks through **the link located at the end of the consent form included below**. If you have questions please contact Mr. Brace at [email address redacted] and he will address your questions. Your participation is greatly appreciated.

Sincerely,

[name redacted]

President

Informed Consent Notification and Link to Survey

Walden University, Minneapolis, USA
Consent Form
PhD Dissertation Research

You are invited to take part in a research study of physician motivation. The researcher is inviting members of the Universal Physician Network to be in the study. You have been determined to be a member of the Universal Physician Network. This

form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

A researcher named Rod Brace, who is a doctoral student at Walden University, is conducting this study. You may already know Rod Brace as the Executive Position for the Universal Health System. His role in this study is separate from the position he holds with the Universal Health System. Survey participation is anonymous and contains no identifiers; therefore, the researcher will not know whether you participate in the survey.

Background Information:
The purpose of this study is to study physician motivations through the use of aspirational statements using an online survey.

Procedures:
If you agree to be in this study, you will be asked to:

- Complete one online survey using SurveyMonkey.com regarding aspirational statements. It is estimated to take approximately 15 minutes to respond to 35 aspirational statements with 3 questions for each statement. You will be provided 2 weeks to complete the survey.

- Respond as to the importance of the aspiration to you, the likelihood it will happen in the future, and the extent to which you have achieved the goal. Responses will be in the form of a numeric scale from 1 to 7 with 1 indicating *not at all* and 7 *very*.

Here are some sample questions:

Life Goal: To help others improve their lives.
- How important is this to you?
- How likely is it that this will happen in the future?
- How much have you already attained this goal?

Life Goal: To choose what I do, instead of being pushed along by life.
- How important is this to you?
- How likely is it that this will happen in the future?
- How much have you already attained this goal?

Voluntary Nature of the Study:
This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at the Universal Physician Network will treat you differently if you decide not to be in the study. Neither the researcher nor Universal Physician Network leaders will know the identity of participants or non-participants. If

you decide to join the study now, you may stop completion of the study at any point before the final question and your results will not be included in the study.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as finding extra time in your day to complete an online survey which may cause fatigue or stress. Being in this study will not pose a risk to your safety or wellbeing.

The aggregated results of the study will be of interest to the leadership of the Universal Physician Network as they examine ways to engage members in meaningful work. By understanding the aspirations and motivations of the Universal Physician Network members, improvements to communication, encouraging involvement in the Universal Physician Network programs, as well as creating beneficial activities may be a result of this study.

Payment:
As a member of the Universal Health Network you are requested to voluntarily participate without compensation.

Privacy:
Any information you provide will be kept anonymous. Completion of the survey will indicate your implied consent to participate in the study. The researcher will not capture or use your personal information. You will not be asked for your name or other personal identifiers. Data will be kept secure during data capture on the SurveyMonkey site, which uses industry standard encryption and password protection. Data will be backed up on a secure server by the researcher and kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now or later by contacting the researcher via email (phone number redacted). If you want to talk privately about your rights as a participant, you can call Dr. [name redacted]. She is the Walden University representative who can discuss this with you. Her phone number is [Redacted]. Walden University's approval number for this study is 11-19-14-0172280 and it expires on November 18, 2015.

Please print or save this consent form for your records.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. This informed consent notification has disclosed

potential conflict of interests known at the time to the researcher. An attempt has been made to convey these terms in an understandable manner. Nothing contained in this notification is meant to waive the legal rights of participants.

By clicking the link below, I understand that I am agreeing to the terms described above and by proceeding to the survey I provide my consent to participate.

[link to SurveyMonkey.com site for this present study]

Appendix E: Follow-up Survey Invitation and Consent

Dear Physician Member,

Approximately one week ago you received an email from me inviting you to participate in a research survey created by Rod Brace, a PhD candidate in Management as part of a doctoral dissertation. He is interested in using the findings to understand the motivational characteristics of Universal Physician Network members, specifically related to the completion of medical protocols (order sets) within our Universal Physician Network.

Since participation is strictly confidential, it is not known if you completed the survey or not so this reminder is being sent to all physician members who received the initial invitation. If you have completed the survey, your time and participation are greatly appreciated. If you have not completed the survey, please know there is still time to do so. Participation in the survey will close in one week.

The survey should take less than 15 minutes to complete. If you agree to participate, please access the online survey at your earliest convenience **through the link below that follows the informed consent information**. If you have questions please contact Mr. Brace at [email redacted] and he will address your questions.

Sincerely,
[name redacted]
President

Informed Consent Notification and Link to Survey

Walden University, Minneapolis, USA
Consent Form
PhD Dissertation Research

You are invited to take part in a research study of physician motivation. The researcher is inviting members of the Universal Physician Network to be in the study. You have been determined to be a member of Universal Physician Network. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

A researcher named Rod Brace, who is a doctoral student at Walden University, is conducting this study. You may already know Rod Brace as the Executive Position for the Universal Health System. His role in this study is separate from the position he holds with the Universal Health System. Survey participation is anonymous and contains no identifiers; therefore, the researcher will not know whether you participate in the survey.

Background Information:
The purpose of this study is to study physician motivations through the use of aspirational statements using an online survey.

Procedures:
If you agree to be in this study, you will be asked to:

- Complete one online survey using SurveyMonkey.com regarding aspirational statements. It is estimated to take approximately 15 minutes to respond to 35 aspirational statements with 3 questions for each statement. You will be provided 2 weeks to complete the survey.

- Respond as to the importance of the aspiration to you, the likelihood it will happen in the future, and the extent to which you have achieved the goal. Responses will be in the form of a numeric scale from 1 to 7 with 1 indicating *not at all* and 7 *very*.

Here are some sample questions:

Life Goal: To help others improve their lives.
- How important is this to you?
- How likely is it that this will happen in the future?
- How much have you already attained this goal?

Life Goal: To choose what I do, instead of being pushed along by life.
- How important is this to you?
- How likely is it that this will happen in the future?
- How much have you already attained this goal?

Voluntary Nature of the Study:

This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at the Universal Physician Network will treat you differently if you decide not to be in the study. Neither the researcher nor Universal Physician Network leaders will know the identity of participants or non-participants. If you decide to join the study now, you may stop completion of the study at any point before the final question and your results will not be included in the study.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as finding extra time in your day to complete an online survey which may cause fatigue or stress. Being in this study will not pose a risk to your safety or wellbeing.

The aggregated results of the study will be of interest to the leadership of Universal Physician Network as they examine ways to engage members in meaningful work. By understanding the aspirations and motivations of Universal Physician Network members, improvements to communication, encouraging involvement in Universal Physician Network programs, as well as creating beneficial activities may be a result of this study.

Payment:
As a member of the Universal Physician Network you are requested to voluntarily participate without compensation.

Privacy:
Any information you provide will be kept anonymous. Completion of the survey will indicate your implied consent to participate in the study. The researcher will not capture or use your personal information. You will not be asked for your name or other personal identifiers. Data will be kept secure during data capture on the SurveyMonkey site, which uses industry standard encryption and password protection. Data will be backed up on a secure server by the researcher and kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now or later by contacting the researcher via email [email address redacted]. If you want to talk privately about your rights as a participant, you can call Dr. [Redacted]. She is the Walden University representative who can discuss this with you. Her phone number is [Redacted]. Walden University's approval number for this study is 11-19-14-0172280 and it expires on November 18, 2015.

Please print or save this consent form for your records.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. This informed consent notification has disclosed potential conflict of interests known at the time to the researcher. An attempt has been made to convey these terms in an understandable manner. Nothing contained in this notification is meant to waive the legal rights of participants.

By clicking the link below, I understand that I am agreeing to the terms described above and by proceeding to the survey I provide my consent to participate.

[link to SurveyMonkey.com site for this present study]

Appendix F: Letter of Cooperation

Note: Original emails on file.

-------- Original message --------
From: Universal Physician Network President
Date:07/08/2014 8:31 AM (GMT-06:00)
To: "Brace, Rod"
Subject: Re: Permission to survey IPA participants - IRB requirement - Dissertation

[Redacted]

Tuesday, July 08, 2014 8:31 AM

Sounds good Rod.
Can I know the questions (not as a prerequisite but just for interest)?

[Name Redacted]
Sent from my iPhone

Brace, Rod

Actions

To:
Universal Physician Network President
Sent Items

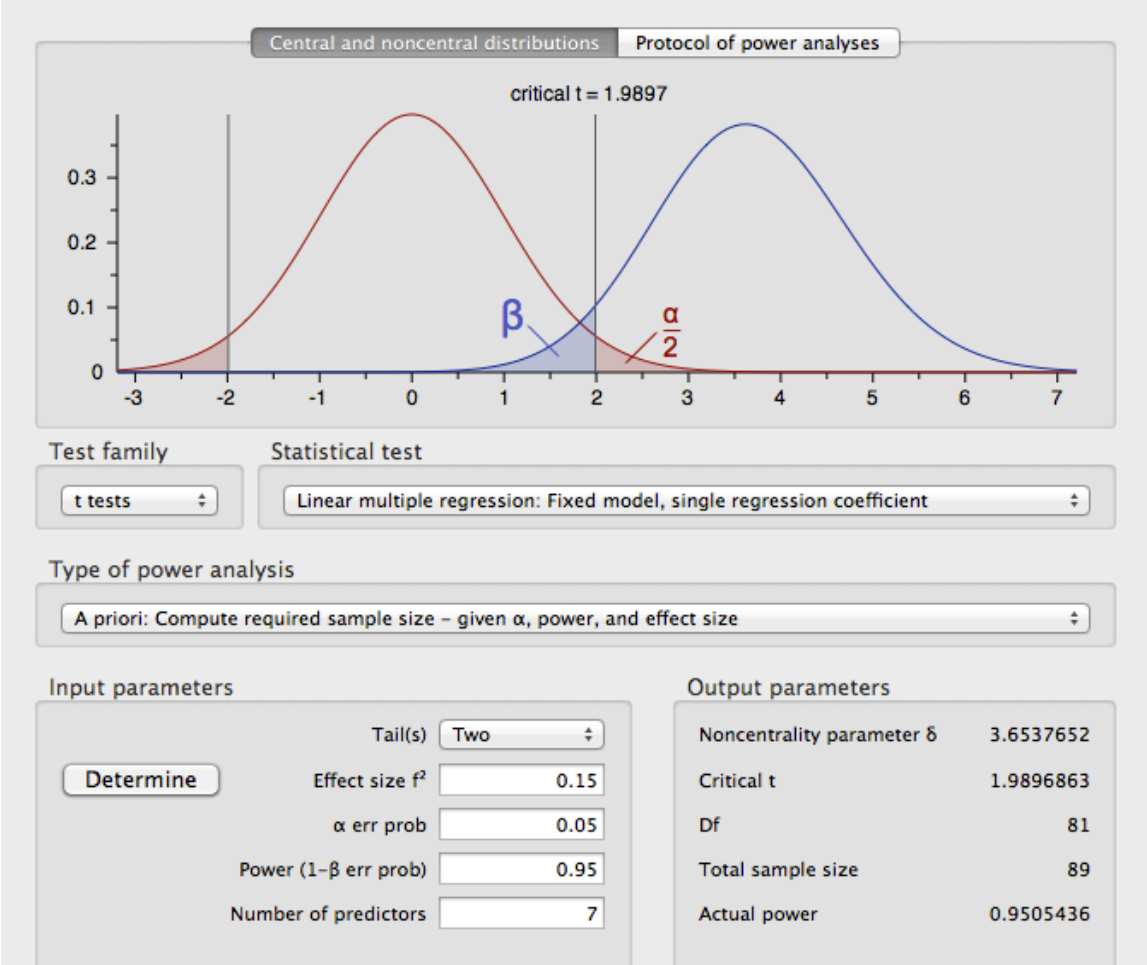
Monday, July 07, 2014 2:12 PM

Dr. [Redacted] - This email requests your permission, as President of Universal Physician Network, an Independent Physician Association (IPA), to survey IPA physician members as part of a research project for my dissertation. Your organization will be requested to email an online survey link to members with at least one year membership in the IPA. The survey will be anonymous and will ask physicians to indicate the number of medical protocols worked on as well as ask them to complete a motivational survey. A statement of informed consent will be provided.

The IRB of Walden University will review this proposed research project and requests your permission for me to access the physician members of your IPA. Your kind reply to this email in the affirmative will suffice for IRB purposes. This email and your reply will be replicated in the dissertation appendix as proof of permission.

Thank you for your consideration of this research project and I look forward to sharing the findings with you.

Appendix G: G-Power Parameters



Appendix H: Permission to Use Research Tool

Note: Original emails on file.

Email requests for permission to use Aspiration Index and replicate survey and scoring key in dissertation.

Dr. Ryan or Dr. Kasser - I am a doctoral student completing my dissertation at Walden University. I propose to use the Aspirations Index in my research among 2,000 physicians. I registered on selfdeterminationtheory.org and was granted online permission/access to the Aspirations Index. However, my dissertation chair is requesting that I receive a more direct approval to include in the Appendix of my dissertation. I inquired via the Contact link on the site but did not receive a reply. I am hopeful that either of you can assist me. A response of approval to this email will suffice.

Thank you in advance for your assistance – Rod Brace

Email Approvals:

Dr. Kasser's Permission:
7:37 AM (3 hours ago)

Rod,

You have my permission to use the AI in your research. Good luck with your project, and let me know if I can be of any help in working with the AI.

[Email address redacted]

Dr. Ryan's Permission:

Ryan, Richard [Email address redacted] 7:06 AM (4 hours ago)

to me

Rod

You have permission to use the aspirations scale and other related scales from our website for academic research purposes.

Best of luck

Richard

Richard M. Ryan, Ph.D.
Professor of Psychology
and Director of Clinical Training,
Clinical and Social Sciences in Psychology
University of Rochester
Rochester, New York 14627
[Phone number redacted]

Website for SDT:
http://www.selfdeterminationtheory.org

Drs. Kasser and Ryan - Thank you again for previously approving use of your Aspirations Index in my dissertation project to research motivations of physicians in a crowdsourcing environment. I previously requested only permission to use the AI tool in my research. My IRB has requested that I gain permission to replicate the questions and scoring key in my dissertation. Your reply in the affirmative to this email will suffice and is greatly appreciated. Thank You!

Tim Kasser 2:26 PM (4 hours ago)

to me, Richard

You have my permission. Good luck with your project.

Sincerely,

Tim Kasser, Ph.D.
Professor of Psychology
Knox College

Appendix I: Operational Definitions – Independent Variables

Motivational category	Operational definition	Aspirational goals
Extrinsic	Wealth	1. To be a very wealthy person. 2. To have many expensive possessions 3. To be financially successful. 4. To be rich. 5. To have enough money to buy everything I want.
Extrinsic	Fame	1. To have my name known by many people. 2. To be admired by many people. 3. To be famous. 4. To have my name appear frequently in the media. 5. To be admired by lots of different people.
Extrinsic	Image	1. To successfully hide the signs of aging. 2. To have people comment often about how attractive I look. 3. To keep up with fashions in hair and clothing 4. To achieve the "look" I've been after. 5. To have an image that others find appealing.
Intrinsic	Personal growth	1. To grow and learn new things. 2. At the end of my life, to be able to look back on my life as meaningful and

		complete.
		3. To choose what I do, instead of being pushed along by life.
		4. To know and accept who I really am.
		5. To gain increasing insight into why I do the things I do.
Intrinsic	Meaningful relationships	1. To have good friends that I can count on.
		2. To share my life with someone I love.
		3. To have committed, intimate relationships.
		4. To feel there are people who really love me, and whom I love.
		5. To have deep enduring relationships.
Intrinsic	Community contributions	1. To work for the betterment of society.
		2. To assist people who need it, asking nothing in return.
		3. To work to make the world a better place.
		4. To help others improve their lives.
		5. To help people in need.
Intrinsic	Good health	1. To be physically healthy.
		2. To feel good about my level of physical fitness.
		3. To keep myself healthy and well.
		4. To be relatively free from sickness.
		5. To have a physically healthy life-style.