

PERSPECTIVES OF INFORMAL CAREGIVERS ON USING IN-HOME  
TECHNOLOGY TO MONITOR ACTIVITIES OF PERSONS  
WITH SERIOUS MENTAL ILLNESS

---

A Dissertation  
presented to  
the Faculty of the Graduate School  
at the University of Missouri-Columbia

---

In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

---

by  
JAROD THOMAS GIGER  
Dr. Martha Markward, Dissertation Supervisor

JULY 2010

© Copyright by Jarod Thomas Giger 2010

All Rights Reserved

The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

PERSPECTIVES OF INFORMAL CAREGIVERS ON USING IN-HOME  
TECHNOLOGY TO MONITOR ACTIVITIES OF PERSONS  
WITH SERIOUS MENTAL ILLNESS

presented by Jarod Thomas Giger, a candidate for the degree of doctor of philosophy, and hereby certify that, in their opinion, it is worthy of acceptance.

---

Professor Martha Markward, Chair

---

Professor Debra Parker Oliver, Committee

---

Professor Dong Pil Yoon, Committee

---

Professor Carol Evans, Outside Committee

## DEDICATION

Thank you to my beautiful soon to be bride and my family and friends. Without your support I would not be where I am at today. I am particularly indebted to my older brother who inspired me throughout this journey. The challenges I have faced in my academic career pale in comparison to the challenges he has faced and subsequently conquered over the course of his life. This research is as much his as it is mine.

## ACKNOWLEDGEMENTS

Countless persons have provided me invaluable support, encouragement, and mentoring throughout my doctoral training and the dissertation process. However, I would be remiss if I did not start off by expressing my sincere gratitude to the faculty members which served on my dissertation committee, particularly Dr. Martha Markward, my mentor and dissertation committee Chair. The patience, time, and expertise I received from my Chair were invaluable and life-changing. Dr. Markward has been a tireless supporter, teacher, and mentor, and without her guidance and structure I would not be where I am today. Words cannot describe how grateful I am to her. Drs. Debra Parker Oliver and Dong Pil Yoon have been involved in my education since I first began my doctoral training. Coming in to MU I was interested in studying technology. I could not have imagined the types of technology I would ultimately be introduced to through my assistantship work with Dr. Parker Oliver. Dr. Dong Pil Yoon's multivariate statistics course helped me to view statistics in a new light and prepared me to successfully defend my research. I now find statistics quite fun. I have also benefited from my association with Dr. Carol Evans from the Missouri Institute of Mental Health. Your knowledge and insight regarding the National Alliance on Mental Illness and the transformation mental health is currently undergoing has enriched both my doctoral education and my dissertation.

Various others have supported me and my education. Drs Marjorie Skubic and Marilyn Rantz, from the MU Center for Eldercare and Rehabilitation Technology, provided me with countless technology-related research projects and experiences at TigerPlace. My experiences at TigerPlace and the Center ultimately contributed to my dissertation, and my interactions with the residents and staff at TigerPlace have made me

a better scholar and researcher. I am truly appreciative of the time and discussions I have had with the many engineering and nursing students I have had the honor to work with and learn from. Drs George Dimirus and Suh Won Lee have helped me enhance my abilities to perform qualitative research and robust quantitative statistical analyzes. Last, the pilot study that served as the basis for this dissertation was partially funded by the Jane Bierdeman-Fike Doctoral Fellowship in Social Work. The financial assistance provided by this Fellowship has helped me tremendously.

I am also fortunate to have been supported through this academic process by my family and friends. It would be careless if I did not specifically thank my wonderful soon to be wife, Jaime Sanders, my mother, Sandra Giger, my father, Thomas Giger, and my brother, Grady Giger, for their support and tolerance during this challenging and exciting chapter of my life. Finally, I want to extend a heartfelt thank you to the executive director of the Missouri National Alliance on Mental Illness, Cindi Keele, and the countless mental health consumers and informal caregivers who participated in this research. Their eagerness to share their life stories not only enriched this research but enriched me as human being.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	ii
ABSTRACT .....	vi
Chapter	
1. INTRODUCTION .....	1
Theoretical Framework	
Statement of Problem	
Significance of Study	
Statement of Purpose	
Hypotheses	
Definitions of Terms	
Assumptions	
Limitations	
Delimitations	
2. LITERATURE REVIEW.....	10
Theoretical Framework	
Evidence for the TRA	
Evidence for the TRA among Technology Use	
Technology Acceptance Model	
Evidence for the TAM	
Evidence for the TAM among Healthcare Settings	
Telemedicine, Telehealth, and Smart Homes	
Evidence for Telemedicine/Telehealth	
Smart Home Technology	
Evidence for Smart Homes	
SHT and Family Caregivers	
Family Caregivers and Serious Mental Illness	
Informal Caregivers of Persons with Serious Mental illness	
Perceptions of Informal Caregivers	
3. METHODOLOGY.....	49
Preliminary Study	
Main Study	
Internal Reliability	
Design	
Scoring/Data Analysis	

4. FINDINGS.....	62
Characteristics of Participants	
Mean Ratings on PU, PEOU, and ATT	
Research Question 1	
Research Question 2	
Research Question 3	
Research Question 4	
5. DISCUSSION.....	72
Conclusions	
Policy, Practice, and Research Implications	
REFERENCES.....	79
APPENDIX	
A. STUDY BROCHURE.....	107
B. STUDY QUESTIONNAIRE.....	109
C. INTRODUCTION LETTER.....	118
D. INFORMED CONSENT.....	119
VITA.....	120

## LIST OF TABLES

Table	Page
1. Sample Comparison with a Recent National Sample of NAMI Caregivers.....	52
2. Means with Confidence Intervals and Standard Deviations on Perceived Usefulness, Perceived Ease of Use, and Attitude Toward Using the IMS Scales.....	64
3. Spearman Correlation Coefficients for Perceived Usefulness, Perceived Ease of Use, and Attitude Toward the IMS.....	65
4. Regression Analysis Summary for Perceived Usefulness and Perceived Ease of Use Variables Predicting Family Member Attitude Toward the IMS.....	68
5. Regression Analysis Summary for Perceived Usefulness and Perceived Ease of Use Variables Predicting Family Member Attitude Toward the IMS Using Logarithmic Transformations.....	70

## ABSTRACT

As a result of the U.S deinstitutionalization policy of the 1960's persons with serious mental illness often live with and rely upon family members and friends to serve as informal caregivers. The purpose of this study was to investigate the perspectives of informal caregivers on using in-home technology such as the In-Home Health Monitoring System (IMS) to monitor activities of persons with serious mental illness. Findings revealed that informal caregivers have a positive attitude toward using the IMS for their loved one's mental health recovery, perceive the IMS to be useful, and find the IMS neither easy nor difficult to use. Findings extend the theoretical literature on the technology acceptance model and support the inclusion of informal caregivers in social work research aimed at determining the extent to which the use of IMS results in positive mental health outcomes for persons with serious mental illness.

## CHAPTER ONE: INTRODUCTION

As a result of the U.S deinstitutionalization policy of the 1960's persons with serious mental illness (SMI) often live with and rely upon family members and friends to serve as informal caregivers (Cook, Cohler, Pickett & Beeler, 1997; Corsentino, Molinari, Gum, Roscoe, & Mills, 2008; Lefley, 1996; 2003; 2009; Warner 2000). Persons with a SMI have a severe psychiatric disability that meets DSM-IV criteria (American Psychiatric Association [APA], 1994) and substantially impairs, typically for 12 months or longer, their overall functioning in one or more major life activities; major life activities include basic activities of daily living (ADL's), such as meal preparation, hygiene, dressing, or instrumental activities of daily living (IADL's), such as money management, maintaining a residence, medication compliance, or functioning in social, family, vocational, and educational contexts (Coursey, Alford, & Safarjan 1997; Endicott, Spitzer, Fliess & Cohen, 1976; Lefley, 2009). Though there is no universal list of illnesses that clearly constitute SMI, adults with schizophrenia, bipolar disorder, major depression, obsessive-compulsive disorder, panic disorder, post traumatic stress disorder, and borderline personality are generally considered to have a SMI (see for example, Lefley, 2009; Morden, Mistler, Weeks, & Bartels, 2009; National Alliance on Mental Illness [NAMI], 2009; U.S. Health and Human Service, 1995).

Approximately 6% of the U.S. population, or 1 in 17, have a SMI (Kessler, Chiu, Demler & Walters, 2005; National Institute of Mental Health [NIMH], 2008). Based on 2007 U.S. Census Bureau data (2009) residential population estimates, this figure translates to approximately 18 million people suffering from a serious mental illness annually. Persons with SMI have an increased risk for chronic medical conditions,

particularly diabetes, lung disease, and liver conditions (Dixon et al., 2004), higher prevalence of chronic bronchitis and emphysema when compared to national comparison participants (Keyes, 2004), and higher cancer rates than the general population (Pandiani, Boyd & Banks, 2005). Adults with SMI die about 25 years younger than other Americans (Colton & Manderscheid, 2006), and a lack of emotional support and social networks, substance use and abuse, limited physical activity, poor diet, and poverty further affect the mortality of persons with SMI (Barreira, 1999; Lambert, Velakoulis, & Pantelis, 2003).

Approximately two-thirds of patients discharged from psychiatric hospitals return to live with their families (Dyck, Short, & Vitaliano, 1999; Lefley, 1987; 2003; Minkoff, 1978; Thompson & Doll, 1982). Conservative estimates find that approximately 33% to 66% of persons with a SMI regularly live with family (Dyck et al., 1999; Lefley, 2003). Other researchers report 50% to 80% of persons with serious mental illness such as schizophrenia or other psychotic disorders reside with or have regular contacts with a family caregiver (McDonell, Short, Berry, & Dyck, 2003).

On April 29, 2002, then President George W. Bush recognized the need and importance of integrating family members in mental health treatment and announced the creation of the first presidential mental health commission in the past 25 years, the President's New Freedom Commission on Mental Health (Hogan, 2003). The final report of the President's New Freedom Commission on Mental Health (2003) identified six goals of a transformed mental health system. Two of the goals are that mental health care is family-driven and that technology should be used to improve access and coordination of mental health care.

## **Theoretical Framework**

Technology can improve many aspects of a person's life. Yet, technologies have limited utility if individuals are unwilling to accept and utilize them (Davis, 1986). Therefore, there is a constant struggle to understand why people accept new technologies. With this context in mind, this study utilized the technology acceptance model ([TAM]; Davis, 1986), which was influenced by the theory of reasoned action (TRA) and attitudinal theory in psychology (see Ajzen & Fishbein, 1973; 1980), as its theoretical framework.

The theory of reasoned action (TRA) has been a dominant force in thinking about attitude-behavior relationships over the past five decades (Ajzen & Fishbein, 1980; Fishbein, 1963; Fishbein & Ajzen, 1975; Langdridge, Sheeran, & Connolly, 2007; Olsen & Zanna, 1993). The TRA specifies that a limited number of psychological variables can influence or predict behavior, attitude toward a behavior and subjective norm (Ajzen & Fishbein, 1973; Ajzen & Fishbein, 1980; Albarracin, Fishbein, Johnson, & Muellerleile, 2001; Langdridge et al., 2007). Ajzen and Fishbein (1980) argued that most behaviors are under a person's volitional control, and that the TRA regards a person's intention to perform a behavior as the direct determinant of the action or inaction. A person's overt behavior is then a function of her/his intention or willingness to engage in the behavior, and that intention is predicted by attitudes and subjective norms.

Building on the theoretical concepts within the TRA, Davis (1986; 1993) noted that one's intention to use a technology, for example, is distinct from whether s/he accepts and uses a technology. To address this limitation, Davis developed a model for predicting and explaining technology use by developing two variables, perceived

usefulness (PU) and perceived ease of use (PEOU). These two variables were hypothesized to predict a person's attitude toward a technology which in turn predicts one's behavioral intent and eventually technology use (Figure 1.). Not only has Davis (1986; 1989; 1993) shown evidence of predictive power of the TAM, other researchers have too demonstrated its ability to predict technology use in various settings (see Adams, Nelson, & Todd, 1992; Aladwani, 2002; Henderson, Rickwood, & Roberts, 1998; Lou, Luo & Strong, 2000; Plouffe, Vandenbosch, & Hulland, 2001).

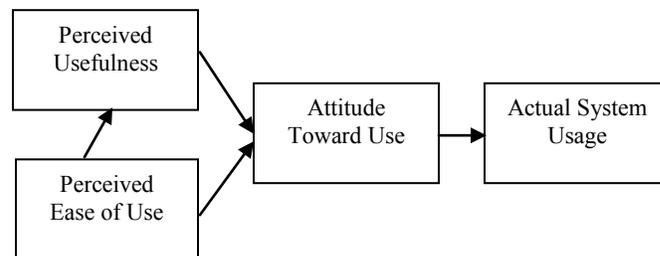


Figure 1. Technology acceptance model (Davis, 1993).

It should be noted that the theory of planned behavior (TPB) extended the TRA by adding an additional variable, perceive behavioral control (Ajzen, 1991). Perceived behavioral control is seen as determinant of both behavioral intention and actual behavior, and has significantly enhanced the prediction of intent and behavior, particularly in circumstances in which actions were constrained (Belleau, Summers, Yingjiao, & Pinel, 2007). With that said, TRA can sufficiently predict straightforward behaviors under one's volitional control. Similar to Belleau et al.'s (2007) research on the behavioral intent of young consumers, this author too believes that the intention to use technology is volitional, and as a result the TAM, which was influenced by TRA, will result in a valid prediction of technology use.

### **Statement of Problem**

Much of the research associated with informal caregiver perceptions has focused on the perceived burden felt by family caregivers of persons with mental illness (Baronet, 1999; Cuijpers, 1999; Dyck et al., 1999; Hoenig & Hamilton, 1966; Hatfield, 1997; Hatfield & Lefley, 1987; Katschnig & Konieczna, 1989; Lefley, 1996; Maurin & Boyd, 1990) and the positive impact family caregivers can have on the course of mental illness (Clark, 2001; Hogarty et al., 1986; McFarlane, Link, Dushay, Marchal, & Crilly, 1995; McFarlane, Lukens et al., 1995). Few researchers, if any, have specifically focused on the perspectives among informal caregivers of persons with serious mental illness, in the context of in-home monitoring technologies such as the IMS. Even though the New Freedom Commission on Mental Health (2003) encouraged and recommended that the current mental health system be transformed into a system that is family and technology driven, no known research has investigated the perspectives of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness. Specifically, there is a void in the literature in terms of perspectives among informal caregivers of persons with serious mental illness, in the context of the IMS. This study addresses this gap in the literature.

### **Significance of the Study**

Progress in the field of information technology (IT) continues producing promising and innovative approaches to monitoring vulnerable or cognitive impaired people in their own residence or home. Smart home technologies have shown promise for people with cognitive impairments, special needs (Alwan, Dalal, et al., 2006; Hensel, Demiris, & Courtney, 2006; Rantz, Skubic, Miller, & Krampe, 2008), and persons with cognitive impairments (LoPresti, Bodine, & Lewis, 2008). Persons with a serious mental

illness such as schizophrenia, major depression, bipolar disorder, or borderline personality disorder, for example, often experience cognitive impairments which can affect one's memory, concentration, and attention (APA, 1994).

For example, the IMS consists of wireless motion sensors, a PC-based data manager, a radio receiver, a bed sensor, a pneumatic bed pad, and a kitchen motion sensor with an integrated stovetop temperature sensor (Alwan, Leachtenauer, et al., 2006). The goal of the IMS is to detect or prevent emergencies, identify the onset of health events that can contribute to functional decline and impaired activities of daily living (ADL's), and ultimately increase quality of life and safety of the person residing in their residence or home. There are a wide range of home based technologies that support physiological monitoring, functional monitoring, safety monitoring, security alarm systems, and applications providing cognitive and sensory assistance, or promoting social interaction (Demiris & Hensel, 2008).

### **Statement of Purpose**

This study investigated perspectives of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness. The study had four objectives: (a) describe to the extent family caregivers of persons with serious mental illness perceive the IMS to be useful and easy to use in terms of their loved one's mental health recovery; (b) examine the extent to which family caregivers of persons with serious mental illness have a positive or negative attitude toward the IMS; (c) investigate whether perceived usefulness and perceived ease of use predict family caregiver attitudes toward using the IMS; and (d) establish whether family caregivers

intend to use the IMS. With the aforementioned objectives in mind, the study answered the following research questions:

1. What are the perspectives of informal caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS, and to what extent are those perspectives related?
2. To what extent do informal caregivers differ in perspectives on perceived usefulness, perceived ease of use, and attitude toward using the IMS by their characteristics and background?
3. Do the perspectives of informal caregivers on perceived usefulness and perceived ease of use predict a significant proportion of the variance on attitude toward use?

Findings from this study contribute to the limited empirical knowledge related to technology acceptance among informal caregivers of persons with serious mental illness toward the IMS, an in-home monitoring technology. This data can benefit social workers and other mental health professionals working with not only the informal caregivers of persons with serious mental illness and persons with serious mental but also advocates and policy-makers working toward improving the lives of those affected by mental illness and reducing health care costs associated with the treatment of persons with serious mental illness.

### **Hypotheses**

To explore technology acceptance among informal caregivers of persons with serious mental illness toward the IMS, a theoretical framework guided by TAM would propose that perceived usefulness and perceive ease of use will affect one's attitude toward the IMS and indicate one's actual system use. This study examined perspectives

of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness. The research hypotheses were:

1. The perspectives of informal caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS are related.
2. There are differences among informal caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS according to their characteristics and background.
3. Perceived usefulness and perceived ease of use predict a significant proportion of the variance in attitude toward IMS use.

### **Definition of Terms**

For the purposes of the study, the following key constructs will be defined as follows:

*In-Home Health Monitoring System (IMS)* - Is a smart home technology that consists of wireless motion sensors, a PC-based data manager, a radio receiver, a bed sensor, a pneumatic bed pad, and a kitchen motion sensor with an integrated stove-top temperature (Alwan, Leachtenauer, Dalal et al., 2006).

*Attitude Toward Using the IMS (ATT)* – Is the value or degree an informal caregiver assigns to the IMS that reflects their state of mind and intent to use the IMS for their loved one’s mental health recovery (Davis, 1993; Guilabert, 2004)

*Perceived Usefulness (PU)* – Is the extent to which an informal caregiver believes that the IMS can enhance their loved one’s mental health recovery (Davis, 1993).

*Perceived Ease of Use (PEOU)* – Is the extent to which a family believes that using the IMS will be free of effort (Davis, 1993).

*Informal Caregiver* – Is a person, often times a parent or other relative, who provides unpaid care and support to a person with a serious mental illness (Lakeman, 2008).

*Persons with Serious Mental Illness* – Are persons age 18 and over, also referred to as mental health consumers, who have as their primary diagnosis schizophrenia, schizoaffective disorder, bipolar disorder, major depression, obsessive compulsive disorder, panic disorder, post traumatic stress disorder, and/or borderline personality disorder (Morden et al., 2009; NAMI, 2009; U.S. Health and Human Service, 1995).

*Smart Home Technology* – Is an in-home technology such as the IMS that integrates technology and services through home networking and automation (Magnusson, Hanson, & Borg, 2004).

*Mental Health Recovery* – Is the process in which persons with serious mental illnesses are able to live, work, learn, and fully participate in their communities. (New Freedom Commission on Mental Health, 2003).

### **Assumptions, Limitations, Delimitations**

This study had like all studies had particular assumptions, limitations and delimitates. It was assumed that all participants read, viewed, and understood the materials and instructions given to them; all participants answered the questionnaire items honestly and accurately; and, the method used to assess technology acceptance was valid and reliable. In terms of limitations, the self-report data may be biased, the sample of family caregivers was purposeful and may not be generalizable to other samples of caregivers, and there was a low Cronbach's alpha on the PEOU variable. The delimitation of study is that it included only family caregivers of persons with serious mental illnesses attending monthly NAMI meetings.

## CHAPTER TWO: LITERATURE REVIEW

This chapter reviewed the literature related to the perspectives of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness. The objective of the review was to examine theory of reasoned action, technology acceptance model, in-home technology, and informal caregivers of persons with serious mental illness. The concepts of reasoned action and technology acceptance are linked within the literature, as are the concepts of smart home technology and informal caregivers of persons with serious mental illness. Literature from the SCOPUS database was systematically reviewed using the following keywords: “theory of reasoned action”, “technology acceptance”, “smart home technology”, “In-Home Health Monitoring System”, and “informal caregivers of persons with serious mental illness.”

The SCOPUS database was purposefully chosen for the systematic review for the following three reasons: (a) the database has broad coverage in terms of scientific, technical, medical and social sciences literature, all of which incorporate the aforementioned keywords; (b) the database has the largest abstract and citation database covering over 16,000 peer reviewed journals; and (c) the database focuses on high impact journals. Examples of SCOPUS databases’ include but are not limited to EBSCO, OVID, PsycARTICLES, Wiley Interscience, Ingenta Connect, SAGE Publications, Elsevier Science Direct, and Oxford University Press.

Four steps guided the systematic review. First, the author limited the SCOPUS search to include the “theory of reasoned action” in the “article title, abstract, keyword” section. This resulted in 659 articles, and identified articles that were obtained from life sciences including agriculture and biological sciences, physical sciences (e.g., chemistry

and engineering), social sciences (e.g., psychology), and health sciences (e.g., medicine and nursing). Second, the search was further refined to include literature with the phrase “theory of reasoned action” in the title, and this allowed for indentifying 134 relevant articles. Next, literature was restricted to health and social science subject areas and included medicine, nursing, psychology, social science, and health professions disciplines. This limitation reduced the number of relevant articles to 96. Last, the review was further narrowed to include only articles having “theory of reasoned action”, or some variation of the term including reasoned action and authors names in the title. The same procedure was utilized for the remaining three keywords and only English language abstracts were reviewed. Bibliographies from germane articles were also hand-searched for additional references and relevant books and dissertations were further examined utilizing Google Scholar. Last, this study utilized Cohen’s (1988) general guidelines to interpreting correlation coefficients. As a result,  $\pm 0.1$  to  $\pm 0.3$  correlations or relationships are referred to as small,  $\pm 0.3$  to  $\pm 0.5$  are referred to as medium, and  $\pm 0.5$  to  $\pm 1.0$  are referred to as large.

### **Theoretical Framework**

The theory of reasoned action (TRA) has been a dominant force in thinking about attitude-behavior relationships over the past five decades (Fishbein, 1963; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Olsen & Zanna, 1993; Langdrige et al., 2007). The foundation for the theory was introduced in 1967 (Fishbein, 1967; see Ajzen & Fishbein, 1980, p. 5) and at that time the theory was called the Fishbein model (see Davis, 1986). The model has since been developed, refined, and tested (Ajzen & Fishbein, 1980). In its contemporary form, the model is known as the theory of reasoned

action.

TRA specifies that a limited number of psychological variables can influence or predict a behavior, namely behavioral intention, attitude toward the behavior, and subject norm (Ajzen & Fishbein, 1973; Ajzen & Fishbein, 1980; Albarracin et al., 2001; Langdrige et al., 2007). Ajzen and Fishbein (1980) pointed out the first step in terms of predicting and understanding an individual's behavior is to identify and measure the behavior of interest. Once the behavior is identified and defined, the next step is to surmise what determines the behavior. The authors' position on behavior is clear. They asserted that most behaviors are under a person's volitional control, and that the TRA regards a person's intention to perform a behavior as the direct determinant of the action or inaction. Therefore, a person's overt behavior is a function of her/his intention or willingness to engage in the behavior, and that intention is predicted by attitudes and subjective norms. Fishbein and Ajzen (1975) defined the concepts intention, attitude, and social norm. Intention is the subjective probability that a person will engage in a particular behavior. This definition is straightforward, and based on TRA's logic, should a person indicate that s/he intends to use a particular technology, it is expected that s/he will likely engage in that behavior.

Attitude pertains to the degree, or weight, a person positively or negatively assigns to a future behavior and such is measured by asking the person to rate where they fall on an affective scale. Albarracin et al. (2001) provided an attitudinal or affective scale used by the Centers for Disease Control (CDC; 1993): *unpleasant-pleasant*, *unwise-wise*, *bad-good*, *unnecessary-necessary*, and *uncomfortable-comfortable*. After a subject completes an affective scale such as the one above, one can reasonably predict whether a

person will or will not perform a behavior. For instance, a person who associated a particular technology as strongly pleasant, wise, good, necessary and comfortable would be more likely to use the technology as compared to person who associated the same technology as strongly unpleasant, unwise, bad, unnecessary, and uncomfortable.

The variable subjective norm is related to a person's perceived degree, or weight, of social pressure. Should a person perceive that the people most important to her/him believe that s/he should engage in the behavior in question, the individual will likely perform the behavior and vice versa. Should a person perceive that the most important people to her/him believe that s/he should use a particular technology, one can reasonably to assume that s/he will engage in the behavior.

In spoken form, TRA can be understood as the weighted social norms and weights of attitude together predict future behavior. Ajzen and Fishbein (1980) commented on the efficiency and robustness of this model. They argued that behaviors can, in a sense, be easily predicted, and the most expedient manner in which to predict whether a person performs a particular behavior is to simply ask him or her whether s/he intends to engage in the behavior.

Ajzen and Fishbein (1980) did not assert that their model is perfect. They noted that there is no perfect relationship between intention and behavior; however, barring unanticipated events, a person will typically perform in accordance with his or her intentions. Similar discussions on the theory as it relates to attitude and subject norm are available (see for example, Conner & Armitage, 1998; Eagly & Chaiken, 1993; Gastil, 2000; Hale, Householder, & Green, 2002; Sutton, 1998).

Volitional behaviors play an intricate role in the TRA (Weber, Martin & Corrigan, 2007). In other words, the scope of theory is limited to behaviors in which person's engage by choice or voluntarily. Ajzen and Fishbein (1980) assumed that human beings, in general, are rational and make systematic use of information provided to them. The authors further felt that social behavior is not controlled by unconscious drives or motives. Likewise, they rejected the assumption that human beings are erratic or unthinking. Instead, Ajzen and Fishbein contended that human beings judge the outcomes, or perceived outcomes, of their behaviors prior to deciding whether to engage in a behavior.

### **Evidence for the TRA**

Numerous researchers have investigated the association between attitudes, subject norms, and behavioral intentions (Hale et al., 2002; Weber et al., 2007), and support for the predictive ability of the TRA exists in both contemporary and mature meta-analytic reviews (Langdrige et al., 2007). Meta-analytic reviews include findings from two or more independent studies and the author or authors of the review report the overall effectiveness of a model or treatment (Davies & Crombie, 1998). Such analyses provide an estimate of the robustness of the main findings of a group of relevant studies.

Cooke and French (2008) performed a meta-analysis to quantify TRA's ability to predict actual attendance to health screening program by examining participants' attitudes and subjective norms. Their review of 33 studies supported the theoretical underpinnings of the TRA. Findings showed that person's attitude toward a health screening was strongly correlated ( $r = .51$ ) to their intent to attend a related health program ( $n = 12,558$ ), while a person's subjective norm had a medium correlation ( $r = .41$ ) with their intention

to attend the program ( $n = 12,354$ ). Results of the meta-analysis highlighted the linear nature of the TRA as evidenced by a person's positive attitude toward as object, health screening, coupled with subject norms, largely predicted attendance at a health screening.

Albarracin et al. (2001) examined how well the TRA predicted condom use. Ninety-six data sets from 42 articles ( $n = 22,594$ ) were included in their analysis. Consistent with Cooke and French's (2008) review of the literature, Albarracin et al. too found that TRA was a successful predictor of condom use. A person's intent to use a condom was moderately to strongly correlated with their condom use ( $r = .45$ ), and a person's attitude toward condoms strongly influenced their intent to use a condom ( $r = .58$ ), while subjective norm had less of an influence but still a noteworthy medium correlation ( $r = .39$ ). Sheeran and Taylor (1999) reviewed data from 67 independent samples and their findings indicated positive attitudes and supportive subjective norms toward condoms were associated with greater intention to use a condom. For example, Sheeran and Taylor's analysis found a person's attitude was moderately to strongly related ( $r = .45$ ) to condom use ( $n = 8,418$ ) as well as subjective norm ( $r = .42$ ) ( $n = 8,126$ ). Likewise, Sheeran, Abraham, and Orbell (1999) reviewed 28 independent samples ( $n = 2,532$ ) and reported a person's behavioral intention toward condom use was moderately to strongly correlated ( $r = .44$ ) to condom use.

Other studies have examined the predictive ability of the TRA on a wide-range of behaviors, not simply health screenings and condom usage. Sheppard, Hartwick, and Warshaw's (1988) meta-analysis included 87 separate studies investigating various behaviors ranging from a person's intent to use birth control pills to a person's intent to purchase a particular brand of grape drink. Again, the relationship among a person's

behavioral intent and their behavior ( $n = 11,566$ ) was strongly correlated ( $r = .53$ ) as well as a person's attitude and subject norm ( $n = 12,624$ ) in terms of their behavior ( $r = .66$ ).

### **Evidence for the TRA among Technology Use**

Support for the predictive nature of the TRA among germane articles more closely related to technology use is presented. Cheung and Huang (2005) investigated how university students utilized the internet. In using a sample of university students, the authors randomly distributed research questionnaires to 500 undergraduate students across different schools and departments, 328 of which were completed and returned. The majority of the participants were 21 years old, on average, and female students accounted for 77% of the respondents. Seventy-two percent of the respondents were first and second year students. Findings showed that student attitudes toward internet use had a medium-sized relationship ( $r = .36$ ) with use and a small relationship with subjective norms ( $r = .19$ ).

Zacharia (2003) examined the attitudes and intention of 13 prospective physics teachers regarding new learning and teaching technologies. The majority of the participants in his qualitative study were female ( $n = 8$ ), and the participants had either a biology or chemistry background and were, on average, 30 years old. Consistent with the quantitative findings, Zacharia's study confirmed prior support for the TRA, in that teacher's attitudes toward particular teaching tools affected their intent to use and feature such technologies into their own teaching curriculum. Araújo, Paiva, Jesuino, and Magalhães (2000) assessed general practitioners' (GP's) ( $n = 53$ ) attitudes and intentions toward a neurology teleconsultation system. They found that physician intent to use the

system was influenced by their attitude toward the technology and subject norms. These two variables accounted for 27% of the variance in the intent to use.

Pancer, George, and Gebotys (1992) conducted a study in which they examined individuals' intention to engage in various technology-related behaviors, such as using a computer for a teaching aid, word processor, graph and chart development, game playing, calculations, and data storage and retrieval. The authors' sample included 238 introductory psychology students of which 100 were male. Participants reported varying levels of computer experience. For instance, 73% reported they had played games on a computer, 62% indicated saving and retrieving information on a computer, and 38% stated they had used a computer for word processing purposes. Only 7% of the sample reported never using a computer. The findings indicated that attitude and subjective norm accurately predicted intention to use the aforementioned computer technologies. Attitude and subject norm combined predicted intent across all seven computer-related behaviors: teaching aid ( $r = .60$ ); word processor ( $r = .58$ ); graph and chart ( $r = .50$ ); game-playing ( $r = .54$ ); calculations ( $r = .54$ ); and data storage and retrieval ( $r = .59$ ).

Though not absolute, the majority of evidence indicates attitude and subjective norm can reasonably predict one's behavior. This is certainly true for health-related, consumer, and technology-related behaviors (see Cooke & French, 2008; Pancer et al., 1992; Sheppard et al., 1988). In spite of this considerable body of evidence, this brings in to question the salience of reasoned action with respect to technology acceptance. As noted by Davis (1986), a person's intent to use a technology, for example, is separate from whether a person accepts and uses a technology. To identify which variables predict

technology acceptance, Davis extended the TRA in to what is now called the technology acceptance model (TAM).

### **Technology Acceptance Model**

Technology can improve many aspects of a person's life. Yet, technologies have limited utility if individuals are unwilling to accept and utilize them (Davis, 1989). Therefore, a constant struggle in the technology arena is to understand user acceptance new technologies. For many decades, researchers have put forth a variety of theories and approaches to address issues related to technology acceptance (King & He, 2006). King and Cleland (1971) focused on analyst-user collaboration early on the in design development process. They posited collaboration could overcome the disinclination of users to actually utilize technology developed specifically for them. Schultz and Slevin (1983) argued that researchers had to partition aspects of technology usage. They proposed that both technical and organizational factors needed to be recognized in order to better understand why technologies were not unanimously used or accepted.

The technology acceptance model (TAM) is based on the TRA, which is parsimonious and intuitive model. Davis (1986) developed measures for predicting and explaining technology use by focusing on two primary predictors, perceived usefulness and perceived ease of use. The dependent variable in TAM is attitude toward the technology or one's behavior intention, which was established by the TRA to be closely linked to actual behavior (King & He, 2006). Davis (1986) created these two predictor variables for the purpose of answering the simple question: Why do people accept or reject technology? Further, building on TRA and attitudinal theory in psychology (see

Ajzen & Fishbein, 1973), Davis argued there is a flow of causality from system design features through perceptions to attitude and finally to system usage (1993, p. 478).

Davis (1986; 1989) posited that people tend to use a particular technology if they believe it will help her or him improve their job performance. He referred to this variable as perceived usefulness (PU) and defined the concept as the extent to which a person believes that utilizing a particular technology or information system would enhance her or his job performance. The logic of PU is apparent as Davis hypothesized that the more a person perceives a system or technology to be useful, the more likely it is that the person will have a positive-use performance relationship. This positive-use relationship is believed to affect a person's likelihood of using or accepting a technology.

In addition to usefulness, Davis (1989) theorized that technology use is also affected by perceived ease of use (PEOU). Here, even if a person believes that a particular technology could be helpful to them in their job, they may simultaneously perceive that the technology is too complicated for them to use and the benefits of utilizing the new technology are outweighed by the effort of utilizing the technology.

### **Evidence for the TAM**

To test the TAM, Davis (1989) recruited 152 participants which included technology users from IBM's Canada's Toronto Development Laboratory ( $n = 112$ ) and students from an evening MBA program at Boston University ( $n = 40$ ). IBM participants were given a questionnaire and were asked to rate the usefulness and ease of use of an electronic messaging system and a word processing system widely used on IBM systems (Davis, 1989). Similarly, MBA students were given a questionnaire and were asked to rate the usefulness and ease of use of a chart-drawing program and a novel computing

tablet. Comprehensive demographic information on the IBM participants was not reported.

Davis did, however, report that the 112 participants had an average of 180 days experience with the technologies of whom 10% were managers; 35% were administrative staff; and, the remaining 55% were professional staff. MBA participants' had on average five years of work experience and they were employed full-time in various industries including manufacturing (8%), education (10%), government (10%), health (18%), and financial (28%). Of the MBA sample, only 17% had extensive experience with computers and only 15% had extensive experience with personal computers. As compared to the IBM participants, the MBA students were more unfamiliar with their two presented technologies.

As hypothesized, Davis (1989) found a strong relationship between usefulness and ease of use and system use across IBM and MBA participants. Perceived usefulness had a large correlation with technology use ( $r = .74$ ) as did perceived ease of use ( $r = .52$ ). Clearly, usefulness was more strongly related to technology usage than was ease of use. Davis surmised that the primary aim of users is to adopt technology that performs a useful function, and that the secondary aim of the user relates to how simple or challenging the technology is in terms of performing the useful functions. Davis' explanation is consistent with the findings from his regression analyses on the effects of usefulness and ease of use on technology usage. Data indicated usefulness accounted for 66% of the variance of the dependent variable, technology usage, and ease of use accounted for 12% of the variance.

Davis' (1989) findings demonstrated usefulness and ease of use can adequately predict technology usage. Yet, an important limitation of his research was that it was cross-sectional research. That is, users were shown technology and then they were asked to complete questionnaires on the PU and PEOU. Based on the preliminary TAM evidence, strong as it is, one cannot, however, definitively state that the TAM holds true over time. To address this limitation, Davis, Bagozzi, and Warshaw (1989) constructed a longitudinal study and gathered data from a sample ( $n = 107$ ) of full-time University of Michigan MBA students that aimed to determine how well TAM could predict behavior after a person's brief interaction with a word processor program. Participants were given questionnaires after a one-hour introduction to the computer program and again after 14 weeks. Findings were notable in that behavioral intent and perceived usefulness predicted one's computer use. Ease of use was not a predominant determinant, as compared to usefulness, of one's intention.

Davis and his colleagues found that after a one-hour overview of the computer program, usefulness ( $\beta = .61$ ) predicted attitude toward the word processor whereas ease of use did not ( $r = .02$ ). In comparison, after 14 weeks attitude again was predicted largely by usefulness ( $r = .50$ ) but ease of use contributed a significant amount as well ( $r = .24$ ). In a similar study, Davis (1993), investigating email and word processing usage among professional and managerial employees ( $n = 112$ ), reported that usefulness and attitude had a large relationship ( $r = .65$ ) as did usefulness and ease of use ( $r = .63$ ), whereas ease of use and attitude had a small relationship ( $r = .13$ ). Davis's findings are compelling as they clearly indicate that the TAM can more than adequately predict one's attitude and acceptance of technology.

Researchers have also examined in the TAM in the context of electronic supermarkets (Henderson et al., 1998), electronic voice mail (Adams et al., 1992), electronic payment systems (Plouffe, Vandebosch, & Hulland, 2001), transactional web sites (Aladwani, 2002), and groupware (Lou, Luo, & Strong, 2000). Findings are universally supportive of the predictive power of TAM. Moreover, recent meta-analyses provide additional evidence supporting the predictor power of the TAM. Schepers and Wetzels (2007) analyzed 53 articles examining the influence perceived usefulness and perceived ease had on computer and internet-related technology use. The sample included Western and non-Western participants, college and non-college students, professionals and non-professionals, and general consumers. The average sample size across studies examining the relationship between usefulness and ease of use was reasonably large ( $n = 226$ ) as were sample sizes for studies examining usefulness and attitude ( $n = 233$ ) and ease of use and attitude ( $n = 216$ ). A majority of the studies (97%) reported significant statistical relationships among perceived usefulness and perceived ease of use ( $r = .49$ ), usefulness and attitude ( $r = .55$ ), and ease of use and attitude ( $r = .47$ ).

King and He (2006) conducted a statistical meta-analysis on 88 TAM studies across a wide variety of fields. The authors' found evidence that not only is the TAM a valid and powerful model for predicting technology use, but that the TAM has potential for wider applicability. Comparable to Schepers and Wetzles (2007) findings, the average correlation of the 59 studies ( $n = 12,657$ ) investigating usefulness and behavioral intent was large ( $r = .59$ ), while the average correlation of the 56 studies ( $n = 12,205$ ) exploring ease of use and behavioral intent was medium-to-large ( $r = .43$ ). The average correlation of the 77 studies ( $n = 16,123$ ) examining useful and ease of use variables was also

medium-to-large ( $r = .49$ ). Only among internet applications was the direct effect of ease important to intention. Since smart home technology is a relatively novel technology, this author expects that the utility of the TAM, with its potential for wider applicability, will reasonably predict one's attitude and ultimately one's actual system use.

King and He's (2006) findings regarding the moderator effects of the type of technology and the participant type were generally corroborated by Schepers and Wetzels (2007). Only the internet usage was found to be different from office applications, job task applications, and general use. Therefore, these findings suggest that TAM studies examining internet usage should not be generalized to other usage among different contexts. The *usefulness-intent* and *ease of use-usefulness* dimensions among professional, student, and general user groups were not different, however, differences on the *ease of use-intent* dimension were reported.

In terms of a relationship, professionals on the *ease of use-intent* dimension were very different from general users, while students were marginal. It appears that professionals, possibly being exposed and recommended to use newer technology more regularly, can more easily adapt to new technologies, whereas general users, possibly with their limited interactions with new technology, find contemporary technologies less easy to use. Ma and Liu (2004) also performed a meta-analysis on the TAM that included 26 empirical articles. Findings again showed medium-to-large correlations between use and intent ( $r = .41$ ), usefulness and ease ( $r = .47$ ), and a weak to moderate correlation between ease of use and intent ( $r = .28$ ).

Evidence from the three meta-analyses suggests perceived usefulness and ease of use can predict acceptance of and intent to use technology. There is additional evidence

that supports the ability of the TAM to not only predict technology use among person's within business organizations, schools, and general consumer contexts, but for the TAM to also predict technology acceptance and usage related to healthcare technologies among healthcare settings.

### **Evidence for TAM among Healthcare Settings**

It is generally accepted that technologies, whether they are information technologies (IT) or information systems (IS), have the potential to greatly improve healthcare services in terms of the effectiveness and efficiency of staff and overall organizational expenditures (Scott, 2007). This is particularly true in hospital settings (Aggelidis & Chatzoglou, 2009). Researchers have even asserted that should healthcare settings such as hospitals not adopt new technologies, they may lose the confidence of their patients and become inefficient and archaic (Ammenwerth, Graber, Herrmann, Burkle, & Konig, 2003; Lu, Xiao, Sears, & Jacko, 2005). Resulting from this acceptance of technology, healthcare settings have moved toward to health information systems (HIS; Croll & Croll, 2007; Sucurovic, 2007).

Analogous to the technology acceptance obstacles businesses and schools have faced, staff must too accept and use new technologies in order for healthcare settings to benefit from the potential of IS/IT. Several individual studies investigating technology acceptance within the healthcare area exist. Results show that perceived usefulness and perceived ease of use can also predict technology use in healthcare settings. Aggelidis and Chatzoglou (2009) found that usefulness and ease of use significantly influenced hospital personnel acceptance and intent to use hospital information technologies. Chen, Yang, Tang, Huang, and Yu (2008) reported usefulness and ease of use affects nurses'

intent to use web-based learning programs. Wu, Shen, Greenes, and Bates (2008) results showed that usefulness and ease of use acceptance had significant effects on healthcare professionals' acceptance and intent to use an adverse event reporting system.

### **Telemedicine, Telehealth, and Smart Homes**

**Telemedicine.** One of the more commonly referenced definitions of telemedicine comes from The Institute of Medicine (see Field & Grisby, 2002; Jones, 1997). The Institute of Medicine (1996) broadly defined telemedicine as a form of medicine that utilizes electronic information and communication technologies to provide care and support to patients when distance separates those involved. Care and support includes diagnostic, treatment and other medicine related services or decisions for patients. Field and Grisby (2002) noted that telemedicine can be applied more narrowly to include medical applications for specialty or subspecialty physician consultations that utilize interactive videos. Key to telemedicine is the direct provision of physician care to a patient at a distance.

Surprising to some, telemedicine has been around for over four decades. In its embryonic stage, telemedicine provided supportive neurological and psychiatric services to patients in Nebraska (Benschoter, 1967). Up until the 1990's, telemedicine was mostly used for specialty consultations by way of videoconferencing technologies. Of late, telemedicine use has focused on non-interactive programs and applications such as relatively inexpensive storage-and-forward technologies that allow physicians to save and transmit medical images or text through multimedia type email (Field & Grisby, 2002).

**Telehealth.** Unlike telemedicine, there seems to be a lack of a consensus regarding the definition of telehealth (Field & Grisby, 2002). This author utilizes

Nickelson's (1998) definition, which simply and concisely defined telehealth as a technological and information tool that allows a broad range of professionals to practice their established professional skill with individuals and organizations who may not have access to service providers. This author would only add that telehealth further provides individuals' with the choice to receive services at their home or at a place of business.

Telehealth has considerable potential and it is garnering attention among service providers and consumers alike as telehealth provides a means to monitor, counsel, and educate individuals at a distance (Paré, Jaana, & Sicotte, 2006; Wooton, Dimmick, & Kvedar, 2006). It offers the possibility of improved health data collection and health monitoring, of a reduced need for in-person home contacts which can reduce home care costs, and consumer empowerment vis-à-vis providing individuals with access to their own remotely monitored health data for self-management purposes. Comparable to telemedicine, home telehealth, or telehealth, provides an alternative for acute hospitalization, a substitute for traditional doctor appointments, visits, and outpatient hospital contacts, and a complementary means of assisting individuals' in maintaining their own health in their own community (Bensink, Hailey, & Wooton, 2006a; 2006b).

Another main distinction from telemedicine is that telehealth technologies such as telemonitoring are utilized in a more restricted sense. That is, telemonitoring encompasses the use of motion, video, and other telecommunication technologies to monitor individuals' health and functioning status at a distance, whereas telemedicine's primary aim to provide specialist consultation to remote communities (Paré et al., 2006). Simply put, self-management of a chronic illness or disease is addressed via telehealth.

### **Evidence for Telemedicine/Telehealth**

As one might imagine, telemedicine and telehealth have broad health and wellness-related applications and these include telepsychiatry (Norman, 2006; Rohland, Saleh, Rohrer, & Romitti, 2000), teleradiology (Bergmo, 1996), teleophthalmology (Flowers, Baker, Khanna, Ali, March, Scott, & Murrillo, 1997), and teledermatology (Eedy & Wootton, 2001). Paré et al. (2006) systematically reviewed 65 home telehealth studies that were primarily conducted in the United States and Europe, 46% and 38%, respectively. Studies under examination were limited to four prevalent chronic illnesses: pulmonary conditions, diabetes, heart disease, and hypertension.

Results from the systematic review showed, among other things, that regardless of their age, socioeconomic status, and nationality, patients accepted and complied with telemonitoring programs. Findings showed that home telemonitoring of chronic diseases is a feasible and a promising approach in terms of a patient managing their disease, and that telemonitoring provided patients with accurate and reliable health data that could empower them, and positively influence their attitudes and behaviors which could improve their medical condition and quality of life.

Other researchers have systematically investigated home telehealth. Bensink et al. (2006a; 2006b) investigated 130 projects undertaken in the United States, United Kingdom, Canada, Italy, Japan, and France. Approximately 70% of the research projects were performed in the US and 80% of the projects were randomized controlled trials (RCT's), which are considered the gold-standard in clinical research (Egger, Smith, & Altman, 2001), that largely included adults (60%) or elderly patients (18%). In terms of aggregate number of studies, the top ten health conditions or aspects of healthcare, listed in order from most to least common, were diabetes, mental health, high risk pregnancy,

health failure, cardiac disease, caregiver-related issues, cancer, smoking cessation, asthma, and hypertension. Diabetes and mental health, the two most common diseases or conditions, accounted for approximately 28% of the studies, and the almost 90% of the projects reported clinical evaluations related to patient outcomes, 21% reported economic related data, and 5% reported caregiver outcomes.

Bensink et al. (2006a; 2006b) concluded that considerable evidence supporting the utility of home telehealth among different health conditions exists. Explicitly, the researchers reported evidence for the clinical effectiveness of home telehealth particularly related to diabetes, mental health, high risk pregnancy monitoring, and heart failure and cardiac disease. As the body of evidence for the utility of telehealth increases, gradually more interactive and non-interactive remote monitoring and other health-related technologies will be developed and used to address individuals' health and social functioning in their own residents (Strode, Gustke, & Allen, 1999). Remote monitoring of a patients' medical condition(s) in their homes may prove to be cost-effective and prove to be more convenient to all individuals involved (Dimmick, Mustaleski, Burgiss, & Welsch, 2000; Field & Grisby, 2002; Johnston, Wheeler, Deuser, & Sousa, 2000). One particular technology for health care consumers and their family caregivers that was not specifically reviewed in Paré et al. (2006) and Bensink et al. (2006a; 2006b) meta-analyses was smart home technology such as the IMS, the technology of interest in this study.

### **Smart Home Technology**

A smart home (SH) is a home with ubiquitous technologies that includes sensors and wireless networks powered by intelligent computation (Bull, Limb, & Rayne, 2004;

Saizmaa & Kim, 2008). Such a home could include a singular intelligent device, which opens doors, controls room temperatures, or connects multifaceted systems to process and infer particular occupants' preferences and assist him or her with specific tasks (David, Colette, & Magdalen, 2002). As smart home technology evolves, the SH may be able to control itself and respond under human supervision (Gann & Barlow, 1999), indentify specific contexts and accomplish programmed actions, and be cognizant of an identified persons' conditions (Mozer, 1998; Taylor, Harper, Swan, Izadi, Sellen, & Perry, 2007).

The smart home concept includes a computer, or local intelligence unit (LIU), which gathers, analyzes, and interprets data from various smart home technologies and a remote control center (RCC), or switchboard, which can instinctively alert emergency personnel and others involved in a person's health care, via radio frequencies, pagers, mobile phones, and internet-related technologies, for example, of an detected emergency or critical event (Rialle, Duchen, Noury, Bajolle, & Demongeot, 2002). A smart home could be equipped with an integrated sensor network that identifies changes in a person's behavior which could signal a health or functioning problem (see Alwan, Dalal, et al., 2006; Alwan, Kell, Dalal, Turner, Mack, & Felder, 2003; Rantz, Skubic, Miller, & Krampe, 2008; Zagier, 2009). For example, such a sensor network could detect a critical incident based on atypical motion sensor data and the RCC could alert those involved with the well being of the person. Notifications and alerts could be sent to an alarm response operator, a family member or caregiver, and health care providers such as doctors, nurses and social workers associated with the person's health care. Smart home technology has considerable promise as it can potentially save lives, increase and

improve a person's independence and overall health functioning, and positively impact caregivers (Alwan, Dalal, et al., 2006; Alwan, Kell, Turner, Dalai, Mack, Felder, 2006; Demiris, Oliver, Giger, Skubic, & Rantz, 2009; Rantz, et al., 2008; Zagier, 2009).

Smart homes and smart home technology may seem to some as science fiction. Yet, the notion of "smart houses", or smart home technology, has existed for over four decades. These technologies were initially introduced in concert with idea of creating home automation (HA) technologies, or "intelligent technologies" and "intelligent buildings" (Demiris, 2004). The foremost objective of the smart home concept was to build a smart home environment for the average person without a disability, and this "smart home" could be used to enhance a person's comfort, security, and energy conservation (Stefanov, Zeungnam, & Won-Chul, 2004). Despite the promise of smart homes, research showed that HA technologies generally failed to significantly improve consumers' lives. The benefits gained from HA technologies were quite small in comparison to the considerable introduction costs of utilizing the technologies. This fact, along with inflexible network infrastructures and limited customizability of the technologies, resulted in limited interest and use of HA (Yamazaki, 2006).

Over the past two decades, smart home technologies using ubiquitous or pervasive technologies have gained considerable traction due to the advances in wireless home networking, networked appliances, sensor networks, mechanical and control engineering and computers (Yamazaki, 2006). Ubiquitous computing is a technology or network of technologies embedded in one's environment and accessed through intelligent interfaces. Such technologies are literally everywhere in a home, and "they weave themselves into the fabric of everyday life until they are indistinguishable from it"

(Weiser, 1991, p. 78). Intelligent ubiquitous technologies can include devices that detect medication adherence (Frangou, Sachpazidis, Stassinakis, & Sakas, 2005), key ADL's including general mobility, meal preparation, showering, bathroom visits, and sleep patterns ( Alwan, Dalal et al., 2006), and falls (Noury et al., 2000). Other examples of smart home technologies involve automatic and motion-sensing devices for lighting control, door and window openers, and motorized curtains and blinds (Elger & Furugren, 1998), and intuitive devices that can detect smoke or gas, or extreme bath-water temperatures (Williams, Doughty, & Bradley, 2000).

Researchers have discussed smart homes and various smart home technologies in detail (see Rantz, Skubic, Burks et al., 2008; Yamazaki, 2006). A few notable technologies include Honeywell's Independent Lifestyle Assistant (ILSA) program (Haigh, Kiff, Mayers, & Krichbaum, 2004; Plocher, Kiff, & Krichbaum, 2004), Massachusetts Institute of Technology's (MIT) living laboratory (Intille, 2002), Georgia Institute of Technology's Aware Home (Kidd et al., 1999), and University of Virginia's In-Home Monitoring System (IMS) (Alwan, Mack, Dalal, Kell, Turner, & Felder, 2006). Other smart homes include the Welfare Techno-House which seeks to promote independence for older adults and people with disabilities and increase their quality of life (Tamura, Togawa, Ogawa, & Yoda, 1998); the MavHome which detects home environmental states through sensors (Das, Cook, Bhattacharya, Heierman III, & Lin, 2002); and the Sensing Room which details daily human behavior over the long term (Mori, Noguchi, Takada, Sato, 2004). These technologies aim to promote independent lifestyles for older adult or people with cognitive and other disabilities.

Sensors play an important role in home based ubiquitous technologies (see Rantz, Skubic, Miller, & Krampe, 2008; Alwan, Dalal et al., 2006; Alwan, Kell, Dalal et al., 2003; Alwan, Mack, Dalal et al., 2006). Sensor-based systems are classified based on their installation requirements and location, and there are three categories (Demiris, Parker-Oliver, Giger et al., 2009). The first category is *on-body sensing*, which includes wearable sensor-based systems that can also be embedded in the person's outfit (Lukowicz, Kirstein, & Troester, 2004). The second category is *infrastructure mediated sensing* where networked sensor systems make use of a person's existing home infrastructure to mediate the transduction of events based on the premise that infrastructure activity such as plumbing can be used as a proxy for human behavior and activities. An example of *infrastructure mediating sensing* can be found in Patel, Robertson, Kientz, Reynolds, and Abowd's (2007) research. They developed a system to unobtrusively detect and group distinctive electrical events on a residential power line in order to infer residents' activities. Finally, *distributed direct sensing* involves the installation of a new sensing infrastructure into a person's resident or home. In this context, a network of sensors is installed to transfer the sensor data to a centralized monitoring system. Sensor components can include but are not limited to bed sensors, motion sensors or visual sensors using video capturing devices, transmitting data sets to a central server for further processing (Demiris, Hensel, Skubic, & Rantz, 2008; see also Rantz, et. al, 2008).

Smart home technologies have shown promise for people with particular health conditions or special needs wanting to live independently or remain living independently in their home or residence (Alwan, Dalal, et al., 2006; Hensel et al., 2006; Rantz, et al.,

2008). Progress in the field of information technology (IT) has produced promising innovative approaches to monitoring vulnerable or cognitive impaired people in their own residence or home. The goal of such technology is to detect or prevent emergencies, identify the onset of health events that can contribute to functional decline and impaired activities of daily living (ADL's) and ultimately increase quality of life and safety of the person residing in their residence or home. There are a wide range of home based technologies that support physiological monitoring, functional monitoring, safety monitoring, security alarm systems, and applications providing cognitive and sensory assistance or promoting social interaction (Demiris & Hensel, 2008).

### **Evidence for Smart Homes**

Celler et al.'s (1995) research is considered to be one the pioneering smart home technology research projects (Alwan, Dalal, et al., 2006). Celler and his colleagues from the University of New South Wales, Sydney, Australia, designed and implemented a research project aimed at obtaining the functional health status of older adults living alone by remotely and continuously monitoring and measuring simple health parameters between a person and their environment. Various sensor technologies have been used by the researchers in order to extract health-related data including infra red sensors, light sensors, temperature sensors, pressure sensors, and sound sensors. Celler and his colleagues posited that deviations from a person's typical activities of daily living (ADL's; see Lawton & Brody, 1969) could suggest changes in a person's health status. Results from the study showed that both the participants and their primary care providers accepted the technology as it was deemed easy to use and effective in terms of increasing the efficiency of chronic disease and illness management (Alwan, Dalal, et al., 2006).

Other researchers have found that non-memory impaired older adults ( $n=15$ ) accepted the IMS--which consisted of wireless motion sensors, a PC-based data manager, a radio receiver, a bed sensor, a pneumatic bed pad, and a kitchen motion sensor with an integrated stove-top temperature sensor—and their quality of life was improved (Alwan, Leachtenauer, Dalal, et al., 2006). Results showed that participant life satisfaction significantly increased ( $p < .05$ ), as measured on Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), pre and post IMS installation. The authors concluded that noninvasive health monitoring technologies could be used as care coordination tool, and this tool could have a positive influence on an IMS users' perceived quality of life. Additional studies provide support for smart homes and the IMS as well (see Alwan, Dalal, et al., 2006; Alwan, Kell, Dalal et al., 2003; Alwan, Kell, Turner, et al., 2006; Alwan, Mack, Dalal et al., 2006).

Rantz et al. (2008) presented two case studies that call attention to the broad potential of remote monitoring smart home technologies, particularly the IMS. The first case involved a 96 year old woman with a history of heart problems living alone in an apartment outfitted with a network of sensors. Observationally, this woman appeared to be in relatively good health and she seemed to maintain her ADL's. The woman's sensor network, however, told a different story as her sensors unobtrusively detected behavioral and health changes, bed restlessness and resting pulse rate, which traditional health care assessments did not. The second case also involved an older adult, a 79 year old male, with heart disease living alone. Following a heart attack and coronary bypass surgery, the man returned to his apartment and began cardiac rehabilitation. Data from his sensor network showed that he was extremely restless while in bed; this restlessness could have

been a result of post-surgery pain, new medications, or unknown post-operative complications. After completing his prescribed rehabilitation, the man's bed restlessness returned to his normal pre-surgery baseline suggesting that his restlessness may have been related to his ongoing heart problems. Both cases illustrate how sensor data can augment traditional health assessments by health care professionals and possibly prevent, delay or mitigate the impact of health issues and adverse health events. For additional literature on smart home technology and older adults readers are encouraged to review the work done by Tomita, Mann, Stanton, Tomita, and Sundar (2007); Demiris, Oliver, Giger et al., 2009; Demiris, Rantz, Aud, Marek, Tyrers, Skubic, and Hussam (2004); Wild, Boise, Lundell, and Foucek (2008); Courtney (2008); and, Johnson, Davenport, and Mann (2007).

### **SHT and Family Caregivers**

The emotional and physical strains related to family caregiving are well researched and documented, and much of the literature regarding the use of technology to provide support to, and reduce burdens of family caregiver focus on the caregiving provided to older adults (Czaja & Rubert, 2002). Specifically, the majority of the gerontology, health telematics, and nursing literature are aimed at caregivers of persons with dementia and stroke (Magnusson, Hanson, & Borg, 2004). For example, employed caregivers experience stress as they are unable to monitor and regulate the activities of their impaired loved one, rendering the older adult vulnerable to an accident or accidents while alone (Mahoney, 2003; Mahoney, Mutschler, Tarlow, & Liss, 2008). Stone and Short (1990) showed that approximately one-third of all employed caregivers either terminated their employment or accommodated their work schedule due to their

caregiving responsibilities. Other researchers have documented that 40% of caregivers utilize sick time, vacation time, or in some cases by arriving late to work due to caregiving (Scharlach & Boyd, 1989; Mutschler, 1999), and Schulz and Beach (1999) found that caregivers experiencing role strain had over a 60% higher mortality rate than non-caregivers.

Technologies can assuage the burdens of caregivers of older adults by alerting them to potential care needs or critical needs requiring direct attention when they are away from their loved one (Alwan, Mack, Dalal et al., 2006). Findings from Topo's (2009) literature review, and various other researchers (see Anderson, Hanson, & Magnusson, 2002; Buckley, Tran, & Prandoni, 2004; Colantonio, Cohen, & Pon, 2001; Czaja & Rubert, 2002; Dang, Remon, Harris, Malphurs, Powell, Chiu & Eysenbach, 2008; Mahoney, Mutschler, Tarlow, & Liss, 2008; Sandals, Cabrera & Nedd, 2008) show that there are various technologies to assist family caregivers and that caregiver perceptions toward various technologies were generally positive. However, these studies were limited to televisions, telephones, videophones, and computer-based technologies, and the population investigated focused on family caregivers of older adults.

Literature explicitly examining the perspectives of family caregivers toward smart home technologies such as the IMS is limited at best. Rialle, Ollivet, Guigui, and Herve (2008) specifically investigated the perceptions of family caregivers of older adults toward smart home technology. In this study, family caregivers were first introduced to various smart home technologies, such as fall sensors and telemonitoring devices able to monitor ADL's and general health functioning, and then they were asked to rate the usefulness of each technology. All caregivers were involved with the loved one's care for

over 4 years, were 64 years of age, on average, and were largely female (66%). Results showed that caregivers found the technologies to be useful or they were rather or completely hostile toward the technologies. Significant gender and age associations were noted. Telemonitoring technologies scored the highest in terms of caregiver acceptance, with female caregivers appreciating it significantly more than males ( $p < .01$ ), and younger caregivers more so than older caregivers ( $p < .001$ ). Food preparation technologies, which provide oral cooking advice to a person, and fall sensors implanted under the skin garnered the least amount of appreciation. Similarly, Alwan, Mack, Dale et al. (2006) findings showed that a smart home technology named the IMS reduced caregiver strain level. Here, results from a dependent sample t-test indicated that caregivers strain levels significantly decreased after the installation of the IMS ( $p = 0.0336$ ) suggesting the technology could assuage strain and burden.

The literature shows that the research on informal caregiver perspectives toward technology generally focuses on the caregivers of older adults. The only two known studies overtly investigating family caregiver perspectives toward smart home technology are Rialle et al.'s (2008) and Alwan, Mack, Dalal et al.'s (2006) research. Interestingly, there is another caregiver population that could also possibly benefit from smart home technology, informal caregivers of persons with serious mental illness (SMI). The final section discusses this population.

### **Family Caregivers and Serious Mental Illness**

**Population needing caregiving.** Persons with a serious mental illness (SMI) have a diagnosable mental, behavioral, or emotional disorder meeting the Diagnostic and Statistical Manual of Mental Disorders criteria ([DSM-IV]; APA, 1994) that results in

functional impairment which significantly impedes or restricts a person in one or more major life activities (Wang, Demler & Kessler, 2002). Examples of impaired role functioning include poor personal hygiene, inability or difficulty maintaining independent living, and compromised social, employment and educational functioning (New Freedom Commission on Mental Health, 2003). Though there is no universal list of illnesses that constitute SMI, adults with schizophrenia, schizoaffective disorder, bipolar disorder, major depression, obsessive-compulsive disorder, panic disorder, post traumatic stress disorder, and borderline personality are generally considered to have a SMI (Lefley, 2009; Morden, Mistler, Weeks & Bartels, 2009; NAMI, 2009; U.S. Health and Human Service, 1995).

Current estimates indicate 1 in 17, or approximately 6% of the U.S. population, have a SMI (Kessler, Chiu, Demler & Walters, 2005; NIMH, 2008). Based on 2007 US Census Bureau data (2009) residential population estimates, this figure translates to approximately 18 million people suffering from a serious mental illness annually. A 2001 Substance Abuse and Mental Health Services Administration ([SAMSHA]; 2001) study reported comparable findings. The SAMSHA study estimated that approximately 15 million adults age 18 or older, or 7% of the population, have a SMI. Young adults aged 18 to 25 were found to have the highest rate of SMI (12%), followed by adults aged 26 to 49 (8%) and those 50 or older (5%). Further, females (9%) were more likely than males (6%) to have a SMI in the past year. Prevalence rates of SMI were highest among American Indian/Alaska Natives (14%), followed by Whites and Blacks (8%), Hispanics (6%), and Asians (4%).

Recently, the National Alliance on Mental Illness ([NAMI]; 2007) released a fact sheet calling attention to the impact of having a SMI. A few compelling statistics were that individuals with SMI tend to die prematurely and have chronic medical conditions. Regarding premature deaths, adults with SMI die about 25 years younger than other Americans (Colton & Manderscheid, 2006). To provide context for this data, the most current U.S. Census Bureau data (2009) estimate the average life expectancy of a male is 75 years. A male with a SMI would therefore be expected to only live to approximately 50 years of age.

Other researchers have documented similar health related issues for persons with SMI. Researchers have found that outpatient clients with SMI have an increased risk for chronic medical conditions, particularly diabetes, lung disease, and liver conditions (Dixon et al., 2004). Persons with SMI have also been found to have a higher prevalence of chronic bronchitis and emphysema when compared to national comparison participants (Keyes, 2004), and higher cancer rates than the general population (Pandiani et al., 2005). Additional reported health risks among this population include hyperlipidaemia, hypertension, myocardial infarction, accelerated osteoporosis, and irritable bowel syndrome (Lambert et al., 2003; see also Davidson, Judd, Jolley, Hocking, Thompson & Hyland, 2001). A lack of emotional support and social networks, substance use and abuse, limited physical activity, poor diet, and poverty also affect mortality among persons with SMI (Barreira, 1999; Lambert et al., 2003).

In the past decade, the U.S. Surgeon General released a comprehensive report on mental health (U.S. Department of Health and Human Services, 1999). The reported annual, indirect economic cost of mental illness in the U.S. was estimated to be \$79

billion, of which 80% or approximately \$63 billion, reflected the loss of productivity because of illnesses. A more recent study estimated SMI costs the U.S. society \$193.2 billion annually in lost earnings alone (Kessler et al., 2008). The authors noted that their estimate is likely conservative, and that findings support previous research showing impaired functioning related to mental disorders is a significant societal burden.

### **Informal Caregivers of Persons with Serious Mental Illness**

Informal caregivers, or family members, of persons with SMI play a significant role in the care of their loved one with the illness. Informal caregivers of persons with illnesses such as schizophrenia have increasingly assumed caregiving responsibilities for their adult family members, particularly over the past four decades (Dyck et al., 1999; Tucker, Barker, & Gregoire, 1997). Deinstitutionalization has largely contributed to this shift (Elbogen, Wilder, Swartz, & Swanson, 2008), and Geller (2000) provides one of the more comprehensive reviews of the deinstitutionalization movement.

Due to the deinstitutionalization policy of the 1960's, family caregivers more regularly assume supportive functions for adults with SMI as a result of scarceness of community-based housing options and mental health treatment and service (Cook, Cohler, Pickett, & Beeler, 1997; Corsentino, Molinari, Gum, Roscoe, & Mills, 2008; Lefley, 1996). It has been estimated that 65% of all patients discharged from public and private psychiatric hospitals return to their families, particularly with their parents (Lefley, 1987; Minkoff, 1978; see also Thompson & Doll, 1982, citing various other researchers). More recently, conservative estimates find that approximately 33% to 66% of persons with a SMI regularly live with family (Dyck et al., 1999; Lefley, 2003). Other researchers report 50% to 80% of persons with serious mental illness such as

schizophrenia or other psychotic disorders live with or have regular contacts with a family caregiver (McDonnell, Short, Berry, & Dyck, 2003).

Family caregivers supporting persons with illnesses such as schizophrenia, major depression, and bipolar disorder face considerable challenges and burdens. The types of the challenges and burdens caregivers face include missed work, disruption in domestic functioning, restrictions in terms of social and leisure activities, shifted attention from other family members, and financial responsibilities (Clark & Drake, 1994; Hatfield, 1987; Kreisman & Joy, 1974). Focusing solely on the economic expenses family members spend on persons with chronic mental illnesses, such as transportation, clothing, spending or pocket money, housing, leisure, food, health expenses, mental health treatment and various other expenditures, Franks (1987; 1990) found that 408 families spent approximately \$4 million dollars annually on their family member with mental illness. In a subsequent study, Franks (1990) calculated that in Massachusetts alone, annual economic contributions to their ill loved one cost families approximately \$50 million annually.

Caregiving for a person with a mental illness also influences family members' physical and psychological well being. As the primary responsibility for the care of a person with mental illness lies effectively with the family, research has shown that family caregivers often experience impaired physical and psychological health (Dyck et al., 1999; Perlick, Hohenstein, Charkin, Kaczynski, & Rosenheck, 2005). Researchers have found that family caregivers of persons with bipolar disorder use primary care services considerably more than comparable rates noted in the National Comorbidity Survey (NCS). Service utilization rates were 14% among caregivers of persons with bipolar

disorder and 6% among the general population (Perlick et al., 2005). Cummings and MacNeil (2008) and Gubman and Tessler (1987) noted that family members could become physically ill because of the strain of caregiving.

Caregiving also leads to considerable psychological burden. Objective demands and subjective reactions to providing caregiving to a person with a mental illness have been defined as burden (Dyck et al., 1999; Maurin & Boyd, 1990). The first researchers to distinguish between subjective and objective dimensions of caregiving burden were Hoenig and Hamilton (1966). Subjective burden refers to family caregivers' perceptions regarding their caregiving situation and the degree the individuals' perceive they are under considerable stress, whereas objective burden refers to negative effects of the mental illness on the home and the demands placed on family members and caregivers (Baronet, 1999; Maurin & Boyd, 1990). Numerous patient illness factors influence burden, and these include the severity and pervasive nature of the symptoms and the illness, the number of previous hospitalizations, and the length of hospitalizations (see Dyck et al., 1999), and both objective and subjective burden can result in impaired family functioning, and low quality of life (Cuijpers, 1999; Katschnig & Konieczna, 1989). Hatfield (1997), Hatfield and Lefley (1987), and Lefley (1996; 2003; 2009) provide some of the most thorough reviews on the impact mental illness has on family members.

Despite the costly consequences of family caregiving, family involvement in caring for persons with mental illness is important, if not essential. Dixon and Lehman's (1995) review of the literature suggests family involvement in the care of a person with a SMI is beneficial. They noted that family involvement in the treatment of persons with schizophrenia could delay and possibly prevent psychiatric relapse by improving family

members' problem solving, crisis de-escalation, stress management, and behavioral intervention skills. The importance of delaying or preventing relapse cannot be overstated. Treatment delays increase the likelihood of negative social outcomes and longer disability for the person with the mental illness, and untreated mental illness results in greater frequency of psychiatric symptoms and episodes (Post & Weiss, 1998; Wang, Berglund, Olfson, Pincus, Wells, & Kessler, 2005). Various other researchers have also discussed the positive results of family involvement (see Clark, 2001; Hogarty et al., 1986; McFarlane et al., 1995; McFarlane, Lukens et al., 1995).

### **Perceptions of Informal Caregivers**

Researchers have examined the perceptions of informal caregivers of persons with mental illness. Cummings and MacNeil (2008) examined the perceptions of burdens and rewards of 66 family caregivers of older persons with severe mental illnesses. Caregivers in the study were predominantly White (75%) women (69%) having age ranges from 17 to 86 years; the mean age was 53.2 years of age ( $SD = 16.2$ ). The average age of the older care recipients was 64 years ( $SD = 9.2$ ), and 82% were women. Twenty percent of the ill family members were married and 40% were either divorced or separated. In terms of housing, about 50% lived in their own home and 33% lived with family members. Eight-four percent of the care recipients had schizophrenia, major depression or bipolar disorder.

Approximately 40% of the family caregivers were adult children and the second largest group was siblings. The educational level of the caregivers was quite diverse as about 33% had not completed high school and more than 10% reported some post baccalaureate education. More than 50% of the caregivers had family incomes less than

\$30,000, and though 85% of the caregivers indicated having regular contact with their family member several times a week, only around 40% knew their family members diagnosis. All caregivers reported that they assisted with various facets of their family members' daily functioning. Common forms of care provision were shopping, transportation, housework, money management, and meal preparation, while less regular assistance was provided for bathing and grooming related activities and these tasks were perceived as more burdensome. Family caregivers further reported they gained significant rewards from their caregiving activities, and this finding supports Chen and Greenberg's (2004) research showing positive aspects of caregiving to young persons with SMI. A majority of the caregivers felt appreciated by their family member with a mental illness and they enjoyed the interactions with their family member.

Kohn-Wood and Wilson's (2005) research also focused on family caregivers of persons with serious mental illness. The researchers included 49 families from the rural southeast in their study, of which 69% were African American ranging in age from 19-89. The average age of the caregivers in the study were 58 years ( $SD = 16.9$ ) and the average education level was 8.4 ( $SD = 2.6$ ). The reported median income ranged from \$9,000 to \$12,000 annually, and 58% of the sample received at least one form of public assistance. Ten percent of the caregivers had never married, 31% were separated, divorced or widowed, and 59% were married or common-law. Similar to Cummings and MacNeil's (2008) findings, the majority of the caregivers were women (69%).

Kohn-Wood and Wilson's (2005) findings supported previous literature showing family involvement affects the course of mental illness (see Clark, 2001; Hogarty et al., 1986; McFarlane et al., 1995; McFarlane, Lukens et al., 1995). That is, perceived burden

was significantly associated with the care recipients level of functioning. The researchers also noted that African American perceived significantly less overall burden than did Whites ( $p < .05$ ) and significantly more social support ( $p = .01$ ).

**Perceptions Toward Technology.** Little is known research in terms of the perceptions informal caregivers of persons with serious mental illness have toward the various technologies previously described. One article was located that specifically investigated family caregiver perceptions toward telepsychiatry (see Greenberg et al., 2006). Greenberg and colleagues used qualitative, exploratory methods and found that caregivers viewed telepsychiatry as a much needed and welcome service that afforded them additional treatment choices. Caregivers reported that the technology had led to reduced travel expenses and a reduction in tardiness at work among caregivers and missing school days for the ill child and siblings. In addition, caregivers felt the technology could increase the chance of remaining active in their communities, while at the same time securing help for their children, thus, reducing the stressful wait time until professional assistance could be obtained. The technology was also seen to minimize disruptions at the caregivers' paid employment, and the authors concluded that increasing the range of services provided by local mental health could potentially contribute to the stability of rural and remote communities.

Recognizing the need and importance of integrating family members, or informal caregivers, and technologies in mental health treatment, on April 29<sup>th</sup>, 2002, then President George W. Bush announced the creation of the first presidential mental health commission in the past 25 years, the President's New Freedom Commission on Mental Health (Hogan, 2003). The final report of the President's New Freedom Commission on

Mental Health (2003) identified six goals of a transformed mental health system. Two of the goals are that mental health care is consumer and family-driven, and that technology be used to improve access and coordination of mental health care in order to help consumers recover from mental illness. Despite the fact these goals were outlined over six years ago, there appears to be a limited research aimed at the perceptions of family caregivers toward health care technologies for mental health recovery.

Though there is the limited evidence on the perceptions of caregivers, the existing, albeit narrow evidence nevertheless underscores the fact that caregivers have favorable views toward health care technologies such as telepsychiatry (see Greenberg et al., 2006). Moreover, there is no known literature focusing solely on the perceptions informal caregivers of persons with serious mental illness have toward in-home or smart home technologies such as the IMS, which may be able to more comprehensively improve the lives of both persons with mental illness and their informal caregivers.

Certainly, the perceptions of persons with serious mental illness regarding their recovery are also imperative. Much literature and discussion is devoted toward the topic of mental health recovery (see Davidson, O'Connell, Tondora, Styron, & Kangas, 2006; Harvey & Bellack, 2009), and the importance of consumer driven mental health care (New Freedom Commission on Mental Health, 2003). Definitions of the concept recovery vary among persons with mental illness or consumers (Mead & Copeland, 2000) and researchers (Jacobson & Greenley, 2001). According to Anthony (1993), mental health recovery involves moving beyond the debilitating and catastrophic effects of mental illness to develop new meaning and purpose in one's life, whereas the New Freedom Commission on Mental Health (2003) defines recovery as the process in which

persons with mental illnesses are able to live, work, learn, and fully participate in their communities.

It should be obvious that mental health recovery is the goal of a transformed mental health system despite the fact there is no clear definition of the concept (Davidson et al., 2006), and consumers play an integral role in their own recovery. However, there are two compelling reasons this study focused on informal caregivers. First, a large percentage of persons with serious mental illness live with their family members (Dyck et al., 1999). By focusing on informal caregivers, researchers and policy-makers will be better able to gauge the interest caregivers have toward in-home technologies such as the IMS which could be development to specifically address and enhance a persons' mental health recovery. Should informal caregivers find utility among in-home technology for monitoring persons with serious mental illness, this knowledge could potentially translate in to powerful national, state, or local initiatives aimed at influencing and perhaps increasing in-home technology-related funding opportunities for informal caregivers and persons with serious mental illness.

Second, informal caregivers such as family members have historically advocated for and brought about improved systems of care for persons with mental illness (Marsh et al., 1996). For example, family caregivers, vis-à-vis the National Alliance on Mental Illness were seen to be helpful in enacting 1984 Social Security Act amendments which restored the rights of persons with mental illness and other disabilities; were active in the promotion of Public Law 99-660 which required U.S. states to design comprehensive mental health plans, including terms for community care for persons with serious mental illness; were involved with other disability stakeholder groups in the passage of the 1990

Americans with Disability Act which protected persons with mental illness from a wide range of discrimination; and were seen as instrumental in passing protection and advocacy changes such as increasing family and consumer representation on various boards and councils (Lefley, 1996). Considering the aforementioned historical influences that informal caregivers such as family members have had on the lives of persons with mental illness, this study focused on informal caregivers. The purpose of this study was to explore the perspectives of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness.

## CHAPTER THREE: METHODOLOGY

This Methods chapter is divided into five sections. First, the results from an initial pilot study used to determine the feasibility of the main study are reported. Second, the characteristics of the participants in the main study are described. Third, the psychometric properties of each scale are described. The attitude toward the IMS (ATT) scale was used to measure informal caregivers' attitudes, whereas the perceived usefulness (PU) and the perceived ease of use (PEOU) scales were used to measure the usefulness and ease to use of the IMS. Forth, procedures are described about how data was collected. Finally, pre-analysis data screening procedures and the main statistical analysis are discussed.

### **Preliminary Study**

**Pilot Study.** It is important to obtain both a high response rate and a low item non-response rate when conducting survey research. Researchers who do not consider and address such issues vis-à-vis thoughtful survey development may unknowingly report findings that are unreliable because the data they collected is missing or systematically biased in some nonrandom manner (Subar, Ziegler, Thompson, Johnson, Weissfeld, Reding, Kavounis, & Hayes, 2001; Keeter, Miller, Kohut, Groves, & Presser, 2000). As a result, the main study questionnaire was systematically developed. To achieve this goal, literature and texts on survey construction were reviewed (Ary, Chester, Razavieh, & Sorensen, 2006; Babbie, 2007; Fowler, 2002; Isaac & Michael, 1995) and surveys from the World Health Organization (WHO), the Centers for Disease Control (CDC), and the General Social Survey (GSS) were analyzed. Literature specifically addressing survey instruments-related to IMS was also reviewed (Alwan, Turner, Kell, & Felder, 2007; Alwan, Turner, Kell, Penberthy, Cohn, & Felder, 2006). After appraising the literature

and the surveys, this author constructed a preliminary survey and conducted a pilot study to test the survey.

During the summer of 2008, this author traveled to the office of the executive director of the National Alliance on Mental Illness (NAMI); location of the office is in a Midwestern state. The purpose of the meeting was to discuss the feasibility of main study. Those in attendance at the meeting included this author, the executive director of NAMI, and three persons with serious mental illness. The purpose and rationale of the pilot study was presented and feedback from those in attendance was solicited. Both the executive director and the three mental health consumers indicated they were supportive of the research and reported no concerns. The executive directed provided a list of the 13 NAMI affiliates in the Midwestern state which included the names and contact information for each affiliate. This author contacted the president or designee of one of the 13 NAMI affiliates and scheduled the pilot study. The pilot study was conducted to consider the preliminary design of the study and data collection materials. The selected affiliate was chosen due to its close geographical location to this author.

In October of 2008, this author attended the NAMI affiliate meeting and conducted the pilot study. Fourteen informal caregivers of persons with serious mental illness participated in the pilot study and commented on the purpose of the study, reviewed the study materials, and completed the 20-item pilot questionnaire. Participants reported no concerns regarding the purpose of the study and the data collection procedures which included showing a short video of an apartment with an actual IMS installed, a color brochure describing the IMS, and the questionnaire. A suggestion was made regarding a particular question that asked participants to report their yearly

household income. This question was thought to be too personal and it was recommended that the question be reworded so that participants could report a monthly income range. Additional feedback from the participants indicated that the length of the questionnaire was appropriate and that adding additional questions would not be a cause for concern.

Data collection procedures established for the pilot study worked appropriately. Considering the feedback from the pilot the income question was modified accordingly and additional questions were added to the main study's questionnaire. It was deemed that this author would obtain the necessary data required to answer the main study's research questions.

### **Main Study**

**Participants.** Informal caregivers of persons with serious mental illness residing in a Midwestern state were the population of interest for this study. There are 13 NAMI affiliate sites throughout the Midwestern state. Ten of the 13 affiliates participated in the study. Two affiliates did not respond to multiple phone and email queries and the remaining affiliate did not want to participate in the study. From the 10 affiliate sites, a nonrandom purposeful sample of 69 informal caregivers of persons with serious mental illness attending monthly NAMI meetings was obtained. Three informal caregivers of persons under the age of 18 and two mental health professionals not caring for a person with a serious mental illness were eliminated from the study leaving a final sample of 64 informal caregivers.

Though the sample in this study was purposeful and nonrandom the demographics of the informal caregivers were roughly consistent to those in other NAMI surveys (Hatfield, Gearon, & Coursey, 1996; Leighninger & Speier, 1996; Marshall & Solomon,

2000; and Mulvaney-Day, 2002). As shown in Table 1, the demographics of this study were similar on most variables as compared to a recent large national random sample NAMI caregivers (Mulvaney-Day, 2002), thus providing an improved degree of confidence in terms of the potential generalizability of this study's findings in relationship to the larger NAMI organization.

Table 1

*Sample Comparison with a Recent National Random Sample of NAMI Caregivers*

Characteristic	Giger (2010) (n = 64)	Mulvaney-Day (2002) (n =628)
Mean caregiver age	61.02	59.3
Caregivers 50 and over	90.6%	76.6%
Caregivers 65 and over	35.9%	36.6%
Female caregivers	69.8%	74.0%
Caregiver race/ethnicity		
White	100%	---
Education of caregiver		
High school graduate	9.4%	34.7%
Some college	23.45%	22.3%
Associates degree	7.8%	8.1%
College graduate	37.5%	25.4%
Post college professional Degree	21.9%	28.9%
Caregiver a parent of family member with a mental illness	64.1%	76.5%

*Note.* Caregiver race/ethnicity was not reported in Mulvaney-Day's (2002) study.

**Study materials.** Materials for the study included a 7 minute and 43 second video showing footage of an IMS already integrated in to an individuals' independent living apartment and a brochure (see Appendix A) demonstrating graphical information that could be obtained from an IMS. Both study materials were created by this author, and though great care was taken in producing the video and the brochure, an argument could be made in terms of the accuracy of both materials. Therefore, an additional measure was taken to ensure the validity of the video and the brochure. Ten experts in social work, engineering, nursing, and health information and informatics reviewed the materials in order to determine the content validity and face validity. Findings from the panel indicated the information shown and described in the video and the brochure was accurate and appropriate.

**Questionnaire.** A 31-item questionnaire (see Appendix B) was developed, and participants were asked to report sociodemographic information and to complete three instruments: (a) perceived usefulness scale; (b) perceived ease of use scale; and (c) attitude toward using the IMS scale. The questionnaire asked about sociodemographic variables such as: relationship to the person with a serious mental illness, diagnosis of the person with a serious mental illness, number of psychiatric hospitalizations, age of first psychiatric hospitalization, satisfaction with current mental health treatment, age, gender, county of residence, relationship status, living situation, employment status, monthly household income, highest degree earned, and number of children. Participants were asked to report similar sociodemographic information on the person with serious mental illness they would be referring to throughout the study.

**Perceived Usefulness Scale.** Perceived usefulness (PU) toward the IMS was measured by the perceived usefulness scale (Davis, 1993). This scale consists of 10 sub items that are represented on a 7-point continuum (1 = Strongly Agree, 7 = Strongly Disagree) where the total score is calculated by summing the scores on all the items. All items are scored in the positive direction and lower scores indicate a higher perceived usefulness. This scale has been psychometrically examined and has high reliability (.97 and .94) and a high degree of convergent and discriminant validity for business professionals and college students (Davis, 1993; Guilabert, 2004). Minor adaptations were made to the scale to accommodate for the context of this study. The original 10 sub items were included for the study, however, this author utilized a 4-point continuum (1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree). The 4-point continuum was used to force a response choice to reduce social desirability among participants. A sample item read: "Overall, I will find an In-Home System with features like the one shown and described easy to use." All PU items were scored in the positive direction, and lower aggregate scores indicated participants perceived the IMS to be more useful.

**Perceived of Ease of Use Scale.** Perceived ease of use (PEOU) toward the IMS was measured by the perceived ease of use scale (Davis, 1993). Similar to the usefulness scale, this scale also consisted of 10 sub items that are represented on a 7-point continuum (1 = Strongly Agree, 7 = Strongly Disagree) where the total score is calculated by summing the scores on all the items. Similar to the usefulness scale, lower ease of use scores indicate a higher perceived ease of use. Again, this scale has good reliability (.91 and .78) and a high degree of convergent and discriminant validity for business professionals and college students (Davis, 1993; Guilabert, 2004). Adaptations were once

more been made to the PEOU scale to accommodate for the context of the study. Again, the original 10 sub items were included for the study and this author for a second time utilized a 4-point continuum (1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree). As was the case in the PU scale, a 4-point continuum was again used to force a response choice to reduce social desirability among participants. A sample item read: "Overall, I will find an In-Home System with features like the one shown and described easy to use." All PEOU items were scored in the positive direction, and lower aggregate scores indicated participants perceived the IMS to be more easy to use.

**Attitude Toward Using The IMS.** Attitude toward using the IMS (ATT) is a five-item measure with a standard 7-point semantic differential rating scale format that measures the extent to which a person has a positive or negative attitude toward a technology (Davis, 1993). The response choices are Good-Bad, Wise-Foolish, Favorable-Unfavorable, Beneficial-Harmful, Positive-Negative, with the midpoint labeled Neutral. A sample item of this measure read: What is your opinion on the following statement?: With respect to mental health recovery for the consumer I care for, my opinion about the In-Home System shown and described earlier is... — Measuring ATT in this manner has been recommended by researchers (see Ajzen & Fishbein, 1980; Davis, 1993). Davis (1993) and Guilbert (2004) operationalized attitudes toward behaviors in this manner and found high reliability (.96 and .90). All ATT items were scored in the positive direction, and lower aggregate scores indicated that participants had a more a positive attitude toward the IMS.

### **Internal Reliability**

Cronbach's alpha was computed to estimate the internal consistency of PU, PEOU, and the ATT scales for this sample. According to Heppner and Heppner (2004) acceptable reliability of scales should be higher than .70. The alpha coefficients were as follows: .97 for PU, .67 for PEOU, and .95 for ATT. Using Heppner and Heppner's guideline, the initial estimates suggest that only PU and ATT scales have acceptable levels of internal consistency. It should be noted that King and He (2006) conducted a meta-analysis on 88 studies that utilized PU, PEOU, and ATT scales. They reported alpha coefficients of .90 (range .67 to .98) for PU, .87 (range .63 to .98) for PEOU, and .85 for ATT (range .69 to .95). The coefficient findings of this study are within the ranges reported by King and He (2004), thus providing this author with some degree of confidence in his findings.

### **Design**

The University of Missouri Institutional Review Board (IRB) approved the study. A cross-sectional survey design was utilized to provide baseline data regarding the perspectives of informal caregivers on using in-home technology to monitor activities of persons with serious mental illness. The survey design of the study allowed for collecting data from informal caregivers of persons with serious mental illness on perceived usefulness, perceived ease of use, and attitude toward using the IMS. The predictor variables were perceived usefulness and perceived ease of use. The criterion variable was attitude toward using the IMS. The two independent variables were entered into a regression equation as predictor variables.

Prior to recruiting informal caregivers at the monthly NAMI meetings, this author contacted each of the NAMI affiliate presidents' or their designees by phone and email.

Each NAMI affiliate president or their designee was given a standardized synopsis (see Appendix C) of the study to be distributed for recruiting purposes. Further, the Midwestern state NAMI included the standardized synopsis of the study in their statewide e-newsletter and their paper newsletter mailed to all current NAMI members. The researcher traveled to the NAMI affiliate meetings to collect data. While at the meetings, the principle investigator distributed and then read aloud the informed consent form (see Appendix D) to the informal caregivers attending the meetings. Participants were asked to read and sign the informed consent explaining the nature of the study and the inclusion criteria. The consent form identified the potential benefits and risks from participating in the study and addressed the fact the study is voluntary and participation in the study is confidential.

After signing the consent form, informal caregivers viewed a 7-minute and 43 second video on a 19 inch Sanyo color television. Following the video, participants were given a brochure on the IMS created by this author and the 31-item survey. Administration of the video, brochure, and questionnaire took approximately 45 minutes to complete. Upon completion, participants placed their surveys face down in a locked collection box. The survey was administered in paper and pencil form, and this author left the room but was available just outside the room during data collection to answer questions.

### **Scoring/Data Analysis**

All data analyses were performed using SPSS for Windows version 18.0 and STATA 10.0. There were no miscoded scores but there was missing data on PU (17%), PEOU (20%), and ATT (6%) variables. Some researchers recommend replacing variables

with 5% to 15% missing values with estimated values and deleting variables with greater than 15% missing cases (Mertler & Vannatta, 2005). Since PU, PEOU, and ATT are the main variables in this study and there is no known literature on the perspectives of informal caregivers of persons with serious mental illness in terms of PU, PEOU, and ATT, the variables were kept and a conservative approach was taken in which the analysis included complete cases and missing values were not replaced so as to not overstate the relationships among the variables.

This study followed the data screening procedures recommended by several experts (Field, 2009; Heppner & Heppner, 2004; Mertler & Vannatta, 2005; Tabachnick & Fidell, 2007). Preliminary data analyses were performed to test for assumptions of parametric data (see Field, 2009; Mertler & Vannatta, 2005; Tabachnick & Fidell, 2007). Three analyses were performed in order to test the three research hypotheses. First, to test the hypothesis the perspectives of family caregivers on perceived usefulness (PU), perceived ease of use (PEOU), and attitude toward using the IMS (ATT) are related, bivariate correlations were performed. PU, PEOU, and ATT were utilized as continuous variables. Normality of the data was tested using the Shapiro-Wilk test (Shapiro & Wilk, 1965) as this test is recommended when a sample size is small to medium (Ahn & Kim, 2009). The normality assumption is vital in that for the test correlation statistic to be valid the sampling distribution needs to be normally distributed (Field, 2009). As recommended by Field (2009), if the data show a non-normal distribution on any of the three variables the nonparametric Spearman correlation (Spearman, 1910) procedure will be used instead of the parametric Pearson correlation. The nonparametric Spearman correlation is used when data violates parametric assumptions such as

normality (Field, 2009). The Spearman's test works by first ranking the data from lowest to highest, and then applying Pearson's equation to those ranks.

Second, to test the hypothesis that there are differences among family caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS according to their characteristics and background, *t* tests and oneway analysis of variance (ANOVA) were performed. Again, normality of the data was tested using the Shapiro-Wilk test (Shapiro & Wilk, 1965) and the homogeneity of variance was examined using the Levene's test. To test the third and final hypothesis, perceived usefulness and perceived ease of use predict a significant proportion of the variance in informal caregivers attitude toward the IMS, standard multiple regression, the main analysis, was employed. The aggregate attitude toward the IMS score was used as the criterion variable and the aggregate perceived usefulness and ease of use scores were used as predictor variables.

Should the data be non-normal the non-parametric Mann-Whitney test (Mann & Whitney, 1947) and Kruskal-Wallis test (Kruskal & Wallis, 1952) will be performed. The Mann-Whitney test is the nonparametric equivalent of the independent *t* test and the Kruskal-Wallis test is the nonparametric equivalent of the oneway ANOVA test (Field, 2009). These non-parametric tests work on the principle of ranking data. For example, the lowest PU score is given a rank of 1 while the next highest score is given a rank of 2, and so on. Low scores are represented by low ranks and high scores are represented by high ranks. The analysis is performed on the ranks rather than the actual data. The group with the smaller mean rank is the group with the greatest number of lower scores in it, thus, the values of the ranks indicates how groups differ.

Mann-Whitney and Kruskal-Wallis procedures use mean ranked data to test whether PU, PEOU, and ATT scores differed according to family caregiver characteristic and background. The median for each main variable (i.e., PU, PEOU, and ATT) would then be reported as it is more appropriate than reporting the mean for nonparametric tests such as the Mann-Whitney test (Field, 2009). Further, the Mann-Whitney  $U$  test statistic is reported in lieu of the equivalent parametric  $t$  test statistic and the Kruskal-Wallis  $H$  test statistic is reported in lieu of the equivalent parametric  $F$  test statistic. As recommended by Field (2009), Mann-Whitney tests will be used to follow up significant Kruskal-Wallis test findings. These follow up Mann-Whitney tests are equivalent to parametric post hoc tests for differences. Further, to guard alpha inflation, a Bonferroni correction will be used to establish the alpha level at .008 (.05/6), which is the original alpha level (.05) divided by the number of comparisons. Field (2009) and Higgins (2004) provide a detailed discussion of modern nonparametric procedures and the importance of utilizing nonparametric procedures when data does not conform to parametric assumptions such as normality.

Last, the robustness of the fit of the regression model will be checked vis-a-vis Shapiro-Wilk, Breusch-Pagan/Cook-Weisberg, variance inflation factor, Durbin-Watson, and Mahalanobis distance tests recommended by several researchers (Field, 2009; Mertler & Vannatta, 2005; Tabachnick & Fidell, 2007). The Shapiro-Wilk test examines for violations of normally distributed errors (Field, 2009) and the Breusch-Pagan/Cook-Weisberg tests (Breusch & Pagan, 1979; Cook & Weisberg, 1983) for heteroskedasticity to examine that the variance in the residuals was constant. A  $p$  value  $< .05$  on the Shapiro-Wilk test indicates the data is non-normally distributed while a  $p$  value  $> .05$  on

the Breusch-Pagan/Cook-Weisberg tests indicates the variance in the residuals are constant. The mean variance inflation factor (VIF) will be used to examine for multicollinearity and a mean VIF factor around 1.00 suggests multicollinearity is not a problem in the model. The Durbin-Watson procedure (Durbin & Watson, 1951) will also be used to determine independence of errors in the model and a statistic between 1 and 3 is considered defensible. Lastly, as recommended by Tabachnick and Fidell (2007), a  $p < .001$  criterion for Mahalanobis distance will be used to identify multivariate outliers.

One additional analysis was conducted. An a priori power analysis using the G\*Power 3 analysis software (Faul, Erdfelder, Lang, & Buchner, 2007) suggested a sample size of 68 participants in order to detect a medium effect size ( $f^2 = 0.15$ ) and achieve a power of 0.80 in simultaneous regression, the main analysis, with 2 degrees of freedom. Since this study had less participants ( $n = 64$ ) than the recommended sample size of 68 a post hoc power analysis was performed.

## CHAPTER 4: RESULTS

Chapter one discussed the need to explore the perspectives of family caregivers on using in-home technology to monitor activities of persons with serious mental illness. Chapter two examined the literature related to the technology acceptance model, which was based on the theory of reasoned action, and the scarcity of literature in terms of family caregiver perspectives regarding in-home home technologies such as the IMS. Chapter three described the pilot study, methods, procedures used to gather data for this study, and the target population of the study. This chapter describes and summarizes the statistical analyses used to evaluate the research questions and hypotheses established in the previous chapters.

First, the characteristics of the family caregivers and the persons with serious mental illness that they care for are presented. Next, the descriptive statistics of the three main variables (see Table 2)--perceived usefulness (PU), perceived ease of use (PEOU), and attitude toward use (ATT)--are reported along with the preliminary analysis examining the internal reliability on the PU, PEOU, and ATT scales. Following the descriptive and preliminary analyses, the results of statistical analyses that were employed to answer the three research questions are reported along with the data screening process used for each analysis.

### **Characteristics of Participants**

The sample consisted of 64 participants who were informal caregivers of persons with serious mental illness. The majority of participants were the parents of persons with serious mental illness ( $n = 41$ , 64%) and all participants in the study were white ( $n = 64$ , 100%). Participants were generally employed part time or full time ( $n = 39$ , 60.9%),

married ( $n = 47$ , 73.4%), and home owners ( $n = 58$ , 90.6%). More participants were female than male (70%, 30%, respectively,  $N = 63$ ) and 36% of participants cared for persons with a serious mental in their home. Sixty-four percent of participants reported a monthly household income of \$2,500 per month and 56.3% of the sample had a four year college degree or master's degree. Nearly 57% of participants cared for a person with a diagnosis bipolar affective disorder.

On average, participants were 61 years of age, had been a caregiver for nearly 14 years, and had cared for 1.2 persons with a serious mental illness. Family members' level of satisfaction toward the loved one's current mental health treatment to date ranged from 1-5, with 1 indicating very satisfied ( $M = 2.87$ ,  $SD = 1.20$ ,  $Mdn = 3.00$ ). The majority of persons with mental illness were males ( $n = 37$ , 64%); the age at which the person with a mental illness was first diagnosed with a mental illness ranged from 5-90 years of age ( $M = 29.79$ ,  $SD = 16.52$ ,  $Mdn = 25.00$ ); and the number of times the person with a mental illness was hospitalized ranged from 0-30 admissions ( $M = 3.57$ ,  $SD = 5.31$ ,  $Mdn = 2.00$ ).

### **Mean Ratings on PU, PEOU, and ATT**

Means, confidence intervals, standard deviations for perceived usefulness (PU), perceived ease of use (PEOU), and attitude toward using the IMS (ATT)--the three variables assessing the perspectives of informal caregivers of persons with serious mental illness—are shown in Table 2.

PU scores ranged from 10 to 40 and the standard error of the mean ( $SEM$ ) = .92; PEOU scores ranged from 21 to 40 and the  $SEM = .47$ ; and ATT scores ranged from 5 to 30 and the  $SEM = .85$ . The results of the Shapiro-Wilk test show that perceived ease of use,

$W(43) = 0.608, p = .000$ , and attitude toward the IMS,  $W(43) = 0.846, p = .000$ , were non-normal, and perceived usefulness,  $W(43) = 0.955, p = .090$ , was normally distributed.

Table 2.

*Means with Confidence Intervals and Standard Deviations on Perceived Usefulness, Perceived Ease of Use, and Attitude Toward Using the IMS Scales*

Variable	<i>n</i>	<i>M</i>	95% CI	<i>SD</i>
Perceived Usefulness	53	21.42	[19.57, 23.26]	6.71
Perceived Ease of Use	51	25.39	[24.45, 26.33]	3.34
Attitude Toward using the IMS	60	11.07	[9.36, 12.78]	6.61

*Note.*  $N = 64$ . Sample  $n$  is not 64 on each variable due to missing items.  $M$  = mean. CI = Confidence interval.  $SD$  = standard deviation.

### Research Question 1

Research question 1 asked what are the perspectives of informal caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS, and to what extent are those perspectives related? A correlational analysis was created to examine the relationships among PU ( $n = 53$ ), PEOU ( $n = 51$ ), and ATT ( $n = 60$ ). There were no miscoded scores but there was missing data on PU (17%), PEOU (20%), and ATT (6%) variables. Due to the findings from the Shapiro-Wilk test that showed that two out of the three main variables were non-normal in terms of their distribution, the Spearman correlation was used.

It was hypothesized that PU, PEOU, and ATT would correlate significantly with each other. To guard against alpha inflation, a Bonferroni correction was used to establish the alpha level at .017 (.05/3), which is the original alpha level (.05) divided by the number of statistical tests. As shown in Table 3, the Spearman correlations between PU

and ATT are statistically significant ( $p = .000$ ) but the correlations between PU and PEOU ( $p = .069$ ) and PEOU and ATT ( $p = .956$ ) are not statistically significant. In sum, the first hypothesis was partially supported by the findings of this study in that only PU and ATT were significantly related.

Table 3.

*Spearman Correlation Coefficients for Perceived Usefulness, Perceived Ease of Use and Attitude Toward the IMS*

Measure	1	2	3
1. Perceive Usefulness	---		
2. Perceived Ease of Use	.277 <sup>a</sup>	---	
3. Attitude Toward the IMS	.659 <sup>b***</sup>	.008 <sup>c</sup>	---

*Note.*  $N = 64$  but due to missing data  $n$ 's vary. <sup>a</sup> $n = 44$ . <sup>b</sup> $n = 51$ . <sup>c</sup> $n = 49$ . \*\*\* $p < .001$ .

## Research Question 2

Research question 2 asked to what extent do informal caregivers differ in perspectives on perceived usefulness, perceived ease of use, and attitude toward using the IMS by their characteristics and background? Similar to hypothesis one, parametric statistics such as independent  $t$  tests and oneway analysis of variance (ANOVAS) were originally planned. Again, due to the non-normality of the variables, Mann-Whitney and Kruskal-Wallis tests were performed.

Multiple Mann-Whitney tests were used to test mean rank differences among two independent groups on the measures of PU, PEOU, and ATT. Note that lower PU, PEOU, and ATT scores indicate more positive perspectives. The results of the Mann-Whitney tests showed a significant difference among informal caregivers according to whether or not a person with a serious mental illness lived with them. Family caregivers

not having a person with a serious mental illness living with them ( $Mdn = 20.00$ ) perceived the IMS to be more useful than did caregivers living with a person with a serious mental illness ( $Mdn = 23.00$ ),  $U = 194.50$ ,  $z = -2.272$ ,  $p = .022$ . No differences were found on measures of PEOU and ATT. Statistically significant differences were also found on PEOU scores by home owner status (home owner v. renter) but not on PU and ATT measurements. Family caregivers who rented ( $Mdn = 23.00$ ) perceived the IMS to be easier to use than did family caregivers who were home owners ( $Mdn = 25.00$ ),  $U = 53.50$ ,  $z = -2.027$ ,  $p = .049$ .

No statistically significant group differences were found on the measures of PU, PEOU, and ATT according to: (1) where the family caregiver lived (rural v. urban); (2) the gender of the family caregiver; and, (3) the gender of the mental health consumer. The family caregiver age variable, a continuous variable, was converted to a discrete variable by dividing it into two subgroups using the mean caregiver age ( $M = 61.00$ ) as the cutoff point (i.e., below the age of 61 v. 61 or above). No statistically significant mean rank differences were found on the measures of PU, PEOU, and ATT according to these two groups.

Multiple Kruskal-Wallis tests were also performed to test mean rank differences among three or more independent groups on the measures of PU, PEOU, and ATT. Again, note that lower PU, PEOU, and ATT scores indicate more positive perspectives and statistically significant findings are reported first followed by non significant findings. One difference was found. PEOU scores were significantly different according to family members' total monthly household income,  $H(3) = 9.59$ ,  $p = .014$ .

Due to the Bonferroni correction alpha level, no significant mean rank group differences were found. However, when using the common alpha level of .05 (i.e., non corrected alpha) mean rank differences were found. Post hoc tests showed that family caregivers with a total monthly household income of \$1,500-\$1,999 ( $Mdn = 23.00$ ) perceived the IMS to be easier to use than did caregivers earning \$2,000-\$2,499 per month ( $Mdn = 26.00$ ),  $U = 2.50$ ,  $z = -2.125$ ,  $p = .035$ , and caregivers earning \$2,500+ per month ( $Mdn = 25.00$ ),  $U = 8.00$ ,  $z = -2.442$ ,  $p = .013$ . Lastly, family caregivers with a total monthly household income of \$2,500+ per month ( $Mdn = 25.00$ ) perceived the IMS to be easier to use than did caregivers earning \$2,000-\$2,499 per month ( $Mdn = 26.00$ ),  $U = 85.00$ ,  $z = -2.028$ ,  $p = .042$ . There were differences among family caregivers by characteristics and background but only by income level on the measure of PEOU. No statistically significant group differences were found on the measures of PU, PEOU, and ATT according to: (1) family member relationship to the person with a serious mental illness (parent, sibling, significant other); (2) the diagnosis of the person with a serious mental illness; (3) family member relationship status (married, divorced, widowed); and, (4) education level of family member. In sum, hypothesis two was also partially supported.

### **Research Question 3**

Research question 3 examined whether perceived usefulness and perceived ease of use predicted a significant proportion of the variance in attitude toward using the IMS. A standard multiple regression was performed between attitude toward the IMS as the criterion variable and perceived usefulness and perceived ease of use as predictor variables. The analysis was performed using SPSS 18.0 and STATA 10.0 for evaluation

of assumptions. Cases with missing data on the above variables were excluded listwise resulting in an elimination of 21 cases.

Regression results indicate the overall model significantly predicts family member attitude toward the IMS,  $R^2 = .429$ ,  $R^2_{adj} = .400$ ,  $F(2, 40) = 15.02$ ,  $p = .000$ . The  $R^2$  value of 43% indicates that just under half of the variability in family member attitude toward the IMS is predicted by perceived usefulness and perceived ease of use. For the two regression coefficients, 95% confidence intervals were calculated; it should be noted that only the regression coefficient for perceived usefulness was significantly different from zero. The confidence limits for perceived usefulness were .492 to 1.078, and those of perceived ease of use were -1.335 to .044. A summary of the regression coefficients is presented in Table 4. The size and direction of the significant relationship ( $B = .785$ ) indicates that as a family members' perception of perceived usefulness decreases by one, family members' attitude toward the IMS decrease by .601 units. Note that lower scores indicate more positive perceptions.

Table 4.

*Regression Analysis Summary for Perceived Usefulness and Perceived Ease of Use Variables Predicting Family Member Attitude Toward the IMS*

Variable	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>
Perceived usefulness	.785	.145	.742	5.41	.000***
Perceived ease of use	-.645	.341	-.259	-1.89	.066

*Note.*  $R^2 = .43$  ( $N = 43$ , \*\*\* $p < .001$ ).

The Shapiro-Wilk test found that standardized residuals were non-normal,  $W(43) = .868, p = .000$ , indicating the violation of normally distributed errors. The Breusch-Pagan/Cook-Weisberg tests for heteroskedasticity were not statistically significant ( $p = .80$ ) indicating that the variance in the residuals was constant. The mean variance inflation factor (VIF) = 1.32 confirms multicollinearity is not a problem in the model and the Durbin-Watson statistic of 1.14 suggests that the assumption of independence of errors is defensible. A  $p < .001$  criterion for Mahalanobis distance was used and one multivariate outlier was identified. Due to the small sample size this multivariate outlier was not removed though.

Since the normality assumption is key in multiple regression the variables were transformed to improve the normality of residuals. Due to the positive skew of the data, natural logarithmic transformations were used on perceived usefulness, perceived ease of use, and attitude toward the IMS. Upon transforming the data, a standard multiple regression procedure was again performed using SPSS 18.0 and STATA 10.0.

Once more regression results indicate the overall model significantly predicts family member attitude toward the IMS (log of),  $R^2 = .455, R^2_{adj} = .428, F(2, 40) = 16.72, p = .000$ . The  $R^2$  value of 46% indicates that just under half of the variability in family member attitude toward the IMS (log of) is predicted by perceived usefulness (log of) and perceived ease of use (log of). For the two regression coefficients, 95% confidence intervals were calculated; it should be noted that once more only the regression coefficient for perceived usefulness (log of) was significantly different from zero. The confidence limits for perceived usefulness (log of) were .817 to 1.727, and those of

perceived ease of use (log of) were -2.490 to .678. A summary of the regression coefficients is presented in Table 5.

Table 5

*Regression Analysis Summary for Perceived Usefulness and Perceived Ease of Use Variables Predicting Family Member Attitude Toward the IMS Using Logarithmic Transformations*

Variable	B	SE B	$\beta$	t	p
Perceived usefulness (log of)	1.27	.225	.721	5.65	.000***
Perceived ease of use (log of)	-.906	.783	-.147	-1.16	.254

*Note.*  $R^2 = .46$  ( $N = 43$ , \*\*\* $p < .001$ ).

The transformation improved the model. The Shapiro-Wilk test found the residuals to be normally distributed,  $W(43) = .949$ ,  $p = .05$ , which is a crucial assumption in multiple regression, and the Breusch-Pagan/Cook-Wiesberg test for heteroskedasticity was not statistically significant ( $p = .50$ ) indicating that the variance in the residuals was constant. The average (VIF) = 1.20 confirmed no multicollinearity and the Durbin-Watson statistic of 1.05 suggested that the assumption of independence of errors is defensible. With the  $p < .001$  criterion for Mahalanobis distance one multivariate outlier was again identified but due to the small sample it was not removed.

It should be noted that the a priori power analysis suggested a sample size of 68 but 64 participants completed the questionnaire. Listwise deletion for regression was performed further reducing participants in this study. As a result of the listwise procedure, only participants that completed all items on the main study variables—PU, PEOU, ATT—were included in the regression analysis ( $n = 43$ ). Since the sample size was below the recommended sample size of 68, a post hoc power analysis was performed using the resulting effect size of ( $f^2 = .46$ ) and the sample size of 43, two predictor

variables, and an alpha of .05. The post hoc power analysis reported a power of .98.

Taken together, by transforming the data and conducting a post hoc power analysis these findings suggest this model appears to fit these data well.

## CHAPTER FIVE: DISCUSSION

This chapter examined the perspectives of informal caregivers on using in-home technology to monitor persons with serious mental illness. The findings are unique in that no other study has been previously conducted. Specifically, no other know study has described the perspectives of informal caregivers on using in-home technology to monitor persons with serious mental illness and in turn test tested the TAM on a novel in-home monitoring technology as well as tested the TAM with informal caregivers of persons with serious mental illness. As such, the results provide insight into the perspectives of informal caregivers in terms of utilizing in-home monitoring technologies for persons with serious mental illness and extend the theoretical literature on the TAM.

### **Discussion**

The results of this study show that informal caregivers of persons with serious mental illness have a positive attitude toward using the IMS and perceive the IMS to be useful. Although the caregivers have a somewhat neutral perspective on how easy the IMS is to use they perceive it to be useful. This supports the hypothesis that informal caregivers would find the IMS to be useful in caring for persons with serious mental illness which is encouraging and consistent with results in previous studies. While this result suggests that the TAM is a powerful and robust predictive model (King & He, 2006), it also extends the TAM literature to include the use of in-home technology, including the IMS by informal caregivers of persons with serious mental illness.

The results also show that perceived usefulness was significantly associated with informal caregiver attitude toward the IMS. The importance of perceived usefulness to the critical value of attitude toward the use of technology has been soundly established in

prior studies (King & He, 2006). Specifically, perceived usefulness has been found to be related to attitude toward use among physicians (Hu, Chau, Sheng, & Tam, 1999), business professionals and managers (Davis, 1993), college students (Gao, 2005), and now among informal caregivers of persons with serious mental illness.

By comparison, the findings show that the relationship between attitude toward using the IMS and perceived ease of use, as well as the relationship between perceived usefulness and perceived ease of use are both nonsignificant. These findings are consistent with the results in several previous studies (Gao, 2005; Hu, Chau, Sheng, & Tam, 1999; Schepers & Wetzels, 2007) but they are inconsistent with at least one other study (Davis, 1993). The results of this study indicate that key TAM variables seem to work reasonably well with informal caregivers of persons with serious mental illness and that perceived usefulness is more important to them than perceived ease of use in considering attitude toward using the IMS.

There were no differences among informal caregivers on attitude toward using the IMS by characteristics or demographic background. This partly supports the hypothesis that there are no differences among informal caregivers on perceived usefulness, perceived ease of use, and attitude toward using the IMS by either characteristics and background. Agarwal and Prasad (1999) found that individual differences do affect acceptance of new technologies though their study did not examine the perspectives of informal caregivers on using in-home technology to monitor persons with serious mental illness.

In the current study, however, perceived usefulness differed among informal caregivers by residence of a person with serious mental illness (living with informal

caregiver v. not living with informal caregiver) and perceived ease of use differed among informal caregivers by caregiver living situation (renter v. home owner) and total household monthly income. The usefulness difference by the residence of a person with a serious mental illness intuitively makes sense. Informal caregivers provide much of the care for persons with serious mental illness regardless of where she/he resides. The IMS could provide caregivers with a sense of security or well being that their loved one is being monitored and is safe living away from the attentive eye of an informal caregiver. This sense of security may ultimately result in decreased caregiver burden and increased piece of mind and could explain the differences in perceived usefulness.

In terms of the perceived ease of use, one might speculate that living arrangements and income of caregivers and persons cared for might be related to perceptions regarding perceived ease of use. However due to the relatively low Cronbach alpha coefficient for this variable ( $\alpha = .63$ ) these results could just as easily be spurious. This would not be too surprising as the homogeneity among persons attending NAMI is documented. As such, it could be that if the alpha coefficient were within a more acceptable range of .70 to .80 no differences would be found.

As anticipated, perceived usefulness and perceived ease of use accounted for a significant portion of the variance in attitude toward using the IMS. This result supported the hypothesis that perceived usefulness and perceived ease of use would predict a significant proportion of the variance in attitude toward using the IMS. This result is consistent with the seminal TAM study (Davis, 1993) and the meta analysis of results in TAM studies (King & He, 2006). Though perceived usefulness and ease of use explained a significant proportion of variance in attitude toward the IMS, ease of use was not a

significant predictor of attitude, with  $p > .05$ , which is consistent with results in a previous study (Gao, 2005). One possible explanation for this finding is that informal caregivers may be seeking for in-home technologies that enhance their loved one's mental health recovery and that help her/him live a more productive and independent life. This explanation is consistent with the conclusion that while ease of use is important, the usefulness is much more important (Davis, Bagozzi, & Warshaw, 1989).

### **Conclusions**

This study was limited in two key ways. First, the analyses included missing data. Without missing data or having fewer missing data, the results might be significantly different. Second, the sample of informal caregivers was purposeful, and the results may not be generalizable to other samples of caregivers in the absence of representation. Third, the self-report nature of the questionnaire is a final limitation. Social desirability might influence the manner in which participants answer the items. Despite these limitations, it is important to note the following unique and vital strengths to this study: (a) the sample included informal caregivers of persons with serious mental illness attending NAMI meetings throughout a Midwestern state and (b) the demographics of caregivers in this sample were comparable to those of caregivers in a large national random sample of NAMI members (see Mulvaney-Day, 2002).

Given the strengths of the study, several conclusions can cautiously be drawn from the results of the study. First, it seems likely that informal caregivers in the state where the study was conducted would look favorably on the use of IMS, especially if psychiatrists and/or case managers were willing to collaborate with them in implementing the technology to enhance the lives of persons with serious mental illness. Second, it

seems likely that the informal caregivers involved in NAMI could be key advocates for the use of IMS. Third, it may be that caregivers in this study might be willing to participate in a well designed study to determine the extent to which the use of IMS results in positive outcomes for persons with serious mental illness. Fourth, caregivers that do not live with their loved one with a serious mental illness give the impression that the IMS could provide them with a sense of comfort knowing that their loved one is living away from home but is being appropriately monitored. Fifth, informal caregivers appear to be willing to tolerate a potentially difficult interaction with the IMS in order to enhance the mental health recovery of a loved one.

### **Policy, Practice, and Research Implications**

Policy seems warranted that funds initiatives for research aimed at informal caregivers and in-home technology used for monitoring persons with serious mental illness. Such objectives would be consistent with objectives in the final report of the President's New Freedom Commission on Mental Health (2003) in which the drafters of the report identified the need for mental health care to be consumer and family-driven and the need for technology that improves access and coordination of mental health care. In this regard, the results of this study provide some insight into the perspective of informal caregivers, or family members, regarding using technology in mental health care. The results in this study suggest that informal caregivers accept specifically the use of IMS to monitor the mental health care of love ones with serious mental illness.

Particular policy initiatives could fund similar larger scale studies which use more robust sampling procedures and incorporate non-NAMI member informal caregivers which would extend the limited knowledge-based on this very important group of

caregivers. Further, and this is addressed substantively in implications for research, should fund pilot and/or large scale studies investigating the perspectives of persons with serious mental illness as well as multidisciplinary formal caregivers such as social workers, psychiatrists, nurses, psychologists, and physical therapists and occupational therapists.

In addition, social work practice focusing on assessing the perspective of informal of persons with serious mental illness in terms of using technology in their loved one's care seems warranted. It is well documented that informal caregivers, or family members, play an important role in the care of persons with serious mental illness (Cook, Cohler, Pickett & Beeler, 1997; Corsentino, Molinari, Gum, Roscoe & Mills, 2008; Lefley, 1996; 2003; 2009; Warner 2000). With an idea of informal caregivers' attitude toward in-home technology, such as the IMS, social workers will be able to discuss alternative treatment options with informal caregivers and recommend that they discuss such options with key treatment stakeholders such as elected officials, psychiatrists and other mental health providers.

Social workers can also educate formal caregivers, including psychiatrists and other health and mental health care professionals about the strong interest among caregivers in using in-home technologies. Social workers can also stress to informal caregivers that in the near future they may have additional treatment choices and options that could enhance their loved one's mental health recovery and that they can advocate for those choices and options. Ideally this information will engender interest among key stakeholder and accelerate future research aimed at informal caregivers and using in-home technology for persons with serious mental illness.

Future research is needed to validate the results in this study. The perspective of a large, nation random sample of both NAMI and non-NAMI informal caregivers seems needed to determine the extent to which informal caregivers across the nation are interested in the use of technology to care for a love one with a serious mental illness. Specifically, there is a special need for examining the perspectives of informal caregivers from ethnic-minority groups. Extending future research to investigate the perspectives of persons with serious mental illness and formal caregivers, such as social workers, psychiatrists, nurses, psychologists, physical therapists, occupation therapists, and psychiatric rehabilitation specialists are obvious choices. The perspectives of forensic mental health professionals working with persons not guilty by reason of insanity or persons now found fit and awaiting placement in the community are needed as well. Having a sense of what these health care providers and administrators think about using in-home technology could vastly expand research in this area.

In addition, further research also seems warranted that examines additional variables that predict informal caregiver attitude toward using the IMS. Though perceived usefulness and perceived ease of use account for a significant proportion of the variance in attitude toward using the IMS, 54% of the variance in attitude is not yet accounted for. Most important, research is need that examines the extent to which the IMS results in positive outcomes for persons with serious mental illness. Given the results of this study, it seems feasible that research can be conducted in the state where this study was conducted that utilizes a quasi-experimental design to determine the effectiveness of using IMS to enhance the lives of persons with serious mental illness.

## References

- Adams, D., A., Nelson, R., R., & Todd, P., A. (1992). Perceived usefulness, ease of use, and usage information. *MIS Quarterly*, *16*(2), 227-247.
- Agarwal, R. & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies. *Decision Sciences*, *30*(2), 361-391.
- Aggelidis, V., P. & Chatzoglou, P., D. (2009). Using a modified technology acceptance model in hospitals. *International Journal of Medical Informatics*, *78*(2), 115-126.
- Ahn, B-J, & Yim, D-S. (2009). Comparison of parametric and bootstrap method in bioequivalence test. *Korean Journal of Physiology Pharmacology*, *13*, 367-371.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179 – 211.
- Ajzen, I. & Fishbein, M. (1973). Attitudinal and normative variables as predictors of specific behaviors. *Journal of Personality and Social Psychology*, *27*, 41-57.
- Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Prentice-Hall Inc.: New Jersey.
- Aladwani, A., M. (2002). The development of two tools for measuring the easiness and usefulness of transactional web sites. *European Journal of Information Systems*, *11*(3), 223-234.
- Albarracin, D., Fishbein, M., Johnson, & Muellerleile. (2001). Theories of reasoned action and planned behavior as models of condom use: A meta-analysis. *Psychological Bulletin*, *127*, 1, 142-161.

- Alwan, M., Dalal, S., Mack, D., Kell, S., Turner, B., Leachtenauer, J., & Felder, R. (2006). Impact of monitoring technology in assisted living: Outcome pilot. *Information Technology in Biomedicine, 10(1)*, 192-198.
- Alwan, M., Kell, S., Dalal, S., Turner, B., Mack, D., & Felder, R. (2003). In-home monitoring system and object ADL assessment: Validation study. *International Conference on Aging, Disability, and Independence*. University of Florida.
- Alwan, M., Kell, S., Turner, B., Dalai, S., Mack, D., & Felder, R. (2006). Psychosocial impact of passive health status monitoring on informal caregivers and older adults living in independent senior housing. *Information and Communication Technologies*.
- Alwan, M., Leachtenauer, J., Dalal, S., Mack, D., Kell, S., Turner, B., & Felder, R. (2006). Psychosocial impact of monitoring technology in assisted living: A pilot study. *Information and Communication Technologies*.
- Alwan, M., Mack, D. C., Dalal, S., Kell, S., Turner, B., & Felder, R. A. (2006). Impact of Passive In-Home Health Status Monitoring Technology in Home Health: Outcome Pilot. *Distributed Diagnosis and Home Healthcare*.
- Alwan, M., Turner, B., Kell, S., & Felder, R. (2007, June). Acceptance and perceived utility of monitoring older adults in their living environment. In *Proceeding of the 2<sup>nd</sup> International Conference on Technology and Aging (ICTA)*.
- Alwan, M., Turner, B., Kell, S., Penberthy, J. K., Cohn, W., & Felder, R. (2006, April). Development of survey instruments to guide the design of health status monitoring systems for the elderly: Content validity evaluation. In *Proceedings of*

*the 2<sup>nd</sup> IEEE International Conference on Information & Communication Technologies: From Theory to Applications.*

American Psychiatric Association (APA). (1994). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed.). Washington, DC: Author.

Ammenwerth, E., Graber, S., Herrmann, G., Burkle, T., & König, J. (2003). Evaluation of health information systems—problems and challenges. *International Journal of Medical Informatics*, 71, 125–135.

Anderson, N.B., Hanson, E. Magnusson, L. (2002). Views of family carers and older people of information technology. *British Journal of Nursing*, 11(12), 827-831.

Anthony, W.A. (1993). Recovery from mental illness: The guiding vision of the mental health service system in the 1990's. *Psychosocial Rehabilitation Journal*, 16(4), 11-23.

Araújo, M.,T., Paiva, T., Jesuino, J.C., & Magalhães, M. (2000). General practitioners and Neurotelemedicine. *Studies in health technology and informatics*, 78, 45-67.

Ary, D., Jacobs, L. C., Razavieh, A., & Sorensen, C. (2006). *Introduction to research education* (7<sup>th</sup> ed). Belmont, CA: Thompson Higher Education.

Babbie, E. (2007). *The Practice of Social Research* (11<sup>th</sup> ed). Belmont, CA: Thompson Higher Education.

Baronet, A-M. (1999). Factors associated with caregiver burden in mental illness: A critical review of the research literature. *Clinical Psychology Review*, 19(7), 819-841.

Barreira, P. (1999). Reduced life expectancy and serious mental illness. *Psychiatric Services*, 50, 995.

- Belleau, B.D., Summers, T.A., Yingjiao, X., & Pinel, R. (2007) Theory of reasoned action: Purchase intention of young consumers, *Clothing and Textiles Research Journal*, 25, 244-257.
- Benschoter, R. (1967). Multipurpose television. *Annals of New York Academy of Science*, 142, 471-478.
- Bensink, M., Hailey, D., & Wooton, R. (2006a). Evidence base for home telehealth. In R. Wooton, S. Dimmick, J. Kvedar (Eds.), *Home Telehealth: Connecting care within the community* (pp. 53-62). London: Royal Society of Medicine Press.
- Bensink, M., Hailey, D., & Wooton, R. (2006b). A systematic review of successes and failures in home telehealth: Preliminary results. *Journal of Telemedicine and Telecare*, 12(3), 8-16.
- Bergmo, T. S. (1996). An economic analysis of teleradiology versus a visiting radiologist service. *Journal of Telemedicine and Telecare*, 2(3), 136-142.
- Breusch, T., & Pagan, A. (1979). A simple test of heteroskedasticity and random coefficient variation. *Econometrica*, 47, 1287-1294.
- Buckley, K., Tran, B. & Prandoni, C. (2004). Receptiveness, use and acceptance of telehealth by caregivers of stroke patients in the home. *Online Journal of Issues in Nursing*. 9(3). Retrieved on June 9<sup>th</sup>, 2009 from [www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume92004/No3Sept04/ArticlePreviousTopic/TelehealthforStrokePatients.aspx](http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume92004/No3Sept04/ArticlePreviousTopic/TelehealthforStrokePatients.aspx).
- Bull, P., Limb, R., & Rayne, R. (2004). Pervasive Home Environment. *BT Technology Journal*, 22(3).

- Celler, B. G., Earnshaw, W., Ilsar, E. D., Betbeder-Matibet, L., Harris, M. F., Clark, R., et al. (1995). Remote monitoring of health status of the elderly at home. A multidisciplinary project on aging at the University of New South Wales. *International Journal of Bio-Medical Computing*, 40(2), 147-155.
- Centers for Disease Control (CDC). (1993). *Baseline female questionnaire. Project RESPECT. ANNOTATED*. Atlanta, GA: Project RESPECT Group.
- Chen, F.P., & Greenberg, J.S. (2004). A positive aspect of caregiving: The influence of social support on caregiving gains for family members of relatives with schizophrenia. *Community Mental Health Journal*, 40, 423-435.
- Chen, I. J., Yang, K. F., Tang, F.I., Huang, C.H., & Yu, S. (2008). Applying the technology acceptance model to explore public health nurses' intentions towards web-based learning: A cross-sectional questionnaire survey. *International Journal of Nursing Studies*, 45(6), 869-878.
- Cheung, W., & Huang, W. (2005). Proposing a framework to assess Internet usage in university education: An empirical investigation from a student's perspective. *British Journal of Educational Technology*, 36, 237-253.
- Clark, R. E. (2001). Family support and substance use outcomes for person with mental illness and substance abuse disorders. *Schizophrenia Bulletin*, 27(1), 93-101.
- Clark, R. E., & Drake, R. E. (1994). Expenditures of time and money by families of people with severe mental illness and substance use disorders. *Community Mental Health Journal*, 30(2), 145-163.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2<sup>nd</sup> ed). Hillsdale, New Jersey: Erlbaum.

- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155-159.
- Colantonio, A., Cohen, C. & Pon, M. (2001). Assessing support needs of caregivers of persons with dementia: Who wants what? *Community Mental Health Journal*, 37(3), 231-243.
- Colton, C.W. & Manderscheid, R. W. (2006). Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Preventing Chronic Disease*, 3(2), 1-14.
- Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology*, 28, 1429-1464.
- Cook, J. A., Cohler, B. J., Pickett, S. A., & Beeler, J. A. (1997). The psychiatric patient grows older: Issues in family care. In E. Light & B. D. Lebowitz (Eds.), *The elderly with chronically mental illness* (pp. 82-110). New York: Springer.
- Cook, R. D., & Weisberg, S. (1983). Diagnostics for heteroskedasticity in regression. *Biometrika*, 70, 1-10.
- Cooke, R. & French, D. P. (2008). How well do the theory of reasoned action and theory of planned behavior predict intentions and attendance at screening programmes: A meta-analysis. *Psychology and Health*, 23(7), 745-765.
- Corsentino, E. A., Molinari, V., Gum, A. M., Roscoe, L. A., & Mills, W. L. (2008). Family caregivers' future planning for younger and older adults with serious mental illness (SMI). *Journal of Applied Gerontology*, 27(4), 466-485.
- Coursey, R. D., Alford, J., & Safarjan, B. (1997). Significant advances in understanding and treating serious mental illness. *Professional Psychology: Research and*

*Practice*, 28, 205-216.

- Courtney, K. L. (2008). Privacy and senior willingness to adopt smart home information technology in residential care facilities. *Methods of Information in Medicine*, 47(1), 76-81.
- Croll, R., R., & Croll, J. (2007). Investigating risk exposure in e-health systems. *International Journal of Medical Informatics*, 76, 460–465.
- Cuijpers, P. (1999). The effects of family interventions on relatives' burden: A meta-analysis. *Journal of Mental Health*, 8(3), 275-285.
- Cummings, S.M., & MacNeil, G. (2008). Caregivers of older clients with severe mental illness: Perceptions of burdens and rewards. *Families in Society*, 89(1), 51-59.
- Czaja, S. J., & Rubert, M. P. (2002). Telecommunications technologies as an aid to family caregivers of persons with dementia. *Psychosomatic Medicine*, 64, 469-476.
- Dang, S., Remon, N., Harris, J., Malphurs, J., Sandals, L., Cabrera, A. L. & Nedd, N. (2008). Care coordination assisted by technology for multiethnic caregivers of persons with dementia: A pilot clinical demonstration project on caregiver burden and depression. *Journal of Telemedicine and Telecare*, 14, 443-447.
- Das, S. K., Cook, D. J., Bhattacharya, A. Heierman, III, E. O. & Lin, T.-Y. (2002). The role of prediction algorithms on the MavHome smart home architectures. *IEEE Wireless Communications* (Special Issue on Smart Homes), 9(6), 77–84.
- David, P., Colette, N., & Magdalen, G. (2002). *Review of the current stats of research on 'Smart Homes' and other domestic assistive technologies in support of TAHI trials*. Loughborough: Loughborough University.

- Davidson, S. Judd, F., Jolley, D., Hocking, B., Thompson, S. & Hyland, B. (2001). Cardiovascular risk factors for people with mental illness. *Australian and New Zealand Journal of Psychiatry*, 35(2), 196-202.
- Davidson, L., O'Connell, M., Tondora, J., Styron, T., & Kangas, K. (2006). The top ten concerns about recovery encountered in mental health system transformation. *Psychiatric Services*, 57(5), 640-645.
- Davies, H. T. O. & Crombie, I. K. (1998). *What is meta-analysis?* Hayward Medical Communications: England.
- Davis, F. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral Dissertation, MIT, 1986).
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339.
- Davis, F. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38, 475-487.
- Davis, F., Bagozzi, R., and Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982 – 1002.
- Demiris, G. (2004). Home based E-health applications. *Studies in Health Technology and Informatics*, 106, 15-24.
- Demiris, G., & Hensel, B., K. (2008). Technologies for an Aging Society: A Systematic Review of “Smart Home” Applications. *Yearbook of Medical Informatics*, 33-40.

- Demiris, G., Hensel, B. K., Skubic, M., & Rantz, M. (2008). Senior residents' perceived need of and preferences for "smart home" sensor technologies. *International Journal of Technology Assessment in Health Care*, 24(1), 120-124.
- Demiris, G., Parker-Oliver, D., Giger, J. T., Skubic, M., Rantz, M. (2009). Older adults' privacy considerations for vision based recognition methods of eldercare applications. *Technology and Health Care*, 17(1), 41-48.
- Demiris, G., Rantz, M., Aud, M., Marek, K., Tyrer, H., Skubic, M., & Hussam (2004) (2004). Older adults' attitudes towards and perceptions of 'smart home' technologies: A pilot study. *Medical Informatics & the Internet in Medicine*, 29(2), 87-94.
- Diener, E., Emmons, R., Larsen, J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49(1), 71-75.
- Dimmick, S., L., Mustaleski, C., Burgiss, S., G., & Welsch T. (2000). A case study of benefits and potential savings in rural home telemedicine. *Home Health Nurse*, 18, 124-135.
- Dixon, L.B., Kreyenbuhl, J.A., Dickerson, F.B., Donner, T.W., Brown, C.H., Wolheiter, K., Postrado, L., Goldberg, R.W., Fang, L., Marano, C. & Messias, E. (2004). Comparison of type 2 diabetes outcomes among persons with and without severe mental illnesses. *Psychiatric Services*, 892-900.
- Dixon, L., B., & Lehman, A. F. (1995). Family interventions for schizophrenia. *Schizophrenia Bulletin*, 21(4), 631-643.
- Durbin, J., & Watson, G. S. (1951). Testing for serial correlation in least squares regression. *Biometrika*, 30, 159-178.

- Dyck, D. G., Short, R. & Vitaliano, P. P. (1999). Predictors of burden and infectious illness in schizophrenia caregivers. *Psychosomatic Medicine*, *61*, 411-419.
- Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Eedy, D. J., & Wootton, R. (2001). Teledermatology: A review. *British Journal of Dermatology*, *144*(4), 696-707.
- Egger, M., Smith, G. D., & Altman, D. G. (2001). *Systematic reviews in health care: Meta-analysis in context*. London: BMJ.
- Elger, G., & Furugren, B. (1998). "SmartBo"-an ICT and computer-based demonstration home for disabled people. *3rd TIDE Congress: Technology for inclusive design and equality improving the quality of life for the european citizen*. Helsinki, Finland.
- Elbogen, E. B., Wilder, C., Swartz, M. S. & Swanson, J. W. (2008). Caregivers as money managers for adults with severe mental illness: How treatment providers can help. *Academic Psychiatry*, *32*(2), 104-110.
- Endicott, J., Spitzer, R. L., Fliess, J. H., & Cohen, J. (1976). The Global Assessment Scale: A procedure for measuring overall severity of psychiatric disturbance. *Archives of General Psychiatry*, *33*, 766-771.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175-191.
- Field, A. (2009). *Discovering statistics using SPSS* (3<sup>rd</sup> Eds.). Thousand Oaks, California: Sage.

- Field, M., J., & Grisby, J. (2002). Telemedicine and remote patient monitoring. *Journal of American Medical Association*, 288(4), 423-425.
- Fishbein, M. (1963). An investigation of the relationship between beliefs about an object and the attitude toward that object. *Human Relations*, 16, 233 - 240.
- Fishbein, M. (1967). Attitude and the prediction of behavior. In M. Fishbein (Ed.), *Readings in attitude theory and measurement*. New York: Wiley.
- Fishbein, M. & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. MA: Addison-Wesley.
- Flowers, C. W., Baker, R., S., Khanna, S., Ali, B., March, G. A., Scott, C., & Murrillo, S. (1997). Teleophthalmology: Rationale, current issues, future directions. *Telemedicine Journal*, 1, 43-52.
- Frangou, S., Sachpazidis, I., Stassinakis, A., & Sakas, G. (2005). Telemonitoring of medication adherence in patients with schizophrenia. *Telemedicine and e-Health*, 11(6), 675-683.
- Fowler, F. J. (2002). *Survey research methods* (3<sup>rd</sup> ed). Thousand Oaks, CA: Sage Publications, Inc.
- Franks, D. D. (1987). *The high cost of caring: Economic contributions of families to the care of the mentally ill*. Unpublished doctoral dissertation, Brandeis University, Waltham, MA.
- Franks, D. D. (1990). Economic contribution of families caring for persons with severe and persistent mental illness. *Administration and Policy in Mental Health*, 18(1), 9-18.

- Gann, D. & Barlow, G. (1999). *Digital futures: Making homes smarter*. Coventry: Chartered Institution of Housing.
- Gao, Y. (2005). Applying the technology acceptance model (TAM) to educational hypermedia: A field study. *Journal of Educational Multimedia and Hypermedia*, 14(3), 237-247.
- Gastil, J. (2000) Thinking, drinking, and driving: Application of the theory of reasoned action to DWI prevention. *Journal of Applied Social Psychology*, 30, 2217-2232.
- Geller, J. L. (2000). The last half-century of psychiatric services as reflected in psychiatric services. *Psychiatric Services*, 51(1), 41-67.
- Greenberg, N., Boydell, K.M., & Volpe, T. (2006). Pediatric telepsychiatry in Ontario: Caregiver and service provider perspectives. *Journal of Behavioral Health Service and Research*, 33(1), 105-111.
- Gubman, G.D., & Tessler, R.C. (1987). The impact of mental illness on families: Concepts and priorities, *Journal of Family Issues*, 8, 226-245.
- Guilabert, M. (2004). *Attitudes toward consumer-customized high-tech products: The role of perceived usefulness, perceived ease of use, technology readiness and customer customization sensitivity*. Unpublished doctoral dissertation, Georgia State University.
- Haigh, K. Z., Kiff, L. M., Mayers, J., & Krichbaum, K. (2004). The independent lifestyle assistant TM (I.L.S.A.): Deployment lessons learned. *The AAAI 2004 Workshop on Fielding Applications of AI* (pp. 11-16), San Jose, CA.

- Hale, J. L., Householder, B. J., & Greene, K. L. (2002). The theory of reasoned action. In J. P. Dillard & M. Pfau (Eds.), *The persuasion handbook*, (pp. 259-288). Thousand Oaks, CA: Sage.
- Harvey, P.D., & Bellack, A.S. (2009). Toward a terminology for functional recovery in schizophrenia: Is functional remission a viable concept? *Schizophrenia Bulletin*, 35(2), 300-306.
- Hatfield, A. B. (1987). Coping and adaption: A conceptual framework for understanding families. In H.B Hatfield & H.P. Lefley (Eds.), *Families of the mentally ill* (pp.60-84). New York: Guilford
- Hatfield, A. B. (1997). Families of adults with severe mental illness: New directions in research. *American Journal of Orthopsychiatry*, 67(2), 254-260.
- Hatfield, A. B., Gearon, J. S., & Coursey, R. D. (1996). Family members' ratings of the use and value of mental health services: Results of a national NAMI survey. *Psychiatric Services*, 47(8), 825-831.
- Hatfield, A. B., & Lefley, H. P. (1987). *Families of the mentally ill: Coping and adaption*. New York: Guilford Press.
- Henderson, R., Rickwood, D., & Roberts, P. (1998). The beta test of an electronic supermarket. *Interacting with Computers*, 10(4), 385-399.
- Hensel, B. K., Demiris, G., & Courtney, K. L. (2006). Defining obtrusiveness in home telehealth technologies: A conceptual framework. *Journal of the American Medical Informatics Association*, 13(4), 428-431

- Heppner, P. P., & Heppner, M. J. (2004). *Writing and publishing your thesis, dissertation & research: A guide for students in the helping professions*. Belmont, California: Brooks/Cole.
- Higgins, J. J. (2004). *Introduction to Modern Nonparametric Statistics*. Stamford, CT: Thompson Learning.
- Hoening, J., & Hamilton, M.W. (1966). The schizophrenic patient in the community and his effect on the household. *The International Journal of Social Psychiatry, 12*, 165-176.
- Hogan, M. F. (2003). New Freedom Commission Report: The President's New Freedom Commission: Recommendations to Transform Mental Health Care in America. *Psychiatric Services, 54*, 1467-1474.
- Hogarty, G.E., Anderson, C.M., Reiss, D.J. Kornblith, S.J., Greenwald, D.P., Javna, C.D., & Madonia, M.J. (1986) Family psychoeducation, social skills training, and maintenance chemotherapy in the aftercare treatment of schizophrenia. *Archives of General Psychiatry, 43(7)*, 633-642.
- Hu, P. J., Chau, P. Y. K., Sheng, O. R. L., & Tam, K. Y. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems, 16(2)*, 91-112.
- Institute of Medicine. (1996). *Telemedicine: A guide to assessing telecommunications in healthcare*. Field, M.J., ed. Washington, DC: National Academy Press.
- Intille, S. (2002). Designing a home of the future. *IEEE Pervasive Computing*, April-June 2002, 80-86.

- Isaac, S. & Michael, W. B. (1995). *Handbook in research and evaluation* (3<sup>rd</sup> ed). San Francisco, CA: EdITS.
- Jacobson, N., & Greenley, D. (2001). What is recovery? A conceptual model and explication. *Psychiatric Services*, 52, 482-485
- Johnson, J. L., Davenport, R., & Mann, W. C. (2007). Consumer feedback on smart home applications. *Topics in Geriatric Rehabilitation*, 23(1), 60-72.
- Johnston, B., Wheeler, L., Deuser, J., & Sousa, K., H. (2000). Outcomes of the kaiser permanente tele-home health research project. *Archives of Family Medicine*, 9, 40-45.
- Jones, M.G. (1997). Telemedicine and the national information infrastructure: Are the realities of health care being ignored? *Journal of the American Medical Informatics Association*, 4, 99-412.
- Katschnig, H., & Konieczna, T. (1989). What works in work with the relatives? - A hypothesis. *British Journal of Psychiatry*, 155, 144-150.
- Keeter, S., Miller, C., Kohut, A., Groves, R. M., & Presser, S. (2000). Consequences of reducing nonresponse in a national telephone survey. *Public Opinion Quarterly*, 64, 125-148.
- Kessler, R. C., Chiu, W. T., Demler, O., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). *Archives of General Psychiatry*, 62(6), 617-627.
- Kessler, R. C., Heeringa, S., Lakoma, M. D., Petukhova, M., Rupp, A. E., Schoenbaum, M., Wang, P. S., Zaslavsky, A. M. (2008). Individual and societal effects of

- mental disorders on earnings in the United States: Results from the National Comorbidity Survey replication. *American Journal of Psychiatry*, 165, 703-711
- Keyes, C. L. (2004). The nexus of cardiovascular disease and depression revisited: The complete mental health perceptible and the moderation role of age and gender. *Aging and Mental Health*, 8(3), 266-274.
- Kidd, C. D., Orr, R., Abowd, G. D., Atkeson, C. G., Essa, I. A., MacIntyre, B., Mynatt, E., Starner, T.E., & Newstetter, W. (1999). The aware home: A living laboratory for ubiquitous computing research. *Proceedings of the Second International Workshop on Cooperative Buildings*.
- King, W. R., & Cleland, D., I. (1971). Manager analyst teamwork in management information systems. *Business Horizons*, 14, 2, p. 59.
- King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information and Management*, 43, 740-755.
- Kohn-Wood, L.P., & Wilson, M.N. (2005). The context of caretaking in rural areas: Family factors influencing the level of functioning of seriously mentally ill patients living at home. *American Journal of Community Psychology*, 36(1/2), 1-13.
- Kreisman, D. E., & Joy, V. D. (1974). Family response to the mental illness of a relative: A review of the literature. *Schizophrenia Bulletin*, 10, 34-57.
- Kruskal, W. H., & Wallis, W. A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*, 47, 583-621.

- Lakeman, R. (2008). Family and carer participation in mental health care: Perspectives of consumers and carers in hospital and home care settings, *Journal of Psychiatric and Mental Health Nursing*, 5(3), 203-211.
- Lambert, T. J., Velakoulis, D., & Pantelis, C. (2003). Comorbidity in schizophrenia. *Medical Journal of Australia*, 178(5), S67-S70.
- Langdridge, D., P. Sheeran, and Connolly, (2007). Analyzing additional variables in the theory of reasoned action. *Journal of Applied Social Psychology*, 37(8) 1884-1913.
- Lawton, M., & Brody, E. (1969). Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*, 9(3), 179-186.
- Lefley, H. P. (1987). Aging parents as caregivers of mentally ill adult children: An emerging social problem. *Hospital and Community Psychiatry*, 38(10), 1063-1070.
- Lefley, H. P. (1996). *Family caregiving in mental illness*. Thousand Oaks, CA: Sage.
- Lefley, H.P. (2003). Changing caregiving needs as persons with schizophrenia grow older. In: C.I. Cohen (Ed.), *Schizophrenia into later life: Treatment, Research, and Policy* (pp. 251-268). Washington, DC: American Psychiatric Press.
- Lefley, H.P. (2009). *Family psychoeducation for serious mental illness*. Oxford University Press, Inc.
- Leighninger, R. D., & Speier, A. H. (1996). How representative is NAMI? : Demographic comparisons of a national NAMI sample with members and non members of Louisiana mental health support groups. *Psychiatric Rehabilitation Journal*, 19(4), 71-76.

- LoPresti, E.F.B., Bodine C. & Lewis, C. (2008). Assistive technology for cognition. *Engineering in Medicine and Biology Magazine*, 27(2), 29-39.
- Lou, H., Luo, W., & Strong, D. (2000). Perceived critical mass effect on groupware acceptance. *European Journal of Information Systems*, 9(2), 91-103.
- Lu, Y., C., Xiao, Y., Sears, A., & Jacko, J., A. (2005). A review and a framework of handheld computer adoption in healthcare. *International Journal of Medical Informatics*, 74, 409–422.
- Lukowicz, P., Kirstein, T., & Troester, G. (2004). Wearable systems for health care applications. *Methods of Information in Medicine*, 43, 232-238.
- Ma, Q., & Liu, L. (2004). The technology acceptance model: A meta-analysis of empirical findings. *Journal of Organizational and End Use Computing*, 16(1), 59-72.
- Magnusson, L., Hanson, E., & Borg, M. (2004). A literature review study of information and communication technology as a support for frail older people living at home and their family carers. *Technology and Disability*, 16, 223-235.
- Mahoney, D. (2003) Vigilance: Evolution and definition for caregivers of family members with Alzheimer's disease. *Journal of Gerontological Nursing*, 29, 24-30.
- Mahoney, D., Mutschler, P. H., Tarlow, B. & Liss, E. (2008). Real world implementation lessons and outcomes from the Worker Interactive Networking (WIN) project: Workplace-based online caregiver support and remote monitoring of elders at home. *Telemedicine and e-Health*, 14(3), 224-234.

- Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *Annals of Mathematical Statistics, 18*, 50-60.
- Marshall, T. B., & Solomon, P. (2002). Releasing information to families of persons with severe mental illness: A survey of NAMI members. *Psychiatric Services, 51*(8), 1006-1011.
- Marsh, D. T., Lefley, H. P., Evans-Rhodes, D., Ansell, V. I., Doerzbacher, B. M., La Barbara, L., & Paluzzi, J. E. (1996). The family experience of mental illness: Evidence for resilience. *Psychiatric Rehabilitation Journal, 20*(2), 3–12.
- Maurin, J.T., & Boyd, C.B. (1990). Burden of mental illness on the family: A critical review. *Archives of Psychiatric Nursing, 6*, 99-107.
- McDonell, M.G., Short, R.A., Berry, C.M., & Dyck, D.G. (2003). Burden is schizophrenia caregivers: Impact of family psychoeducation and awareness of patient suicidality. *Family Process, 42*(1), 91-103.
- McFarlane, W. R., Link, B., Dushay, R., Marchal, J., & Crilly, J. (1995). Psychoeducational multiple family groups: Four-year relapse outcome in schizophrenia. *Family Process, 34*, 127-144.
- McFarlane, W. R., Lukens, E., Link, B., Dushay, R., Deakins, S. A., Mead, S. & Copeland, M.E. (2000). What recovery means to us: Consumers' perspectives. *Community Mental Health Journal, 36*(3), 315-28.
- Mertler, C. A., & Vannatta, R. A. (2005). *Advanced and multivariate statistical methods: Practical application and interpretation* (3<sup>rd</sup> ed.). Pyrczak Publishing: Glendale, CA.

- Minkoff, K. (1978). A map of chronic mental patients. In J.A. Talbott (Ed.), *The Chronic Mental Patient*. Washington, DC: American Psychiatric Association.
- Morden, N. E., Mistler, L. A., Weeks, W. B. & Bartels, S. J. (2009). Health care for patients with serious mental illness: Family medicine's role. *Journal of the American Board of Family Medicine*, 22, 187–195.
- Mori, T., Noguchi, H., Takada, A., & Sato, T. (2004). Sensing room: Distributed sensor environment for measurement of human daily behavior. *Proceedings of First International Workshop on Networked Sensing Systems* (pp.40–43).
- Morris, C., Kurinczuk, J. J., Fitzpatrick, R., & Rosenbaum, P. L. (2006). Do the abilities of children with cerebral palsy explain their activities and participation? *Developmental Medicine & Child Neurology*, 48, 954-961.
- Mozer, M. C., (1998). The neural Network House: An environment that adapts to its inhabitants. In M. Coen, (Eds.), *Proceedings of American Association for artificial Intelligence Spring Symposium* (pp.100-114).
- Mulvaney-Day, N. E. (2002). *Estimating the value of mental health treatment outcomes: An application of the willingness to pay approach*. Brandeis University, Massachusetts.
- Mutschler, P.H. (1999). *Opportunity costs of caregiving: The MetLife juggling act study*. Waltham, MA: Brandeis University, National Center on Women and Aging.
- Retrieved on June 15<sup>th</sup>, 2009, from <http://www.geckosystems.com/downloads/juggling.pdf>.
- National Alliance on Mental Illness (NAMI). (2007). *Mental illness fact sheet*. Retrieved on February 3<sup>rd</sup>, 2009, from

[http://www.nami.org/Template.cfm?Section=About\\_Mental\\_Illness&Template=/ContentManagement/ContentDisplay.cfm&ContentID=53155](http://www.nami.org/Template.cfm?Section=About_Mental_Illness&Template=/ContentManagement/ContentDisplay.cfm&ContentID=53155)

National Alliance on Mental Illness (NAMI). (2009). *What is mental illness: Mental illness facts*. Retrieved on June 14<sup>th</sup>, 2009, from [http://www.nami.org/Content/NavigationMenu/Inform\\_Yourself/About\\_Mental\\_Illness/About\\_Mental\\_Illness.htm](http://www.nami.org/Content/NavigationMenu/Inform_Yourself/About_Mental_Illness/About_Mental_Illness.htm).

National Institute of Mental Health (NIMH). (2008). *The numbers count: Mental disorders in America*. Retrieved on February 13<sup>th</sup>, 2009, from <http://www.nimh.nih.gov/health/publications/the-numbers-count-mental-disorders-in-america/index.shtml>.

New Freedom Commission on Mental Health: Achieving the Promise: Transforming Mental Health Care in America. Final Report. DHHS pub no SMA-03-3832. Rockville MD, Department of Health and Human Services, 2003. Available at [www.mentalhealthcommission.gov/reports/finalreport/fullreport-02.htm](http://www.mentalhealthcommission.gov/reports/finalreport/fullreport-02.htm)

Nickelson, D., W. (1998). Telehealth and the evolving health care system: Strategic opportunities for professional psychology. *Professional Psychology: Research and Practice*, 29(6), 527-535.

Norman, S. (2006). The use of telemedicine in psychiatry, *Journal of Psychiatric & Mental Health Nursing*: Blackwell Publishing Limited.

Olsen, J. M., & Zanna, M. P. (1993). Attitudes and attitude change. *Annual Review of Psychology*, 44, 117 – 154.

Pancer, S., M., George, M., & Gebotys, R. J. (1992). Understanding and predicting attitudes toward computers. *Computers in Human Behavior*, 8, 211-222.

- Pandiani, J. A., Boyd, M. M., & Banks, S. M. (2005). Cancer: Elevated incidence for adults with serious mental illness. *Fifteenth annual conference on state mental health agency services research, program evaluation, and policy*. Baltimore: MD.
- Paré, G., Jaana, M., & Sicotte, C. (2006). Systematic review of home telemonitoring for chronic diseases: The evidence base. *Journal of the American Medical Informatics Association, 14(4)*, 269-277.
- Patel, S.N., Robertson, T., Kientz, J.A., Reynolds, M.S., & Abowd, G.D. (2007). At the flick of a switch: Detecting and classifying unique electrical events on the residential power line. *Proceedings of Ubicomp* (pp. 271-288).
- Perlick, D.A., Hohenstein, J.M., Clarkin, J.F., Kaczynski, R. & Rosenheck, R.A. (2005) Use of mental health and primary care services by caregivers of patients with bipolar disorder: a preliminary study. *Bipolar Disorders, 7(2)*, 126-135.
- Plocher, T., Kiff, L. & Krichbaum, K. (2004). Promoting and maximizing independence through new technologies. *AAHSA Future of Aging Services Conference*. Washington: DC.
- Plouffe, C., R., Vandenbosch, M., & Hulland, J. (2001). Intermediating technologies and multi-group adoption: A comparison of consumer and merchant adoption intentions toward a new electronic payment system. *The Journal of Product Innovation Management, 18(2)*, 65-81.
- Post, R. M., & Weiss, S. R. B. (1998). Sensitization and kindling phenomena in mood, anxiety, and obsessive-compulsive disorders: the role of serotonergic mechanisms in illness progression. *Biological Psychiatry, 44(3)*, 193-206.

- Powell, J., Chiu, T. & Eysenbach, G. (2008). A systematic review of networked technologies supporting carers of people with dementia. *Journal of Telemedicine and Telecare*, 14, 154-156.
- Rantz, M., Skubic, M., Burks, K., Yu, J., Demiris, G., Hensel, B. K., Alexander, G. L., He, Z., Tyrer, H. W., Hamilton, M., Lee, J., & Brown, M. (2008). Functional assessment technologies. In M. Alwan & R. A. Felder (Eds.), *Eldercare technology for clinical practitioners*. Totowa, NJ: Humana Press.
- Rantz, M., Skubic, M., Miller, S.L., Krampe, J. (2008). Using technology to enhance aging in place. *Proceedings of the 6<sup>th</sup> international conference on smart homes and health telematics*. Ames, IA.
- Rialle, Ollivet, C., Guigui, C., & Herve, C. (2008). What do family caregivers of alzheimer's disease patients desire in smart home technologies? Contrasted results of a wide survey. *Methods of Information in Medicine*, 47(1), 63-69.
- Rialle, V., Duchene, F., Noury, N., Bajolle, L., & Demongeot, J. (2002). Health "smart" home: Information technology for patients at home. *Telemedicine Journal and e-Health*, 8(4), 395-409.
- Rohland, B. M., Saleh, S. S., Rohrer, J. E., & Romitti, P. A. (2000). Acceptability of telepsychiatry to a rural population. *Psychiatric Services*, 51(5), 672-674.
- Saizmaa, T. & Kim, H. (2008). Smart home design: Home or house? *Third 2008 International Conference on Convergence and Hybrid Information Technology*.
- Scharlach, A.E., & Boyd, S.L. (1989). Caregiving and employment: Results of an employee survey. *Gerontologist*, 29, 382-387.

- Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management, 44*(1), 90-103.
- Schultz, R.L. & Slevin, D.P. (1983). The implementation profile, *Interfaces, 13*(1), 87-92.
- Schulz, R., & Beach, S. (1999). Caregiving as a risk factor for mortality: The caregiver health effects study. *Journal of the American Medical Association, 282*, 2215-2219.
- Scott, R.E. (2007). e-Records in health--Preserving our future. *International Journal of Medical Informatics, 76*(5), 427-431.
- Shapiro, S.S., & Wilk, M.B. (1965). An analysis of variance test for normality. *Biometrika, 52*(3), 591-599.
- Sheeran, P., Abraham, C. & Orbell, S. (1999). Psychosocial correlates of heterosexual condom use: A meta-analysis, *Psychological Bulletin, 125*(1), 90-132.
- Sheeran, P., & Taylor, S. (1999). Predicting intentions to use condoms: A meta-analysis and comparison of the theories of reasoned action and planned behavior. *Journal of Applied Social Psychology, 29*(8), 1624-1675.
- Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *The Journal of Consumer Research, 15*(3), 325-343.
- Spearman, C. (1910). Correlations calculated with faulty data. *British Journal of Psychology, 3*, 271-295.

- Stefanov, D. H., Zeungnam, B., & Won-Chul, B. (2004). The smart house for older persons and persons with physical disabilities: Structure, technology arrangements, and perspectives. *Neural Systems and Rehabilitation Engineering, IEEE Transactions on*, 12(2), 228-250.
- Stone, R.I., & Short, P.F. (1990). The competing demands of employment and informal caregiving to disabled elders. *Medical Care*, 28, 513-526.
- Strode, S.W., Gustke, S. & Allen, A. (1999). Technical and clinical progress in telemedicine. *Journal of the American Medical Association*, 281, 1066-1068.
- Subar, A. F., Ziegler, R. G., Thompson, F. E., Johnson, C. C., Weissfeld, J. L., Reding, D., Kavounis, K. H., & Hayes, H. B. (2001). Is shorter always better? Relative importance of questionnaire length and cognitive ease on response rates and data quality for two dietary questionnaires. *American Journal of Epidemiology*, 153(4), 404-409.
- Substance Abuse and Mental Health Service Administration (SAMHSA). (2002). *Serious mental illness among adults*. Retrieved June 9<sup>th</sup>, 2009 from <http://www.oas.samhsa.gov/2k2/SMI/SMI.cfm>.
- Sucurovic, S. (2007). Implementing security in a distributed web-based EHCR. *International Journal of Medical Informatics*, 76, 491-496.
- Sutton, S. (1998). Predicting and explaining intentions and behavior: How well are we doing? *Journal of Applied Social Psychology*, 28(15), 1317-1338
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5<sup>th</sup> Ed.). Boston: Pearson Education, Inc.
- Tamura, T., Togawa, T., Ogawa, M., & Yoda, M. (1998). Fully automated health

- monitoring system in the home. *Medical Engineering and Physics*, 20, 573–579.
- Taylor, A.S., Harper, R. Swan, L., Izadi, S., Sellen, A., & Perry, M. (2007). Homes that make us smart. *Personal and Ubiquitous Computing*, 11(5), 383-393.
- Thompson, E. D., & Doll, W. (1982). The burden of families coping with the mentally ill: An invisible crisis. *Family Relations*, 31, 379-388.
- Tomita, M. R., Mann, W. C., Stanton, K., Tomita, A. D., & Sundar, V. (2007). Use of currently available smart home technology by frail elders: Process and outcomes. *Topics in Geriatric Rehabilitation*, 23(1), 24-34.
- Topo, P. (2009). Technology studies to meet the needs of people with dementia and their caregivers: A literature review. *Journal of Applied Gerontology*, 28(1), 5-37.
- U.S. Census Bureau. (2009). *Expectation of Life at Birth, 1970 to 2005, and Projections, 2010 to 2020*. Retrieved on June 14<sup>th</sup>, 2009, from <http://www.census.gov/compendia/statab/tables/09s0100.pdf>
- U.S. Department of Health and Human Services. (1995). *Persons with severe mental illness: How do they fit into long-term care*. Retrieved on June 9<sup>th</sup>, 2009, from <http://aspe.hhs.gov/daltcp/reports/mentalil.htm>.
- U.S. Department of Health and Human Services. (1999). *Mental health: A report of the Surgeon general*. Rockville: MD.
- Wang, P. S., Berglund, P., Olfson, M., Pincus, H. A., Wells, K. B., & Kessler, R. C. (2005). Failure and delay in initial treatment contact after first onset of mental disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, 62(6), 603-613.

- Wang, P.S., Demler, O., Kessler, R.C. (2002). Adequacy of treatment for serious mental illness in the United States. *American Journal of Public Health, 92(1)*, 92-98.
- Warner, R. (2000). *The environment of schizophrenia: Innovations in practice, policy and communications*. London, U.K. Routledge.
- Weber, K., Martin, M. M., & Corrigan, M. (2007). Real donors, real consent: Testing the theory of reasoned action on organ donor consent. *Journal of Applied Social Psychology, 37(10)*, 2435-2450.
- Weiser, M. (1991): *The Computer for the 21st Century*. In *Scientific American* 265, Nr. 3, S. 94-101.
- Wild, K., Boise, L., Lundell, J., & Foucek, A. (2008). Unobtrusive in-home monitoring of cognitive and physical health: Reactions and perceptions of older adults. *Journal of Applied Gerontology, 27(2)*, 181-200.
- Williams, G., Doughty, K., & Bradley, D. A. (2000). Safety and risk issues in using telecare. *Journal of Telemedicine and Telecare, 6(5)*, 249-262.
- Wooton, R., Dimmick, S., Kvedar, J. (2006). *Home telehealth: Connecting care within the community*. London: Royal Society of Medicine Press.
- Wu, J.H., Shen, W.S., Lin, L.M., Greenes, R.A., & Bates, D.W. (2008). Testing the technology acceptance model for evaluating healthcare professionals' intention to use an adverse event reporting system. *International Journal for Quality in Health Care, 20(2)*, 123-129.
- Zagier, A. S. (2009). High-tech sensors help seniors live independently. *The Seattle Times*, from

[http://seattletimes.nwsourc.com/html/nationworld/2008719808\\_techseniors08.html](http://seattletimes.nwsourc.com/html/nationworld/2008719808_techseniors08.html)

Yamazaki, T. (2006). Beyond the smart home. International Conference on Hybrid Information Technology (2), (pp. 350-355).

Zacharia, Z. (2003). Beliefs, attitudes, and intentions of science teachers regarding the educational use of computer simulations and inquiry-based experiments in physics. *Journal of Research in Science Teaching*, 40(8), 792-823.

## Smart Home Technology For Mental Health Recovery

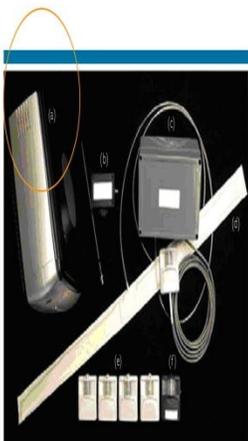


Figure 1. MARC

In-Home Health Status

Monitoring System (IMS)

Components: (a) PC-Based

Data Manager, (b) Radio

Receiver, (c) Bed Sensor

System, (d) Pneumatic Bed

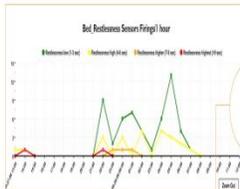
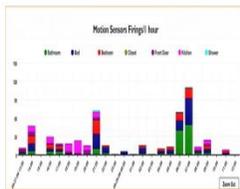
Pad, (e) Wireless Motion

Sensors, and (f) Kitchen

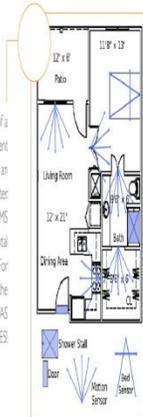
Motion Sensor with an

integrated stove-top

temperature sensor.

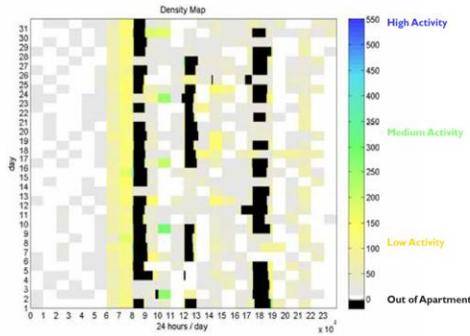


A mental health consumer wanting to improve her sleep may be able to benefit from the IMS information gained from the IMS can help the consumer and her health care providers work on her sleep concerns. Notice the line graph shows that "Jane Doe" sleeps from 9:00pm to 8:00am (—). Her recovery goal is to sleep from 10:00pm to 6:00am, so that she can work and attend school.

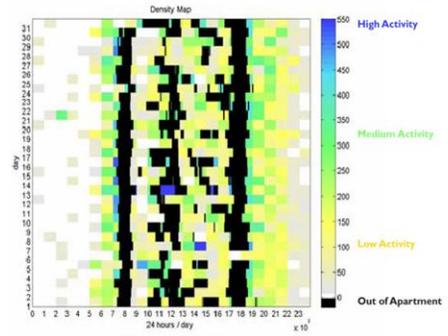


Imagine that the IMS graph below shows the activity pattern of an **INACTIVE** mental health consumer with major depression living alone in an apartment within an independent living center. As you will notice, "Jane's" depressive symptoms negatively impact her life. The 3 broken vertical black lines indicate that Jane occasionally leaves her apartment to go to the community dining area for meals around 8:00am, 12:00pm, and 5:30pm. The limited colors in the graph suggest Jane is usually inactive and isolated in her apartment. To address her symptoms, Jane develops a customized recovery plan with her family and her health care providers. Jane's plan focuses on improving her socialization and independent living skills through medication and/or targeted psychosocial interventions.

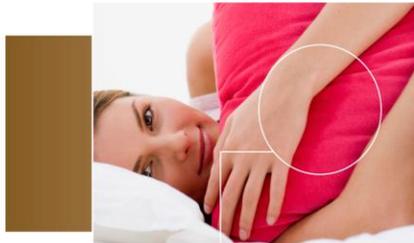
After implementing the mutually agreed upon mental health recovery plan, Jane is now more **ACTIVE** and productive. The 3 vertical black lines indicate that now Jane **regularly** leaves her apartment around meal times. You will also notice that prior to and immediately following meal times Jane often times remains out of her apartment, and the various colors in the graph indicate that overall Jane is more active as compared to before. Note that when Jane returns to her apartment she is more productive. It appears Jane's recovery plan has effectively treated her depression and increased her quality of life.



Sedentary Life Style



Active Life Style



*sedentary life style*



*active life style*

Appendix B

**Informal Caregivers and the In-Home System**

Please take time to answer the following questions. Do not put your name on the form.

In several of the following items, an **Informal Caregiver** means a person, often a family member, who is not paid to provide care services to a person with a mental illness (transportation, medication reminders, food, etc.).

**Part I. The Mental Health Consumer You Care For.**

(1) Assume the In-Home System is available to use, cost is not an issue, and it can be customized to identify only the consumer you care for.

**What is your opinion on the following statement?** With respect to mental health recovery for the consumer I care for, my opinion about the In-Home System shown and described earlier is... (Circle *one* number for each pair offered)

				<b>In-Home System</b>				
				Neutral				
Good	1	2	3	4	5	6	7	Bad
Wise	1	2	3	4	5	6	7	Foolish
Favorable	1	2	3	4	5	6	7	Unfavorable
Beneficial	1	2	3	4	5	6	7	Harmful
Positive	1	2	3	4	5	6	7	Negative

(2) How many person(s) with a mental illness are you currently caring for?

\_\_\_\_\_ → If you answered "2" or more, please answer the rest of the questions about the person you care for ***the most***.

(3) What was the age of the consumer when s/he was **first diagnosed** with a mental illness? (give your best estimate) \_\_\_\_\_

## Informal Caregivers and the In-Home System

---

(4) How many times has the consumer you care for been admitted to a psychiatric hospital? (give your best estimate) \_\_\_\_\_

(5) What is the age of the consumer you care for? \_\_\_\_\_

(6) Assume the In-Home System is available to use, cost is not an issue, and it can be customized to identify only the consumer you care for.

**With respect to mental health recovery for the consumer you care for, thinking about the In-Home System shown and described earlier, please indicate how much you agree or disagree about the usefulness of the system.**

	Strongly Agree	Agree	Disagree	Strongly Disagree
Using an In-Home System with features like the one shown and described will improve the quality of life of the consumer I care for.				
Using such an In-Home System will give the consumer I care for greater control in her/his home life.				
An In-Home System with features like the one shown and described will enable the consumer I care for to accomplish tasks more quickly.				
The In-Home System will support critical aspects of the life of the consumer I care for.				
Using such an In-Home System will increase the productivity of the consumer I care for.				
Using an In-Home System with features like the one shown and described will improve the quality of life of the consumer I care for.				
An In-Home System with features like the one shown and described will allow the consumer I care for to accomplish more than would otherwise be possible.				
Using such an In-Home System will enhance the effectiveness of the consumer I care for.				
Using an In-Home System with features like the one shown and described will make life easier for the consumer I care for.				
Overall, I will find an In-Home System like the one shown and described useful to the consumer I care for.				

---

## Informal Caregivers and the In-Home System

---

**(7) What is your relationship to the mental health consumer you care for?**

- I am her/his Parent (mother/father)
- I am her/his Sibling (brother/sister)
- I am her/his Friend
- I am her/his Significant Other (girl/boyfriend/partner)
- Other (mother/father-in-law, other relative, neighbor), please specify: \_\_\_\_\_

**(8) Overall, to what extent are you satisfied with the mental health treatment the consumer you care for has received to date?**

- Very Satisfied  Satisfied  Neutral  Dissatisfied  Very Dissatisfied

**(9) What is the primary mental health diagnosis of the consumer you care for? (give your best estimate)**

\_\_\_\_\_

**(10) What is the primary living arrangement of the mental health consumer you care for?**

- S/he lives with me.
- S/he lives on their own in a house or apartment ←
- S/he lives in an independent living facility (group home).
- S/he lives in a skilled nursing facility
- Other, please specify: \_\_\_\_\_

**(11)** Skip this question and #12 if you answered, "S/he lives on their own in a house ..." on #10. **Indicate the extent to which you agree or disagree with the following statement:** I want the consumer I care for to live on her/his own in a house or apartment.

- Strongly Agree  Agree  Disagree  Strongly Disagree

**(12)** Skip this question if you answered, "S/he lives on their own in a house..." on #10. **Indicate the extent to which you agree or disagree with the following statement:** I would be comfortable having the consumer I care for to live on her/his own in a house or apartment.

- Strongly Agree  Agree  Disagree  Strongly Disagree

## Informal Caregivers and the In-Home System

---

**(13)** Assume the In-Home System is available to use, cost is not an issue, and it can be customized to identify only the consumer you care for.

**With respect to mental health recovery for the consumer you care for, thinking about the In-Home System shown and described earlier, please indicate how much you agree or disagree about the ease of use of the system.**

	Strongly Agree	Agree	Disagree	Strongly Disagree
I will find an In-Home System with features like the one shown and described cumbersome to use.				
In general, learning to operate an In-Home System with features like the one shown and described will be easy for me.				
Interacting with an In-Home System with features like the one shown and described will be often frustrating.				
I will find it easy to get an In-Home System like that to do what I want it to do.				
An In-Home System with features like the one shown and described will be rigid and inflexible to interact with.				
It will be easy for me to remember how to perform tasks with an In-Home System like the one shown and described.				
Interacting with an In-Home System like the one shown and described will require a lot of mental effort.				
My interaction with an In-Home System with features like the one shown and described will be clear and understandable.				
It will take a lot of effort to become skillful at using an In-Home System like the one shown and described.				
Overall, I will find an In-Home System with features like the one shown and described easy to use.				

**(14)** How many years have you been an Informal Caregiver? \_\_\_\_\_

---

## Informal Caregivers and the In-Home System

---

**(15)** In several of the following items, a **Formal Caregiver** means a psychiatrist, medical doctor, social worker, caseworker, psychologist, or nurse who is paid to provide care services to a person with a mental illness.

**What are the potential benefits of an In-Home System with features like the one shown and described earlier to Formal Caregivers working with the consumer you care for? (Check (✓) all that applies).**

- Show others how the consumer is doing with hygiene, appetite, and socialization.
- Help the consumer stay healthy and active.
- Allow others to know whether the consumer has taken medications or not
- Notify others if the consumer has not been active
- Allow others to know if the consumer is not sleeping well
- Allow the consumer to live safely on her/his own instead of with you/others or an independent living facility (group home)
- Allow the consumers psychiatrist and/or other formal caregivers to possibly detect emerging/new mental health and health issues early
- Assist the consumers' psychiatrist and/or other formal caregivers to better manage the existing chronic mental health and health conditions the consumer you care for has
- Improved care coordination among the consumers psychiatrist and/or other formal caregivers
- Other, please specify: \_\_\_\_\_

**(16) What is the gender of the consumer you care for?**

- Male
- Female
- Other, please specify: \_\_\_\_\_

**Part II. Finally, I Would Like to Know A Little About You.**

**(17) What Missouri County (or zip code) do you primarily live in?** \_\_\_\_\_

**(18) What is your age?** \_\_\_\_\_

---

## Informal Caregivers and the In-Home System

---

**(19) What is your gender?**

- Male
- Female
- Other, please specify: \_\_\_\_\_

**(20) What race do you consider yourself?**

- Caucasian/White
- African American/Black
- Hispanic/Latino
- American Indian or Alaskan Native
- Asian
- Native Hawaiian or other Pacific Islander
- Bi-racial/multi-racial, please specify: \_\_\_\_\_
- Other, please specify: \_\_\_\_\_

**(21) What is your current relationship status?**

- Married
- Widowed
- Divorced
- Separated
- Single, never married
- Other, please specify: \_\_\_\_\_

**(22) How many children ages 18 or under do you have living in your primary residence? \_\_\_\_\_**

**(23) What is *your approximate* total household income *per month*, including employment, Social Security, child support or other cash payments, after tax? (0-\$499, \$500-\$999, \$1,000-\$1499, \$1,500-\$1,999, \$2,000-\$2,499, \$2,500+) (*give your best per month estimate*) \_\_\_\_\_**

---

## Informal Caregivers and the In-Home System

---

**(24) How would you describe your current living situation?**

- I Rent
- I Own my Home
- I Live with Family
- I Live with Friends
- Other, please specify: \_\_\_\_\_

**(25) How would you describe your current work status?**

- Full Time Employee
- Part Time Employee
- Homemaker
- Not Currently Working-Retired
- Not Currently Working-Other, please specify: \_\_\_\_\_

**(26) What is the highest degree you have earned to date?**

- Less than high school
- High School/GED
- Some College
- 2 year College Degree (Associate)
- 4 year College Degree (BA, BS)
- Master's Degree
- Doctoral Degree (PhD)
- Professional Degree (MD, JD)
- Don't Know
- Other, please specify: \_\_\_\_\_

**(27) What is the highest degree your biological mother has earned to date? (see #26 and write in the *best* answer)**

\_\_\_\_\_

---

## Informal Caregivers and the In-Home System

---

(28) What is the highest degree your biological father has earned to date? (see #26 and write in the *best* answer)

\_\_\_\_\_

(29) In terms of mental health recovery, do you think it is a good idea to use the In-Home System shown and described earlier in the consumers living setting / residence if they were not living with you?

- Yes
- No
- Unsure



If "No" or "Unsure", why do not wish to use the In-Home

System for the consumers mental health recovery? (Check (✓) all that applies).

\_\_\_\_ Not necessary for her/him

\_\_\_\_ Personal privacy issues

\_\_\_\_ Information privacy / security

\_\_\_\_ The equipment might change the way the residence looks

\_\_\_\_ The equipment might get in the way

\_\_\_\_ Other, please specify: \_\_\_\_\_

---

### Informal Caregivers and the In-Home System

---

(30) How would the cost of the In-Home System impact whether or not you would recommend the system to the consumer you care for? (Check all that apply.)

	<u>I would</u> recommend	<u>I would NOT</u> recommend	I am not sure
System is free to consumer/family	_____	_____	_____
System is <u>less than</u> \$50 per month	_____	_____	_____
System is \$51-\$100 per month	_____	_____	_____
System is \$101-\$150 per month	_____	_____	_____
System is <u>more than</u> \$150 per month	_____	_____	_____

(31) What do you think would be the benefits of the In-Home System to you?

Thank you! Please use the backside of this survey to tell me additional thoughts about using the In-Home System for mental health recovery.

---

Smart Home Technology for Mental Health Recovery

## *Appendix C*

### **You Can Help With Research**

Jarod Giger, a Ph.D. student at the University of Missouri's School of Social Work, needs our help. Mr. Giger is interested in learning the views mental health consumers and family caregivers have toward new technologies that could be used for mental health recovery. In the coming months, he will be contacting NAMI affiliates to ask for volunteers to assist with a research project.

Participants will watch a short video showing an In-Home Health System, and then complete a short questionnaire. All responses will be kept confidential. Participants need to be 18 years of age or older and be their own legal guardian. You will receive additional information as Jarod contacts affiliates to coordinate presentation times.

*Appendix D*

**NAMI and the IMS**

**Informed Consent:**

Thank you for participating in this study! This study is being conducted under the direction of Dr. Martha Markward from the School of Social Work at the University of Missouri. In this study I am exploring the perceptions of mental health consumers and their family caregivers regarding the In-Home Health Status Monitoring System. This study should take about 30 minutes. You will be asked a variety questions. Your participation in this study is voluntary, and you do not have to answer any questions you do not want to answer. Criteria for participating in this study is that you are an adult, 18 years of age or older, and you or either an informal caregivers of a person with a serious mental illness or a mental health consumer. The results of this study may be published, but only group data will be reported. You will never be identified by name. You may decide to withdraw during the study. This is your right, and you will not be penalized in any way for withdrawing.

There is minimal risk involved with your participation in this study. This study is not expected to involve risks greater than those ordinarily encountered in daily life. Although it is not possible to identify all potential risks in this study, all reasonable safeguards have been taken to minimize any potential risks. You should be aware that some questions will ask about you and your loved ones' mental health history. Recalling such information could bring to mind upsetting or distressing aspects of your life. Feel free to ask me, Jarod Giger, any questions you may have. I will be available during the study. You may contact me at a later date at 314-494-8832 should you have other questions regarding the study. You may also contact Dr. Martha Markward, my faculty advisor at (573) 884-6159.

For questions about your rights as a research subject, you may contact the University of Missouri Campus Institutional Review Board (which is a group of people who review the research studies to protect participants' rights) at (573) 882-9585.

Please sign and date below to indicate that you give your consent to participate in the study. Your signature does not constitute a waiver of any legal rights. This page will be separated from your responses so that your name cannot be associated with your answers.

---

Your Signature

---

Today's Date

---

Witness

---

Today's Date

## VITA

Jarod Thomas Giger was born in St. Jacob, Illinois. He graduated from Triad High School in St. Jacob, Illinois. In May 1999, he graduated from Southern Illinois University Edwardsville with a Bachelor of Science degree in Psychology and a minor in Sociology as a first generation college graduate. Following his undergraduate work, Jarod again attended Southern Illinois University Edwardsville where he received his Master of Social Work degree in December of 2001. After completing his Master's degree, Jarod worked as a psychiatric social worker for approximately six years. In 2003, Jarod successfully passed his clinical social work licensure exam and earned his license in Illinois. Soon after his licensing he started a small private practice and consulting business in St. Louis, Missouri. In 2007, Jarod began his doctoral training at the University of Missouri School of Social Work. He successfully defended his dissertation on April 21<sup>st</sup>, 2010, and graduated from the University of Missouri with a Doctor of Philosophy degree in the summer of 2010. Jarod accepted a tenure track faculty position at the University of South Dakota. He will continue his research and teaching at the University of South Dakota in the School of Health Sciences.