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Client Adherence with Home Programs after Discharge from a Campus-Based Occupational
Therapy Adult Clinic

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This research, submitted by Wendell M. Nakamura, has been approved and accepted
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Abstract

This retrospective, descriptive study used the *Ecological Model of Adherence* to examine how client, provider, intervention, and contextual factors are associated with client adherence with home programs, two months after discharge from a campus-based occupational therapy clinic. Twelve participants ($M = 60.67$ years, $SD = 13.68$, range: 30-78 years) were interviewed and occupational therapy clinic records were reviewed. The reported rate of adherence with home programs was 25% ($n = 4$). Point-biserial correlations and Phi coefficient cross-tabulations were calculated between 10 variables and client-reported adherence with home programs, two of which were high, positive, and statistically significant: the correlations between client-reported adherence and the inclusion of client-identified occupational performance problems in the home program ($r_{\phi}(1) = .63, p = .028$) and the time required to perform the home program ($r_{\phi}(1) = .82, p = .017$). These findings suggest that home programs that explicitly included clients' occupational performance problems and required a greater investment of time were strongly associated with higher levels of adherence, two months after discharge. Results should be interpreted with caution due to the low power of the study. Although the results of this study did not demonstrate sufficient support for the *Ecological Model of Adherence*, further investigation of the mechanisms that influence client adherence with home programs could improve occupational therapists' understanding of these factors.

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Chronic diseases, such as diabetes, lower respiratory disease, hypertension, cardiovascular disease, and cerebrovascular disease, are among the most frequently cited causes of disability (Centers for Disease Control and Prevention, 2009) and death (Heron, 2016) in the U.S. As chronic diseases become more prevalent, the focus of health care services in the U.S. increasingly includes interventions that rely on clients' ability to successfully self-manage their conditions (DiMatteo, 2004; Linden, Butterworth, & Roberts, 2006). It is estimated, however, that only approximately 30% to 60% of clients with chronic conditions follow through with medical and behavioral recommendations made by their health care providers after leaving services (Christensen, 2004; Clay & Hopps, 2003; DeForge et al., 2008). Low rates of client adherence with treatment recommendations are reported in nearly every healthcare service (Christensen, 2004) and have been shown to adversely affect medical outcomes for clients with diabetes, acquired immunodeficiency syndrome, asthma, hypertension (Jin, Sklar, Oh, & Li, 2008), cardiovascular disease (Miller, 2012), cerebrovascular disease (Duncan et al., 2002), and heart failure (Zhang, Dindoff, Arnold, Lane, & Swartzman, 2015). Low rates of adherence are also shown to result in excessive resource utilization such as preventable urgent care visits and hospitalizations (Christensen, 2004; Clay & Hopps, 2003; DeForge et al., 2008; Jin et al., 2008), costing between \$100 - \$300 billion annually in the U.S. (DiMatteo, 2004; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001).

The World Health Organization (WHO) defines adherence as “the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations from a health care provider” (WHO, 2003, p. 3).

While researchers and clinicians generally agree on similar definitions of adherence, the identification of barriers to and facilitators for adherence has remained specific to the type of recommendation being made, focusing mostly on medication use and health behaviors, such as diet and exercise (Chen, Neufeld, Feely, & Skinner, 1999; DiMatteo, 2004; Vermeire et al., 2001). The tremendous body of literature attempting to identify and understand the barriers to and facilitators for adherence of clients with chronic disease is testament to the growing concerns of health care providers and researchers (Christensen, 2004; Clay & Hopps, 2003; DeForge et al., 2008; DiMatteo, 2004; Vermeire et al., 2001), including rehabilitation professionals (Clay & Hopps, 2003; DeForge et al., 2008; Radomski, 2011).

Occupational therapists are also involved with chronic disease management, with the largest number of clients seen having chronic conditions such as stroke, traumatic brain injury, and spinal cord injury (Radomski, 2011). Systematic reviews in occupational therapy literature show that the use of therapeutic occupation has powerful and lasting effects on improving the performance of activities of daily living (ADL; Wolf, Chuh, Floyd, McInnis, & Williams, 2015), performance of instrumental activities of daily living (IADL; Orellano, Collón, & Arbesman, 2012), health management and maintenance (Arbesman & Mosely, 2012), and the overall health and well-being (Stav, Hallenen, Lane, & Arbesman, 2012) of community-dwelling older adults. The potency of intervention, however, might be significantly diminished if clients do not follow through with treatment recommendations after discharge. Many recipients of occupational therapy services are discharged with home programs designed to promote health, well-being, and occupational participation, including successful health management and maintenance of their chronic conditions. As in other health disciplines, however, occupational therapy practitioners face challenges with their clients who are at risk for low rates of adherence with treatment

recommendations (Clay & Hopps, 2003; Radomski, 2011). After discharge from occupational therapy services, clients may alter their home programs, start then stop a home program, or not even start all together (Radomski, 2007).

As in medical and behavioral research, the literature describing the factors that influence client adherence with adult occupational therapy home programs has been specific to the type of recommendations being made. Research thus far has focused on the use of adaptive equipment (DeForge et al., 2008; Kraskowsky & Finlayson, 2001; Thomas, Pinkelman, & Gardine, 2010; Wessels, Dijcks, Soede, Gelderblom, & DeWitt, 2003; Wielandt & Strong, 2000), therapeutic exercise (Chen et al., 1999; DeForge et al., 2008), splint wear (Sandford, Barlow, & Lewis, 2008), joint protection techniques (Hammond & Freeman, 2004), home modification and falls prevention (Cumming et al., 2001), and family caregiver training (Dooley & Hinojosa, 2004). Rates of adherence (summarized in Table 1) ranged from 28.59% to 100%, with lowest rates of adherence seen in the utilization of joint protection techniques (Hammond & Freeman, 2004) and highest rates of adherence seen in the use of adaptive equipment following orthopedic surgeries (Wielandt & Strong, 2000). Furthermore, Kraskowsky and Finlayson (2001) noted that adherence with recommendations for adaptive equipment following orthopedic surgeries decreased over time.

There is evidence that low rates of adherence with occupational therapy home program recommendations negatively impact specific rehabilitation outcomes (Clay & Hopps, 2003; Kraskowsky & Finlayson, 2001; Wessels et al., 2003; Wielandt & Strong, 2003). A more comprehensive discussion of the factors that predict adherence with home programs, regardless of the type of home program recommended, however, is lacking in occupational therapy practice and research (Radomski, 2011). To date, few studies in the occupational therapy literature

identify the broader mechanisms that impact client adherence with occupational therapy home program recommendations.

Occupational Therapy Models used to Explain Adherence

Occupational therapists make many different types of recommendations for home programs to extend treatment outcomes and improve clients' independence and participation in valued life activities (Proffitt, 2016). Because of the wide variety of recommendations utilized in home programs, a broad framework may be useful in understanding adherence across the spectrum of recommendations made. To better understand the complex mechanisms involved in adherence with home programs, it is important to first explore the theoretical models by which occupational therapy researchers attempted to explain client adherence with occupational therapy home program recommendations. In a review of the occupational therapy literature, only two profession-specific models for understanding adherence with home programs were found.

Model of Human Occupation. Chen et al. (1999) examined the use of the *Model of Human Occupation* (MOHO; Kielhofner & Nelson, 1983) to predict adherence in adults who received occupational therapy for upper extremity injuries and impairments and were issued home exercise programs (HEP). They hypothesized that the MOHO's three subsystems (performance, habituation, and volition) could be used in conjunction with the *Health Belief Model* (Hochbaum, 1958) and the *Health Locus of Control* model (Wallston, Wallston, Kaplan, & Maides, 1976) to understand the broader mechanisms influencing adherence. Key constructs of the *Health Belief Model* include perceived severity of the condition, perceived benefits of intervention to mitigate threat, perceived barriers to undertaking recommended actions, and self-efficacy to produce desired outcomes (Champion & Skinner, 2008). Key constructs of the *Health Locus of Control Model* include the degree to which an individual believes his or her

health to be a result of one's actions, under the control of others, or a result of chance (Norman, Bennett, Smith, & Murphy, 1998).

Chen et al. (1999) predicted that greater perceived benefits of rehabilitation, greater severity of disease or injury, greater self-efficacy, lower perceived barriers to executing the HEP, higher health locus of control, and higher interest in exercise activities would result in higher adherence. They surveyed 62 participants ranging from one week to over one year following discharge from occupational therapy services. Results of the study showed that 35% were fully adherent to the prescribed HEP; data for rates of partial adherence and nonadherence were not discussed. Results also indicated that perceived self-efficacy (as measured by two questions related to health beliefs) demonstrated a statistically significant but low, positive association with adherence with the HEP. It was unclear from the study whether these questions were specific to the prescribed HEP or reflected a more general construct of health self-efficacy. Furthermore, the researchers found that higher degrees of self-efficacy and lower degrees of internal health locus of control demonstrated statistically significant but low predictive value for adherence with the HEP. Chen et al. (1999) concluded that only the volitional subsystem of the MOHO contributed to adherence, suggesting that clients were most motivated when choosing their activities and that motivation may be an important contributor to adherence with home programs. While Chen et al. (1999) found only partial support for the proposed theoretical model integrating the *Model of Human Occupation*, *Health Beliefs Model*, and *Health Locus of Control* model, it was an important first step at integrating and applying existing models in occupational therapy and psychology to predict and explain the barriers to and facilitators for client adherence with home programs.

Ecological Model of Adherence. Consistent with other ecological models in general occupational therapy theory, Radomski (2011) proposed the *Ecological Model of Adherence* as a theoretical framework through which client adherence with home programs may be more globally understood, irrespective of the type of recommendation being made. It posits that a client's successful adherence with occupational therapy home program recommendations first requires deliberate consideration of the interactions among three primary domains: person (client) factors, provider factors, and intervention factors (Radomski, 2011). These three categorical domains are further shaped within the contexts of environmental, social, and technological supports and barriers (Radomski, 2007; 2011). While the *Ecological Model of Adherence* provides a framework that may be applied across different intervention strategies, specific barriers to and facilitators for adherence were not identified and the model has not yet been evaluated under clinical conditions (Radomski, 2011). As a result, intervention-specific research in the occupational therapy literature was reviewed using the *Ecological Model of Adherence* to identify potential barriers to and facilitators for client adherence with home programs in occupational therapy practice (see Tables 1 and 2).

Factors Associated with Adherence

The *Ecological Model of Adherence* describes three categorical domains (person, provider, and intervention factors) across three contextual factors (environmental, technological, and social). It is used here as a method by which to organize previous occupational therapy research on client adherence with different home program recommendations.

Person factors. The client is the first domain described in the *Ecological Model of Adherence*. Person factors are those characteristics that are directly inherent to the individual client and are believed to either support or detract from adherence (Clay & Hopps, 2003;

Radomski, 2007). Much of the early research on client adherence in the medical and psychology literature explored client demographic variables, demonstrating widely mixed and limited correlations with client adherence (Clay & Hopps, 2003; DiMatteo, 2004; Jin et al., 2008; Vermeire et al., 2001). In occupational therapy literature, evidence of correlations between client demographics and adherence with home programs is also mixed and limited. Fuller (2012) and DeForge et al. (2008) found that increased age was associated with lower rates of adherence with HEP recommendations and Wessels et al. (2003) found that increased age was associated with lower rates of adherence with recommendations for assistive technology. By contrast, Chen et al. (1999) did not find statistically significant correlations between age and adherence with HEP, Cumming et al. (2001) did not find statistically significant correlations between age and adherence with home modification recommendations, and Sandford et al. (2008) did not find statistically significant correlations between age and adherence with splint wear.

While demographic variables such as age may significantly impact adherence with some types of home program recommendations, over-arching reviews of the occupational therapy literature indicated that when examined broadly across interventions, there is little clear and conclusive evidence that client demographic variables contribute to adherence with occupational therapy recommendations (Clay & Hopps, 2003; Kraskowsky & Finlayson, 2000; Wessels et al., 2003; Wielandt & Strong, 2000). These findings indicate that there may be other, more potent factors that consistently predict adherence with occupational therapy home programs.

There are several other person factors described in the occupational therapy literature that are thought to be associated with higher adherence with home programs. These include higher degrees of self-esteem (Clay & Hopps, 2003), greater locus of control (Chen et al., 1999; Clay & Hopps, 2003; Kraskowsky & Finlayson, 2001), stronger belief in the value and perceived

necessity of interventions (Cumming et al., 2001; DeForge et al., 2008; Kraskowsky & Finlayson, 2001; Wielandt & Strong, 2000), greater agreement with treatment recommendations (DeForge et al., 2008; Wielandt & Strong, 2000), greater expectations of self and of interventions (Wessels et al., 2003), lower acceptance of disability (Wessels et al., 2003), and higher degrees of internal motivation (DeForge et al., 2008; Fuller, 2012; Wessels et al., 2003; White, 2013; Wielandt & Strong, 2000). Two factors more broadly examined in other health professions and consistently demonstrating robust associations with adherence, self-efficacy (Christensen, 2004) and perceived health status (DiMatteo, Haskard, & Williams, 2007), have been given limited attention in occupational therapy literature.

Self-efficacy. Self-efficacy is a person's subjective perception of his or her ability to successfully evoke sufficient change to achieve a desired outcome (Champion & Skinner, 2008; Linden & Roberts, 2004). It is a judgment of one's capability (Bandura, 2006) or feelings of competence (Linden & Roberts, 2004; Radomski, 2000) at performing a specific task and "may explain the discrepancy between what persons are able to do and what they actually do" (Radomski, 2000, p. 1). Task-specific self-efficacy influences motivation and sustains action in the face of barriers (Linden & Roberts, 2004; Radomski, 2000). A client with a high degree of self-efficacy is more likely to persevere through a challenging task or utilize adaptive coping strategies (Radomski, 2000). Despite the statistically significant but low strength of the association between self-efficacy and adherence with home exercise programs reported by Chen et al. (1999), there is moderate-to-strong evidence in the medical literature that higher degrees of self-efficacy contribute to higher adherence with other types of health care recommendations such as medications, general exercise and activity levels, and diet (Christensen, 2004; Linden & Roberts, 2004).

Perceived health status. How patients perceive their health status and the severity of the disease for which they are being treated have been examined as contributors to adherence (Jin et al., 2008; Linden & Roberts, 2004; Vermeire et al., 2001). In a meta-analysis of the medical literature on adherence, DiMatteo et al. (2007) found that patients who perceived their overall health status to be poor but whose health conditions were not relatively serious were more likely to follow treatment recommendations. The authors suggested that clients who reported higher functional independence and lower caregiver burden were more likely to be adherent with medical recommendations (DiMatteo et al., 2007). When patients perceived their health status to be poor but reported that their disease conditions were relatively more serious, however, patients were less likely to comply with treatment recommendations (DiMatteo et al., 2007). The authors speculated that when clients are faced with significant health issues that are more serious in nature, many physical, psychological, and practical limitations become barriers to clients' best efforts to adhere with medical recommendations.

In occupational therapy, research on the impact that health status and severity of illness have on adherence has focused primarily on physical functioning and the findings have been mixed. DeForge et al. (2008) found that higher functional independence (higher scores on the Functional Independence Measure) was associated with poorer adherence with follow-up therapy appointments and that better balance (higher scores on the Berg Balance Test) was associated with poorer adherence with use of a walker. Similarly, Thomas et al. (2010) found that self-reported improvement of participants' medical conditions was associated with decreased use of adaptive equipment following total hip replacement. In literature reviews of adherence with adaptive equipment recommendations in occupational therapy, Kraskowsky and Finlayson (2001), Wessels et al. (2003), and Wielandt and Strong (2000) also found that improved physical

functioning was associated with poorer adherence with adaptive equipment use. By contrast, DeForge et al. (2008) found that having greater medical complications was associated with decreased adherence with home exercise programs in people who were identified as frail or were recovering from orthopedic conditions. Similarly, Hammond and Friedman (2004) found that poorer hand function was associated with decreased adherence with joint protection strategies in people with rheumatoid arthritis. While this summary of the literature appears to show that the degree and direction of association between a client's health status and adherence with occupational therapy home program recommendations are dependent on the type of recommendation being made, this conclusion should be viewed with caution as these studies used different measures of health status and adherence, investigated different populations in differing clinical settings, and had widely varied lapses of time since discharge.

Occupational therapists also recognize that physical functioning may not be the only contributor to a client's perceived health status. Other aspects of clients' perceived health status, such as psychological states, levels of vitality, participation in social roles, and engagement in valued daily activities, may contribute to a client's sense of well-being and overall health (Hocking, 2014). According to the WHO (2017), these aspects encompass a broader multidimensional concept: health-related quality of life (HRQL). A review of the occupational therapy literature, however, did not find these factors to be investigated as potential barriers or facilitators that influence adherence with home programs in occupational therapy.

The identification of various person factors that consistently predict client adherence with various treatment recommendations in medicine and behavioral science has been a goal for health care researchers for nearly 50 years, yet has remained somewhat elusive (Christensen, 2004; Vermeire et al., 2001). Comprehensive and systematic reviews of medical and behavioral

research identify self-efficacy (Christensen, 2004) and overall perceived health status (DiMatteo et al., 2007) as consistently strong predictors for adherence, yet these variables remain relatively unexplored in occupational therapy. Client demographic variables were studied in occupational therapy research, yielding mixed results (Clay & Hopps, 2003; DiMatteo, 2004; Jin et al., 2008; Kraskowsky & Finlayson, 2000; Radomski, 2007; Vermeire et al., 2001; Wielandt & Strong, 2000). Further investigation of the extent to which these client factors influence adherence with occupational therapy home programs may provide valuable insight into identifying client factors that may be barriers to and facilitators for adherence.

Provider factors. The health care provider is the second domain described in the *Ecological Model of Adherence*. Provider factors are those characteristics inherent in the health care provider that affect the relationship with the client (Clay & Hopps, 2003). Several provider factors often cited in occupational therapy research as barriers to adherence with home programs include not taking clients' lifestyles and routines into consideration when designing home programs (Chen et al., 1999; Clay & Hopps, 2003; Fuller, 2012; White, 2013; Wielandt & Strong, 2000), not involving clients in the decision-making process (Clay & Hopps, 2003; Thomas et al., 2010; Wessels et al., 2003; Wielandt & Strong, 2000), not providing sufficient education and training to the client's satisfaction (Kraskowsky & Finlayson, 2001; Wessels et al., 2003; Wielandt & Strong, 2000), and lack of follow-up (Wessels et al., 2003). By contrast, several provider factors have been implicated to facilitate client adherence. When providers involve clients and caregivers in the decision-making process (Thomas et al., 2010; Wessels et al., 2003; Wielandt & Strong, 2000), answer clients' questions (Clay & Hopps, 2003), and follow-up with recommendations (Clay & Hopps, 2003; Wessels et al., 2003), clients

demonstrate higher rates of adherence. These provider factors enhance the therapeutic alliance between client and provider through client-centered communication (Pinto et al., 2012).

Client-centered communication. Therapeutic alliance is the affective bond established between client and practitioner in client-centered practice (Hall, Ferreira, Maher, Latimer, & Ferreira, 2010) that affects behavior change (Street & Epstein, 2008). More specifically, the provider's competence at utilizing client-centered, verbal and non-verbal communication is identified as one of the key aspects of building a strong therapeutic alliance (Pinto et al., 2012; Street & Epstein, 2008). The strength of the alliance between the client and health care provider has been shown to significantly influence treatment adherence and client rehabilitation outcomes (Clay & Hopps, 2003; Jin et al., 2008; Hall et al., 2010; Radomski, 2007; Wessels et al., 2003).

While it is generally agreed that strong interpersonal communication skills are critical in client-centered practice (Christensen, 2004; Duncan et al., 2002; Jin et al., 2008; Miller, 2012; Vermeire et al., 2001; WHO, 2003), there is no consensus regarding which specific communication skills are most important in promoting adherence. Additionally, researchers do not agree on the most effective methods for measuring health communication (Vermeire et al., 2001), as there are differences between patient-reported, clinician-reported, and observer measures (Clayton, Latimer, Dunn, & Haas, 2011).

Perceived adequacy of instruction. The degree to which clients feel that they are adequately instructed in the home programs prescribed to them has been the focus of modest research in occupational therapy. In systematic reviews of the occupational therapy literature on adherence with the use of recommended adaptive equipment, clients who felt that they did not receive adequate instruction were less likely to follow those recommendations (Kraskowsky &

Finlayson, 2001; Wessels et al., 2003; Wielandt & Strong, 2000). More recent reviews of the literature on this topic, with adaptive equipment or other home programs, were not found.

To date, little research exists in the occupational therapy literature about the extent to which client-centered communication and the perceived adequacy of instruction of the home program impact adherence with home programs. An investigation of the roles that these two factors have on adherence with home programs may provide additional insight into identifying which provider factors present as barriers to and facilitators for client adherence.

Intervention factors. The third domain of the *Ecological Model of Adherence* that may have a significant impact on adherence with home programs is that of the intervention itself. Intervention factors are those characteristics of the intervention that either facilitate or impede client adherence (Clay & Hopps, 2003). In medical encounters, recommendations that are less complex, require less time to complete, and have fewer unintended side effects are associated with increased adherence (DeForge et al., 2008). Similarly, in occupational therapy, intervention factors associated with improved adherence with home programs include fewer numbers of treatment recommendations (Fuller, 2012; White, 2013) and more training sessions (Hammond & Freeman, 2004; Kraskowsky & Finlayson, 2001; Wielandt & Strong, 2000). Despite the investigation of intervention factors studied in occupational therapy, several additional factors have received little attention in occupational therapy literature. Each of these is discussed below.

Congruence with client-identified occupational performance problems. The efficacy of human occupation as a means for achieving outcomes in occupational therapy is well documented (Arbesman & Mosely, 2012; Orellano et al., 2012; Stav et al., 2012; Wolf et al., 2015), but the impact of occupation-based recommendations verses rote exercise or preparatory activities on adherence with home programs after discharge has been given relatively little

notice. As classified in the Occupational Therapy Practice Framework (OTPF; American Occupational Therapy Association [AOTA], 2014), *occupations* are “client-directed daily life activities that match and support or address identified participation goals,” (p. S29). They are “central to a client’s identity and sense of competence and have particular meaning and value to the client” (AOTA, 2014, S5). In contrast, *activities* are “actions designed and selected to support the development of performance skills and performance patterns to enhance occupational engagement” (AOTA, 2014, p. S29). The use of human occupation as an agent of change “to remediate impaired abilities or capacities” (Trombly, 1995, p. 964) and advance clients toward improved occupational outcomes has been the defining characteristic of occupational therapy. According to Trombly (1995), *occupation-as-means* is therapeutic only if it involves two essential aspects, purposefulness and meaningfulness. Several studies in the occupational therapy literature have examined the use of purposeful activities or value-added activities to promote participation (Heck, 1988; Kircher, 1984; Steinbeck, 1986; Yoder, Nelson, & Smith, 1989). Although these studies did not discuss its impact on adherence with home programs, their findings indicate that the use of therapeutic activities that hold inherent meaning and value to clients can be a powerful force toward engaging clients in the therapeutic process.

To investigate the influence of occupation on adherence with home programs, Fuller (2012) surveyed 18 adult clients seven months after receiving three months of outpatient services in an on-campus occupational therapy adult clinic. She compared rates of adherence with home programs that were based on the use of therapeutic occupations and activities to rates with home programs based on preparatory tasks (rote exercise). The rates for clients who were “entirely adherent” to the home programs were 16% for occupation- or activity-based home programs and 27% for preparatory activities. The difference in rates of adherence for the two groups was not

statistically significant. Consistent with the findings of Chen et al., (1999), the participants in Fuller's (2012) study cited the ability to incorporate home exercise programs into daily routines as the single greatest factor that contributed to increased adherence. One limitation of Fuller's study is that participants were surveyed seven months after having received services. It is possible that during the long interval of time between home program instruction and survey, clients' skills and abilities may have changed to the extent that the home programs were no longer appropriate, leading to decreased adherence. Client adherence with therapy home programs at one month following discharge has been shown to be highly predictive of longer-term adherence (Kraskowsky & Finlayson, 2001), so a shorter interval between discharge and survey may provide additional clues on the factors influencing clients' adherence with home programs following discharge.

As a follow-up to Fuller (2012), White (2013) re-examined the intervention factors (occupations, activities, and preparatory tasks) in the same on-campus, occupational therapy adult clinic. Like Fuller, she surveyed 18 adults who received three months of occupational therapy intervention and had been discharged approximately eight months prior to being surveyed. White (2013) measured adherence using the same ordinal scale as Fuller (2012) and utilized the same independent and dependent variables, with one significant change. Her independent variable (intervention type) had three levels (occupation-based, activity-based, and preparatory task), rather than two. White (2013) compared the rates of adherence for each type to those of preparatory tasks. In contrast to Fuller, White's results indicated that 69.2% of occupation-based home programs were adhered to "entirely," compared to 50% for purposeful activities and 24.1% for preparatory activities. She concluded that occupation-based home programs resulted in statistically higher rates of adherence after discharge when compared to

home programs that included preparatory activities. The rates of adherence between the activity-based and preparatory task groups were not statistically different. While White (2013) demonstrated a difference in rates of adherence between occupation-based recommendations compared to preparatory task recommendations, the study shared similar limitations as Fuller (2012).

Given that human occupation has been shown to demonstrate a strong and positive impact on participation and performance (Heck, 1988; Kircher, 1984; Steinbeck, 1986; Yoder et al., 1989), its potential to positively impact adherence with home programs holds significant promise. According to White (2013), designing home programs to include client-identified occupational performance problems might engage clients for longer periods of time and lead to increased adherence. The impact of occupation-based activities on adherence with home program recommendations warrants further study.

Clarity of educational materials. Client education handouts are often used by occupational therapists to reinforce learning during direct service (Griffin, McKenna, & Tooth, 2003; 2006). In a survey of 384 occupational therapists in the U.S. who provided care to clients with neurologic injuries, 85.3% reported using written handouts as part of a HEP (Proffitt, 2016). Written handouts provide consistency in teaching content and flexibility in the delivery of education (Griffin et al., 2003). Clients may refer to the handouts later and learn at their own pace (Griffin et al., 2003), which may further enhance adherence with home programs. The availability of written health information, however, does not guarantee client learning or follow-through with the recommendations, particularly if the material is not written in a manner that can be clearly understood by clients (Griffin, et al., 2003). For written materials to be effective tools in client education, the information must be written and presented in a manner that the client can

read, understand, apply, and reference (Griffin et al., 2003; 2006) when performing home programs. Important characteristics of written health information include readability levels, design characteristics, clarity of content, format, layout, language, legibility, and use of illustrations (Griffin et al., 2003). It is generally recommended that the purpose of the content be made immediately relevant and practical to the client (Clay & Hopps, 2003; Griffin et al, 2003; 2006) and that materials provide the most important point first (Griffin et al., 2003; 2006); be written at the fifth-grade reading level (Griffin et al., 2003); use headings and subheadings, bullet points, and larger fonts with emphases such as bold face or underline (Griffin et al., 2006); incorporate illustrations, picture, and diagrams (Griffin et al., 2006); and use actionable language (Griffin et al., 2003; 2006). By utilizing written health information that matches clients' health literacy, is easily understood, and reinforces client learning, occupational therapists can potentially impact clients' empowerment, satisfaction, and adherence with treatment recommendations (Griffin et al., 2003). While the impact that the quality and usefulness of client education handouts has on adherence with treatment recommendations has been widely studied in the medical and behavioral literature, it has not been addressed in the occupational therapy literature.

Treatment complexity. The influence that the complexity of home program recommendations has on adherence has been studied widely in the medical literature. Evidence suggests that regimens that were perceived by the client to be more complex resulted in poorer rates of adherence (Christensen, 2004; Jin et al., 2008; Vermiere et al., 2001). Furthermore, in a systematic review of studies on medical recommendations and medication adherence, Christensen (2004) noted that when treatment recommendations are complex and extensive, clients are selective in choosing what parts to follow. The examination of perceived treatment

complexity and its potential impact on adherence with home programs has been absent in occupational therapy literature.

Time commitment required. How much time is required to participate in treatment recommendations has also been the subject of investigation in adherence. Literature reviews on medication adherence suggest that increased frequency of dosing is associated with poorer adherence (Christensen, 2004; Jin et al., 2008). In occupational therapy, Proffitt (2016) noted that the most common dosing for HEP with clients with neurologic injuries was between 16 and 30 minutes. Many of the occupational therapists surveyed felt that HEP of longer durations are “burdensome to clients and thus reduce adherence rates” (Proffitt, 2016, p. 7003290020p3). This sentiment is reflected in studies of treatment duration and adherence with occupational therapy home programs that include adaptive equipment (Clay & Hopps, 2003; Kraskowsky & Finlayson, 2001) and therapeutic exercise (Clay & Hopps, 2003; White, 2013). These studies reported that home programs of longer duration resulted in poorer adherence. In fact, several studies show that home programs that fit with a client’s existing routine are more likely to result in greater adherence (Chen et al., 1999; Clay & Hopps, 2003; DeForge et al., 2008; Fuller, 2012; White, 2013).

Presence or absence of unintended, adverse side effects. Despite clinicians’ best efforts, there are times when recommendations for medical interventions produce unintended, adverse side effects (Christensen, 2004; Jin et al., 2008). While the majority of the research in this area is related to medication adherence (Clay & Hopps, 2003; Jin et al., 2008), the impact that unintended, adverse side effects have on rehabilitation outcomes has received little attention. Treatment recommendations that cause physical discomfort have been identified as an important factor in reduced rates of adherence with wearing pressure garments in clients with burns

(Stewart, Bhagwangee, Mbakaza, & Binase, 2000). Further investigation on the influence that unintended, adverse side effects such as physical discomfort may have on adherence with home programs is warranted.

In studies of adherence with occupational therapy home programs, intervention factors that have not been widely studied in occupational therapy include whether the home program directly addresses a client-identified problem, the clarity of written handouts issued to clients, the perceived complexity of the home program, the amount of time required to complete the home program, and the presence of unintended, adverse side effects as a direct result of the home program. Further investigation of each of these factors and their impact on adherence may provide additional insight into the barriers to and facilitators of client adherence with home programs.

Contextual factors. Although no less important than the other three domains described previously, the influence that contextual factors have on adherence with home programs has been studied far less frequently. The *Ecological Model of Adherence* describes three primary contexts that may present as barriers to or facilitators for occupational performance and adherence. These include *environmental contexts* (physical environment), *technological contexts*, and *social contexts* (social environment).

Environmental contexts for adherence include the generalizability of treatment recommendations to the client's living environment and the presence or absence of architectural barriers (Clay & Hopps, 2003; Wessels et al., 2003). Particularly with occupational therapy recommendations involving adaptive equipment, a fit between the recommended device and the client's home environment was found to be a strong predictor of adherence (Kraskowsky & Finlayson, 2001; Thomas et al., 2010; Wessels et al., 2003; Wielandt & Strong, 2000). In

contrast, when the client's home environment presented with architectural barriers that make it more difficult to install or use the adaptive equipment recommended by occupational therapists, adherence was much less likely (Clay & Hopps, 2003; Kraskowsky & Finlayson, 2001; Thomas et al, 2010; Wessels et al., 2003; Wielandt & Strong, 2000).

Technological contexts, such as access to technology (including a phone or other electronic device), may influence the rates of adherence with home programs (Radomski, 2011). The use of an electronic device as a reminder to take medications or complete exercises, for example, may enhance client adherence (DeForge et al., 2008). Additionally, the quality, durability, and cosmetic appearance of an acquired assistive device (DeForge et al., 2008; Kraskowsky & Finlayson, 2001; Wessels et al., 2003) and ease of its use (Clay & Hopps, 2003; Kraskowsky & Finlayson, 2001; Wessels et al., 2003) are also associated with improved adherence with treatment recommendations.

Thirdly, *social contexts* may have a significant influence on client adherence and have been the focus of research in recent years. The OTPF defines the client's *social environment* as "the presence of, relationships with, and expectations of persons, groups, and populations with whom clients have contact" (AOTA, 2014, p. S9). In an extensive review of the medical literature, Christensen (2004) found that the availability of and perceived satisfaction with social-emotional support networks has mixed and variable associations with client adherence. Social support was strongly associated with adherence to recommendations for medical procedures and medications, particularly when the client experienced a stressful life event (Christensen, 2004). Adherence with behavioral recommendations, such as diet, exercise, and drinking behavior, however, showed much more mixed results (Christensen, 2004). In occupational therapy, while degrees of social support were positively associated with adherence with HEP (Chen et al, 1999;

DeForge et al., 2008; Fuller, 2012), home modifications (Cumming et al., 2001), and adaptive equipment use (Thomas et al., 2010; Wessels et al., 2003), the strength of those associations was also mixed and variable. Clients are less likely to follow treatment recommendations when their families or caregivers do not place high value on the treatment recommendations, possibly due to conflicts with cultural values (DeForge et al., 2008; Vermeire et al., 2001). Other social factors that may influence adherence with home programs include the degree to which a family member or caregiver may feel over-burdened with other tasks related to the client's overall care (Dooley & Hinjosa, 2004), child care (Chen et al., 1999), and providing transportation (DeForge et al., 2008; Fuller, 2012). Clients whose social support systems are already over-taxed are less likely to continue home programs after discharge (DeForge et al., 2008).

Of the contextual factors discussed above, the degree to which a client perceives the strength and quality of social support has been the most widely studied, although the results have been varied. Further investigation of the association between perceived social support and adherence with occupational therapy home programs is warranted.

Gaps in the literature

Occupational therapists prescribe many different types of interventions as home programs (Proffitt, 2016) to extend the outcomes achieved during direct service. The design of such home programs must consider factors related to the person, provider, intervention, and contexts if adherence is to be improved (Radomski, 2011). The identification of barriers and facilitators that consistently influence client adherence with intervention-specific home programs has been the subject of modest research in occupational therapy. Investigations thus far have been largely intervention-specific, focusing on the use of adaptive equipment (DeForge et al., 2008; Thomas et al., 2010), therapeutic exercise (Chen et al., 1999; DeForge et al., 2008), splint wear (Sandford

et al., 2008), joint protection (Hammond & Freeman, 2004), home modification and falls prevention (Cumming et al., 2001), and family caregiver training (Dooley & Hinojosa, 2004). Furthermore, the application of an occupational therapy-based theoretical framework to explain and predict adherence across treatment approaches remains almost non-existent. In response to the need for a more comprehensive model that considers multifactorial aspects of adherence, the *Ecological Model of Adherence* was proposed, yet no empirical studies have tested its feasibility in a clinical setting.

The purpose of this retrospective, descriptive study was to examine the clinical applicability of the *Ecological Model of Adherence* by evaluating the associations between client-reported adherence and person, provider, intervention, and contextual factors in clients who were prescribed a home program following discharge from a campus-based occupational therapy adult clinic. Based on the literature in medical, behavioral, and occupational therapy research, it was hypothesized that greater adherence with home programs is associated with 1) higher levels of client self-efficacy, 2) moderate levels of perceived physical functioning, 3) higher levels of perceived client-centered communication, 4) perceived adequacy of instruction, 5) greater congruence between home programs and client-identified occupational performance problems, 6) clearer client-education materials, 7) lower perceived complexity of the treatment, 8) lesser time commitment required, 9) absence of unintended, adverse side effects, and 10) higher levels of perceived social support. The evaluation of these factors was expected to provide clinically-based empirical evidence that supports the application of the *Ecological Model of Adherence* and further the understanding of adherence with home programs in occupational therapy practice.

Method

Research Design

This retrospective, descriptive study was designed to evaluate the associations between client-reported adherence and the person, provider, intervention, and contextual factors identified in the literature and the *Ecological Model of Adherence*. Additionally, this study sought to solicit participants' comments on the barriers to and facilitators for adherence with their home programs. Data for this study were collected via participant interview, standardized measures, and a review of occupational therapy clinic records.

Participants

The accessible population was a convenience sampling of clients who attended the University of Puget Sound School of Occupational Therapy Adult Clinic in Tacoma, Washington, during the spring semester of 2016. The intended sample included clients who met the following inclusion criteria: adults aged 18 years or older who 1) possessed sufficient cognitive and decisional abilities to make autonomous decisions without requiring a health care power of attorney or legal guardian, 2) received occupational therapy services for at least four weeks prior to discharge, 3) were discharged from occupational therapy services for at least one month, and 4) were not receiving occupational therapy services at the time of the study. The study excluded clients who 1) self-reported having (or were reported to have) a significant decrease in health status or hospitalization after discharge from the clinic in April 2016 such that their ability to complete the home program was compromised, and 2) received occupational therapy services from the principal investigator or students supervised by the principal investigator. As this study used a convenience sampling, sample size could not be set a priori using power analysis.

Instrumentation

The factors identified in the medical, behavioral, and occupational therapy literature related to client adherence with home programs were considered for deeper investigation using the *Ecological Model of Adherence*. These factors are as follows:

1. Person factors (self-efficacy, perceived health-related quality of life),
2. Provider factors (client-centered communication, perceived adequacy of instruction),
3. Intervention factors (congruence with client-identified occupational performance problems, clarity of education materials, complexity, time commitment, adverse side-effects), and
4. Contextual factors (perceived level of social support).

The selection of measurement instruments for each of these factors was guided by a review of the literature. Where possible, standardized measures with high-level psychometric properties were selected. In instances where no standardized measurement instrument was available, the principal investigator developed study-specific methods to collect the data as noted below.

Data were initially collected for this study through face-to-face interviews with study participants (see Procedure section). During the interviews, study participants completed some of the measures (described below) and answered the questions in the questionnaire (see Appendix), either verbally or in writing. The principal investigator allowed participants to complete the questionnaire by themselves, if they wished to do so, or recorded participants' responses for them on the questionnaire if they did not. The questionnaire was not piloted for item clarity prior to use in this study. Following participant interviews, the principal investigator reviewed participants' occupational therapy clinic records located at the University of Puget Sound School

of Occupational Therapy Adult Clinic. Demographic (age, sex, primary diagnosis for which the client was being seen, years since onset of condition) and clinical (number of treatment sessions attended, days since discharge) information were recorded and the remaining measures were scored by the principal investigator. A description of each of the measures used and procedures for data collection follows.

Overall rates of adherence. Study participants were asked during the interview to describe the home program recommendations that were prescribed and how often they continued to perform their home program, either in whole or in part (both are open-ended questions; see Appendix). Participants were allowed to consult their printed educational materials, a family member, or caregiver if they chose to do so. As participant interviews were conducted before the principal investigator reviewed participants' clinic records, the principal investigator was unaware of the prescribed home program and did not guide participants' responses through leading questions.

Following the interview, participants' descriptions of their home programs and the reported frequencies of carrying out the programs were compared to the home program described in the occupational therapy clinic record to evaluate for congruence. If the participant reported performing all aspects of the home program activities described in the clinic record, the participant's behavior was coded by the principal investigator as "fully adherent." If the participant reported performing at least one, but not all, of the home program activities in the clinic record, the participant's behavior was coded by the principal investigator as "partially adherent." If the home program activities described by the participant had no items in common with the home program described in the clinic record or the participant reported having stopped the home program, the participant's behavior was coded by the principal investigator as

“nonadherent.” Study participants who reported continuing with at least part of their home program, either as prescribed or with modifications, were asked to identify the primary reason that supported its continuance. If participants reported that they stopped performing their home program, they were asked to identify the primary reason for discontinuance.

Person factors. Data on participant factors were collected in two areas: generalized self-efficacy and perceived health-status. The instruments by which this information was collected are described below.

Generalized self-efficacy. The measurement of self-efficacy has been widely studied for decades (Scherbaum, Cohen-Charash, & Kern, 2006). While the concept of self-efficacy was developed to reflect a task-specific belief in one’s competence, more recent debate on the measurement of self-efficacy has proposed a generalized self-efficacy as a valid construct (Scherbaum et al., 2006). Generalized self-efficacy is described as a trait-like attribute describing an “individual’s perception of their [sic] ability to perform across a variety of different situations” (Judge, Erez, & Bono, 1998, p. 170) and is independent of a particular situation or task (Scherbaum et al., 2006). Because occupational therapists prescribe many different kinds of interventions for home programs, a broader, more generalized measure of self-efficacy was used.

The Generalized Self-Efficacy Scale (GSES) was developed to assess a client’s general sense of perceived self-efficacy in the management of stressful life events and to predict adaptation after life changes (Schwarzer & Jerusalem, 1995). The GSES is unidimensional (Cronbach’s alpha between .82 and .93), demonstrating high internal consistency (Schwarzer & Jerusalem, 1995). Concurrent validity has been established with other psychological measures, including positive correlations with self-esteem, beliefs of internal control, and optimism, and negative correlations with general anxiety, performance anxiety, shyness, and pessimism

(Schwarzer & Jerusalem, 1995). Two-year predictive validity is correlated with self-esteem (0.40) and optimism (0.56) for women and 0.20 and 0.34 for men, respectively. The GSES also demonstrates validity across different cultures (Luszczynska, Scholz, & Schwarzer, 2005). To evaluate the degree of generalized self-efficacy, each participant completed a printed version of the GSES during the interview. GSES scores reflect participants' agreement with ten statements about his or her ability to cope successfully with adverse events in various contexts. The statements of the GSES were scored using a 4-point Likert scale, with anchor points at 0 = "not at all true" and 4 = "exactly true." Total scores out of a possible 40 were used in analysis, with higher scores on the GSE indicating greater degrees of generalized self-efficacy.

Perceived health-related quality of life. Instead of using a measure of health status, a measure of health-related quality of life was used. It was felt that a multidimensional measure was more appropriate to measure non-physical aspects of health and well-being. The Adult Profile 43, v2.0 of the Patient Reported Outcome Measurement Information System (PROMIS) is a self-reported, normative, generic measure of a client's perceived health-related quality of life (HRQL) across eight domains: physical functioning, anxiety states, depressive states, fatigue level, sleep disturbances, ability to participate in social roles and activities, pain interference, and pain intensity (Rothrock et al., 2010). Higher scores on the physical functioning subtest of the PROMIS indicate higher degrees of functioning, on the anxiety subtest indicating greater degrees of anxiety, on the depression subtest indicating greater degrees of depressive symptoms, on the fatigue subtest indicating greater levels of fatigue, on the sleep disturbances subtest indicating greater degrees of disturbance, on the social roles subtest indicating more involvement in social roles and activities, and on the pain interference subtest indicating more interference with activities. Statements about each of the subtests of the PROMIS were scored using a 5-point

Likert scale; anchor points varied depending on the item. Pain intensity subscores were measured in response to participants' pain rating in the previous seven days using an ordinal scale with "0" representing no pain and "10" representing worst imaginable pain. To evaluate the degree of study participants' overall perceived health-related quality of life, the principal investigator used the PROMIS subtest raw scores that were recorded in the participants' occupational therapy clinic records. Although the PROMIS is typically scored using t-scores (with a mean of 50 and standard deviation of 10), the principal investigator converted participants' aggregate t-scores from each of the domain subtests (except for pain intensity) at discharge to z-scores for analysis. The subtest scores for pain intensity were not analyzed for the current study because they only reflect the pain experienced in the seven days prior to completion of the PROMIS measure.

Provider factors. Data on provider factors were collected in two areas: the degree to which participants' student therapist provided client-centered communication and participants' perception of the adequacy of instruction. Each of these areas is described below.

Client-centered communication. The Communication Assessment Tool (CAT) is a client-reported rating of the degree to which a medical professional communicates using a client-centered approach during a single clinical encounter (Makoul, Krupat, & Chang, 2007). Internal consistency was high (Cronbach's alpha .98) across physician specialty and client demographics and construct validity with the patient satisfaction survey of the Colorado Permanente Medical Group was established (Makoul et al., 2007). Designed to be used after a single encounter between physicians-in-training and clients, the CAT was modified for the current study by replacing the word "physician" with the words "student occupational therapist" and by asking participants to consider the communication styles of the student occupational therapist over the

course of the clinic. The modified CAT was not assessed for construct validity. Fifteen statements about client-centered communication were scored using a 5-point Likert scale, anchored at 0 = “poor” and 5 = “excellent.” Scores were reported as a percentage of the highest possible score, with higher scores indicating that the study participant perceived more client-centered communication. Participants completed printed versions of the modified CAT during the interview to measure their perceptions of student therapists’ client-centered communication. CAT total percentages were used in analysis.

Perceived adequacy of instruction. Participants were asked during the interview if they were offered the opportunity to practice their home program with the student therapist observing, and if so, were they provided feedback that the participants found useful. As participants’ functional abilities may improve over time, the principal investigator also asked participants if they were taught how to make their home programs more challenging or when to stop the home program if it became no longer appropriate (see Appendix). Participants were asked to categorize the adequacy of these instructional components as “thoroughly,” “somewhat,” “a little,” or “not at all.” The principal investigator coded the responses to each of these questions using an ordinal scale (1 = “thoroughly” and 4 = “not at all”).

Intervention factors. Data on intervention factors were collected in five areas: degree to which the home program is congruent with client-identified occupational performance problems, clarity of education materials, perceived treatment complexity, time required to perform the home program, and the presence or absence of unintended side effects. The instruments by which this information was collected are described below.

Congruence with client-identified occupational performance problems. The Canadian Occupational Performance Measure (COPM; Law et al., 1990) was used in this study to identify

clients' occupational performance problems and priorities for treatment. The COPM is widely used in occupational therapy practice and research and demonstrates strong test-retest reliability and face and concurrent validity with other measures of occupational performance (Carswell et al., 2004). To evaluate the degree to which participants' home programs are congruent with client-identified occupational performance, the primary investigator noted the top five occupational performance problems that were identified by the participant in the COPM at discharge and recorded in the participant's clinic record. Comparisons were then made to the home program recorded in the clinic record. Home programs were considered congruent (in part or in whole) if any aspect of the home program included any of the client-identified occupational performance problems identified in the COPM. For example, if the home program involved the incorporation of tone reduction techniques (such as bearing weight through the upper extremity) specifically during a dishwashing activity and the client identified in the COPM that home care or meal preparation was problematic, the home program was considered to be congruent. If, however, the home program involved incorporation of tone reduction techniques during a grooming activity, but the client did not identify grooming as an area of concern, the home program was considered incongruent. Binary data were recorded ("0" = incongruence; "1" = congruence) for each of the study participants.

Clarity of educational materials. The Patient Education Materials Assessment Tools for print materials (PEMAT-P) provides a systematic inventory for the clarity of printed education materials (Shoemaker, Wolf, & Brach, 2014). Materials are evaluated across two domains: *understandability* and *actionability*. Inter-rater reliability for understandability items range from moderate-to-very-high ($\kappa = .40$ to $.84$) and for actionability items from low-to-high ($\kappa = .35$ to $.76$; Shoemaker et al., 2014). The PEMAT also demonstrates high internal consistency

(Cronbach's alpha .70 to .75; Shoemaker et al., 2014). Construct validity could not be established, though the authors recommend further development and validation of the instrument with a larger sample population (Shoemaker et al., 2014). Scores were reported as percentages, with higher scores on *understandability* and *actionability* subtests indicating that the materials included design elements that were more easily understood by the reader and language that directs the reader to action. To evaluate the clarity of printed home program education materials in this study, the primary investigator scored the client education materials in the participants' clinic record using the PEMAT-P. Aggregate scores for *understandability* and *actionability* of printed client education materials were included for analysis.

Treatment complexity. The principal investigator asked participants to rate how complicated they thought the home program was to follow and to categorize their responses as “thoroughly,” “somewhat,” “a little,” or “not at all,” which were scored using the same ordinal scale (1 = “thoroughly” and 4 = “not at all”).

Time commitment required. The principal investigator asked participants to approximate how much time it took to complete the home program that was prescribed and to categorize their responses as “less than 10 minutes,” “between 10 and 20 minutes,” “between 20 and 30 minutes,” “and more than 30 minutes,” which were scored using an ordinal scale (1 = “less than 10 minutes” and 4 = “greater than 30 minutes”).

Presence or absence of unintended side effects. The principal investigator asked participants whether they experienced any unintended adverse side effects as a direct result of the home program, which were scored using a binary scale (0 = “none reported” and 1 = “adverse side effect reported”). Participants who reported adverse side effects were asked to describe them.

Contextual factors. Data on the factors related to social context were collected in one area: perceived social support. Environmental and technological contexts were not evaluated because the home programs prescribed to participants in the Occupational Therapy Adult Clinic did not include recommendations for environmental modifications and only one participant had a recommendation for a single piece of assistive technology. The instrument by which perceived social support was measured is described below.

Perceived social support. The Multidimensional Scale of Perceived Social Support (MSPSS) is a client-reported rating scale of his or her perceived amount of emotional and instrumental support to cope with life stressors (Zimet, Dahlem, Zimet, & Farley, 1988). The MSPSS demonstrates good internal consistency (Cronback's alpha .84 to .92; Gottlieb & Bergen, 2010) and good stability (test-retest values .72 to .85; Zimet, Powell, Farley, Werkman, & Berkoff, 1990). The MSPSS demonstrates moderate construct validity (negative correlations with the Depression and Anxiety subscales of the Hopkins Symptom Checklist; Zimet et al., 1988). Statements regarding social support are scored using a 7-point Likert scale, with anchor points 0 = "very strongly disagree" to 7 = "very strongly agree". Scores were reported as a percentage with higher scores on the MSPSS indicating higher degrees of social support. Scores on the MSPSS reflected study participants' agreement with statements about their perceived support to cope successfully with adverse events in various contexts.

Procedure

The protocol for the study was approved the University of Puget Sound's Institutional Review Board and was conducted in a manner that conformed to the approved protocol. The principal investigator contacted the clinic coordinator for the Occupational Therapy Adult Clinic to obtain a list of clients eighteen years and older who attended the clinic during the spring

semester of 2016. Inclusion/exclusion criteria were applied to identify potential study participants. Clients were informed of the purpose and procedures of the study and were offered an opportunity to decline participation in the current study. Clients who agreed to participate in the study and completed a signed consent form were interviewed in a location of their choosing (either at home or on the university campus) and were not provided compensation for participation.

Data Analysis

All data were analyzed using IBM SPSS™ Statistics 24 (IBM Corporation, 2016). Descriptive statistics of range, central tendency, and variance were used to summarize the demographic profile of the overall sample of study participants regarding age, years since onset of condition, days since discharge, and number of treatment sessions attended. They were also used to summarize continuous data for the GSES, PROMIS, CAT, PEMAT-P, and MSPSS. Frequency distributions were used to summarize categorical data regarding sex, primary diagnosis for which the client was being treated, hand dominance, congruence with client-identified occupational performance problems, educational approaches and feedback, treatment complexity, time commitment required, presence of adverse side effects, and overall rates of adherence with the home program.

During statistical analysis, an α level of .05 was set, indicating a clinically acceptable rate of 5% chance of making a Type I error (falsely rejecting the null hypothesis). Initially, data were to be analyzed using regression analysis of continuous data to identify the predictive strengths of the variables. However, nonparametric statistics were used to analyze data instead because the assumption that data were of normal distribution could not be met due to the small sample size.

Point-Biserial Test of Association (r_{bs}), a special case of the Spearman rank correlation coefficient, was used to evaluate associations between the ratio/continuous variables (listed below) and the dichotomous, category variable (adherence).

1. Person factors (generalized self-efficacy [GSES], health-related quality of life [PROMIS]),
2. Provider factors (clients' perception of therapists' use of client-centered communication [CAT]),
3. Intervention factors (clarity of education materials [PEMAT-P]), and
4. Contextual factors (client social-emotional support [MSPSS]).

The Mean Square Contingency (Phi) Coefficient (r_{ϕ}) was used to evaluate the associations between the category variables (intervention factor [congruence with client-identified occupational performance problems]) and the dichotomous, category variable (adherence). A two-tailed significance was used for all analyses. The strength of the relationships between variables, measured by correlation coefficients, was interpreted as negligible correlation, 0 - .20; low correlation, .20 - .40; moderate correlation, .40 - .60; high correlation, .60 - .80; and very high correlation, .80 - 1.00 (Tomita, 2006).

Results

Study Sample

Thirty-seven adult clients received occupational therapy services at University of Puget Sound School of Occupational Therapy Adult Clinic during the spring semester of 2016. All clients receiving services were provided home programs that were designed by graduate students enrolled in the occupational therapy program who were supervised by licensed occupational therapists. Of the 37 clients, six had statements in their occupational therapy clinic record that

they did not wish to be contacted for research purposes. The accessible population consisted of 31 clients. Nine clients did not meet criteria for inclusion in the study (seven required guardianship and two experienced a decline in medical status). Of the intended sample of 22 clients, the principal investigator was unable to contact four of the clients. Eighteen clients were invited to participate in the study; three declined participation. Of the 15 eligible clients, one client did not have a home program reported in the medical record and two had incomplete data on the COPM. The final sample included in this study consisted of 12 participants. Seven clients were interviewed in their home and five were interviewed on the University of Puget Sound campus.

Participant demographics

Six participants in the sample were men (50.00%), six were women (50.00%). Ages ranged from 30 years to 78 years ($M = 60.67$, $SD = 13.68$). All participants ($N = 12$) were right-handed. Participants received services for the following diagnoses: left-sided cerebrovascular accident (CVA) with right hemiparesis ($n = 5$, 41.67%), right-sided CVA with left hemiparesis ($n = 3$, 25.00%), Parkinson's Disease ($n = 1$, 8.33%), bilateral synovitis ($n = 1$, 8.33%), right distal radius fracture ($n = 1$, 8.33%), and congenital hydrocephalus ($n = 1$, 8.33%). The time since onset of the condition ranged from 1.17 years to 21 years ($M = 5.07$, $SD = 5.49$).

Participants attended between 10 and 21 occupational therapy treatment sessions ($M = 17.58$, $SD = 3.48$), with approximately 50 minutes per session. At the time of the study, participants had been discharged from services for between 55 and 63 days ($M = 59.67$, $SD = 2.93$).

Overall Rates of Adherence

Of the twelve participants in this study, one (8.33%) was fully adherent, three (25.00%) were partially adherent, and eight (66.67%) were nonadherent with the home program prescribed

to them in the Occupational Therapy Adult Clinic. The three participants who were partially adherent chose to make modifications to their home programs; two (16.67%) participants increased the challenge when the home program became easy to accomplish and one (8.33%) participant increased the frequency from two days per week to five days per week. All three cited the reason for making modifications was because “I want my hand to work again.”

Eight (66.67%) participants decided on their own to stop their home program all together, citing reasons such as “lack of time” ($n = 3, 37.5\%$), “caregiver burden” ($n = 1, 12.5\%$), “rather do something else” ($n = 2, 25.0\%$), “forgot” ($n = 1, 12.5\%$), and “home program wasn’t flexible enough” ($n = 1, 12.5\%$). Two participants (16.67%) described their home programs with enough detail that accurately reflected the program described in the occupational therapy clinic record. Seven (58.33%) described the home program in the clinic record with at least partial congruence. Two (16.67%) described home programs that were completely different than what was described in the clinic record, citing “walking” and “pool exercises,” and one (8.33%) could not recall the home program at all. The two (16.67%) participants who recalled their home programs produced the education materials provided to them, although they reported no longer needing them to guide performance. The remaining ten participants reported that they did not know where their education materials were located.

Person factors

Generalized self-efficacy. The sample’s GSES scores (summarized in Table 3) were comparable to those of the normative sample of adults living in the U.S., indicating normal levels of generalized self-efficacy. The correlation between GSES scores and adherence was negligible, positive, and not statistically significant (see Table 3 for details).

Perceived health-related quality of life. The sample's PROMIS subtests z-scores (summarized in Table 3) indicate that, on average, participants presented with scores similar to the normative sample but individual participant scores varied up to 2 SD away from the normative population mean. There were wide variances ($SD > .50$) noted in participants' z-scores for all seven of the subtests indicating a large degree of variability in the reported HRQL of study participants (See Table 3). As expected given the wide variability in the scores on each of the subscales, correlations between PROMIS subtest scores and adherence were negligible-to-low, variable, and not statistically significant ($p > .05$; see Table 3 for details).

Provider factors

Client-centered communication. The sample's CAT scores (summarized in Table 3) indicate that all of the participants perceived their student therapists to use a very high level of client-centered communication strategies during therapeutic interventions. Due to the low power of the study and because the participants' responses on the CAT were clustered at the high end of the scale with little variability, a correlation statistic was deemed unlikely to yield meaningful results and was not calculated.

Perceived adequacy of instruction. One (8.33%) participant reported that she was "thoroughly" instructed by her student therapist in how to increase the challenge of her home program, five (41.67%) were instructed "somewhat," three (25.0%) reported "a little," and three (25.0%) reported "not at all." None (0.0%) of the participants reported that they were "thoroughly" taught when to stop doing their home program, three (25.0%) reported "somewhat," one (8.33%) reported "a little," and eight (66.67%) reported "not at all." The correlation between perceived adequacy of instruction and adherence was moderate and positive, but not statistically significant (see Table 3 for details).

Intervention factors

Congruence with client-identified occupational performance problems. Two (16.67%) of the home programs that were prescribed included therapeutic activities that were based on the occupational performance problems identified by the participant. One of the participant's client-identified occupational performance problems was "walking around in my neighborhood." Her home program included neuromuscular and cognitive strategies to operate the elevator from her apartment, exit the building, and cross the street without assistance. The other participant whose home program was congruent with her client-identified occupational performance problem of "typing on (her) computer to answer emails" was provided a home program designed to adapt the user interface using the accessibility features of the computer and to reduce tone in her hand through slow stretching and positioning.

Ten (83.33%) of the participants were provided home programs that did not match participants' client-identified occupational performance problems. They included preparatory activities, activities that were not identified as an area of concern, or both. Preparatory activities unrelated to occupational performance included gross and fine motor resistance training ($n = 5$, 41.67%), mirror therapy exercises ($n = 2$, 16.67%), weight-bearing exercises ($n = 2$, 16.67%), slow stretching for muscle tone reduction ($n = 2$, 16.67%), generalized stretching for relaxation ($n = 1$, 8.33%), tendon glides ($n = 1$, 8.33%), and the use of compression garments to reduce edema ($n = 1$, 8.33%). General activities that were prescribed in the home programs, but were not related to client-identified occupational performance problems, included playing lawn games ($n = 1$, 8.33%), vacuuming ($n = 1$, 8.33%), dancing ($n = 1$, 8.33%), washing the car ($n = 1$, 8.33%), gardening ($n = 1$, 8.33%), yoga ($n = 1$, 8.33%), and driving ($n = 1$, 8.33%).

A statistically significant, high, positive correlation was found between adherence with the home program and whether that home program included an occupational performance problem identified by the client in the COPM (see Table 3 for details).

Clarity of education materials. The sample's PEMAT-P scores (summarized in Table 3) indicate that, in general, student therapists designed written handouts that provided a moderate level of understandability and actionability, although there was wide variability in design and language. The correlations between the PEMAT subtest scores and adherence were negligible-to-low, positive, and not statistically significant (see Table 3 for details).

Treatment complexity. Two (16.67%) participants felt that the home program was "not at all complex," four (33.33%) felt that it was "a little complex," two (16.67%) felt that it was "somewhat complex," and four (33.33%) felt that it was "thoroughly complex." The correlation between treatment complexity and adherence was low, positive, and not statistically significant (see Table 3 for details).

Time commitment required. Two (16.67%) participants reported that they completed the home program assigned to them in 10 minutes or less. Seven (58.33%) reported taking 10 to 20 minutes. No participants reported taking 20 to 30 minutes. Three (25.0%) reported that their home program took greater than 30 minutes to complete. These three participants all continued to be adherent with their home programs two months following discharge. There was a statistically significant, very high, positive correlation between the time commitment required to complete the home program and adherence (see Table 3 for details).

Presence or absence of unintended side effects. Only one (8.33%) participant reported "feeling frustrated and impatient" with herself while performing her home program adding, "I know it just takes time, but I really want my hand to work." No other participants (91.67%)

reported unintended adverse side effects, such as pain or discomfort, during or as a result of their home program. Due to the clustering of the data, with only one participant reporting an unintended, adverse side effect, a correlation statistic was deemed inappropriate and was not calculated.

Contextual factors. The sample's MSPSS scores (summarized in Table 3) indicate that, on average, participants in this study reported a high level of social support. The correlation between MSPSS scores and adherence was positive, negligible to low, and not statistically significant (see Table 3 for details).

Discussion

This study sought to provide clinically-based empirical evidence to support the *Ecological Model of Adherence* in the examination of barriers to and facilitators for adherence with occupational therapy home programs. It was hypothesized that greater adherence would be associated with 1) higher levels of client self-efficacy, 2) moderate-levels of perceived physical functioning, 3) higher levels of perceived client-centered communication, 4) perceived adequacy of instruction, 5) greater congruence between home programs and client-identified occupational performance problems, 6) clearer client-education materials, 7) lower perceived complexity of the treatment, 8) lesser time commitment required, 9) absence of adverse side effects, and 10) higher levels of perceived social support.

Four key findings emerged from this study. First, the rate of adherence in this study (25.0%) was similar to those of studies examining adherence with HEP (35%, Chen et al., 1999), joint protection (28.59%, Hammond and Freeman, 2004), and splint wear (32.9%, Sandford et al., 2008). Participants in this study, however, demonstrated lower rates of adherence compared to other studies examining adherence with home modifications (65%, Cumming et al., 2001),

adaptive equipment recommendations (69%-91%, DeForge et al., 2008; 47%-82%, Kraskowsky & Finlayson; 72%, Thomas et al., 2010; 35%-100%, Wielandt & Strong, 2000), HEP (59%, DeForge et al., 2008), and family caregiver training (65.1%, Dooley & Hinojosa, 2004). This finding is not surprising as, with one exception, the home programs in this study did not include home modifications, adaptive equipment use, or caregiver training. The home programs that were prescribed to participants in this study were widely varied, most often containing a mix of occupation-based, activity-based, and preparatory activities (e.g., gross and fine motor strengthening exercises, slow stretches for muscle tone reduction, and sensorimotor reeducation), with an emphasis on activity-based and preparatory activities. These findings are consistent with Proffitt's (2016) finding that occupational therapists working with clients with neurological injuries incorporate a wide variety of recommendations in home programs, heavily focusing on preparatory activities. Furthermore, the findings are consistent with DeForge et al.'s (2008) findings that when multiple recommendations are made, the types of recommendations have an influence on the rate of adherence.

Second, the inclusion of occupation-based activities in the home program was highly and positively correlated with higher rates of adherence. Participants whose home programs explicitly included a problem area identified in the COPM were more likely to continue these home program two months after discharge. This finding supports the findings of White (2013) in that the inclusion of client-identified occupational performance problem areas in the design of home programs may have a significant impact on clients' adherence to home program recommendations, regardless of the specific type of intervention prescribed. Occupational therapy practitioners use human occupation as a critical component of intervention directed toward promoting health, well-being, quality of life, role competence, and participation in life

(AOTA, 2014). While occupational therapists may incorporate activity-based or preparatory interventions in home programs, including client-identified occupational performance concerns as part of an occupation-based home program may be a key facilitator for adherence.

Third, the amount of time required by participants to complete the home program was very highly and positively correlated with higher rates of adherence. Participants who reported that their home program required a greater amount of time (in excess of 30 minutes) to complete were more likely to be adherent. This finding is in sharp contrast with the findings of literature reviews (Christensen, 2004; Jin et al., 2008) and other studies (Clay & Hopps, 2004; Kraskowsky & Finlayson, 2001; White, 2013) on adherence, which indicate that home programs of longer duration negatively impact adherence with treatment recommendations. It also contrasts with occupational therapists' perceptions that home programs exceeding 30 minutes would be burdensome to clients (Proffitt, 2016). A potential reason for this discrepancy with previous research may be that engagement in occupation-based activities has been shown to result in increased engagement and longer participation (Heck, 1988; Kircher, 1984; Steinbeck, 1986; Yoder et al., 1989). The results of this study revealed that participants in this study who were adherent with their home programs also had home programs that included occupation-based activities. It may be that for the participants in this study, engagement in occupation-based activities may have taken more time to complete than preparatory activities.

Fourth, the reasons participants cited for discontinuing their home programs (lack of time, caregiver burden, rather do something else, forgot, and wasn't flexible enough) are consistent with those cited in previous reviews (Clay & Hopps, 2003; DeForge et al., 2008) of adherence in occupational therapy and may be attributed to several barriers identified in the literature. These barriers may include misfit with participants' existing routines (Chen et al.,

1999; Clay & Hopps, 2003; DeForge et al., 2008; Fuller, 2012), lack of involvement in the decision-making process (Thomas et al., 2010; Wessels et al., 2003; Wielandt & Strong, 2000), adding to the responsibilities of an already-burdened caregiver (Clay & Hopps, 2003), and acceptance of disability (Clay & Hopps, 2004; Wessels et al., 2003). It may be that for participants who did not continue their home programs, these barriers outweighed the perceived benefit of continuing the home program.

There were two factors that demonstrated moderate correlations with adherence, although these were not statistically significant: perceived adequacy of instruction and perceived treatment complexity (see table 3 for details). Given the low power of this study, consideration of these variables in relationship to the literature is warranted. Participants who reported receiving more instruction in how to modify their home programs were more likely to be adherent with them. This finding, although not statistically significant, is consistent with the findings of other studies (DeForge et al., 2008; Hammond & Freeman, 2004; Kraskowsky & Finlayson, 2001; Thomas et al., 2010; Wessels et al., 2003; Wielandt & Strong, 2000). Additionally, participants who perceived their home programs to be less complex in nature were also more likely to be adherent with their home programs. This finding is consistent with literature reviews (Clay & Hopps, 2003; DeForge et al., 2008) of adherence with occupational therapy home programs.

Limitations

A power analysis of the study revealed very low power, where $1 - \beta = .24$ and the probability of making a Type II error was .76 (based on a sample size of $N = 12$, an expected moderate effect size of .40, and an alpha level of .05 with two-tailed significance). Because of the low power of this study, statistically significant associations between most of the factors studied and adherence with home programs could not be established. Unfortunately, the results

of the study could not provide empirical support for the *Ecological Model of Adherence*. The findings of this study should not be generalized to other populations or to the types of home programs recommended by licensed occupational therapists. In order to improve the power of the study to clinically acceptable levels ($1 - \beta = .80$) with moderate effect sizes ($ES = .40$), an estimated 46 participants would be required (Portney & Watkins, 2015).

In addition to low power, there were several, significant limitations in the design, sampling, and methodology of this study that may have also impacted results. This study utilized a retrospective design to investigate participants' adherence. Retrospective research is limited in that variables of interest cannot be controlled, manipulated, or observed for change over time (Portney & Watkins, 2015). As this study was conducted through convenience sampling of a single cohort of clients from the adult clinic, a limited number of participants could be recruited for this study. Furthermore, the participants in this study are not representative of the variety of clients who receive occupational therapy services and the home programs were designed and instructed by student occupational therapists, although they were supervised by licensed occupational therapists. There may be important differences between the sample studied and other recipients of occupational therapy services or the manner in which home programs were designed and provided to participants, since the home programs were a required assignment for the student therapists.

Although efforts were made in the design of this study to select appropriate, standardized instruments with strong psychometric properties, some of the instruments used in this study may not have accurately measured the intended variable of interest. For example, the lack of a standardized, or even agreed-upon, method for operationalizing and measuring adherence was problematic. In previous research, adherence has been measured as a percentage of total

recommendations made (Chen et al., 1999; Cumming et al., 2001; Dooley & Hinojosa, 2004), the number of adaptive aids used divided the number of aids owned (Kraskowsky & Finlayson, 2001), by direct observation of client performance (Hammond & Freeman, 2004), and by client self-report according to differing categorizations, such as “adherent” and “nonadherent” (Sandford et al., 2008); “full,” “partial,” and “nonadherent” (DeForge et al., 2008); “entirely,” “mostly,” “a little bit,” and “not at all” (Fuller, 2012; White, 2013); and a variety of other descriptors (Wessels et al., 2003). In this study, adherence was defined as following, either in whole or in part, the home program recommendations as they were prescribed in the clinic record. Participants were strictly categorized as either “adherent” or “nonadherent.” Because adherence has been operationalized differently across studies, comparisons between studies may be difficult. Although the rate of adherence in this study was similar to those of other studies, it is important to consider that adherence to home programs occurs across a continuum between fully adherent and fully nonadherent and that clients’ behaviors cannot be easily operationalized into discrete categories.

A generalized self-efficacy measure was selected for use in this study because of the diversity of home program recommendations made by occupational therapists. While the generalized self-efficacy has been repeatedly shown to be a reliable and valid construct of a person’s capability to handle new and difficult tasks (Schwarzer & Jerusalem, 1995), using a measure of task-specific self-efficacy may have yielded different results.

Furthermore, while the CAT (Makoul et al., 2007) has been validated for use with medical practitioners, it has not been validated for use with rehabilitation therapists. Because the frequency and duration of interactions between clients and physicians and clients and occupational therapists are different, there may also be important differences between the

communication styles they employ (Petrosino, 2004). Because the participants in this study received home program recommendations from students enrolled in a graduate occupational therapy curriculum and the primary investigator was a faculty member of the curriculum, when asked to rate the communication styles of their student therapists, participants may have knowingly or unknowingly elevated their ratings. Additionally, while the clinic participants seek treatment, they often value the opportunity to help students and may be inclined to rate students more highly.

Future research

Given the absence of empirical research using the *Ecological Model of Adherence*, there are several recommendations in design, sampling, and methodology that could be implemented to further examine the associations between barriers to and facilitators for adherence with occupational therapy home programs. A prospective, longitudinal, quantitative study that uses repeated measures may reveal how these factors change over time. This information might help practitioners more specifically target important factors to facilitate adherence with home programs. Studies that examine the associations between adherence with home programs and various person, provider, intervention, and contextual factors should be designed with sufficient power to allow for regression analysis to measure predictive validity of relevant variables. Additionally, investigating samples from more traditional venues of service provision would likely yield more generalizable results. Surveying clients from a variety of inpatient, outpatient, and community-based services, with a wide range of acute and chronic health conditions may provide valuable information about potential differences between these populations.

While researchers generally agree on a definition of adherence that is consistent with the WHO, variable operational definitions continue to be used in research. An in-depth examination

and meta-analysis of the various ways adherence with occupational therapy home programs has been measured would prove helpful in finding consistency across studies.

Although client motivation was not a variable investigated in this study, the literature indicates that client motivation to complete a home program is strongly associated with improved adherence (Chen et al., 1999; DeForge et al., 2008; Fuller, 2012; Wessels et al., 2003; White, 2013; Wielandt & Strong, 2000). Wanting to regain hand function was the single common reason cited by most participants in this study who continued their home programs, two months following discharge. The strong desire to regain hand function may mitigate the influence of barriers to adherence. Future studies that examine the strength of association between motivation and adherence with home programs would help to identify whether the degree of motivation to regain hand function might be a predictor of adherence.

Future studies may also use other instruments to evaluate the influence of the variables studied. For example, a visual analogue scale to assess participants' subjective experience is an effective method for measuring a unidimensional characteristic (Portney & Watkins, 2015). Using a visual analog scale to measure participants' self-efficacy with executing the home program before the time of discharge may yield important findings for clinicians to address when prescribing home programs. Additionally, while the use of an unstandardized questionnaire to gather information may be useful for preliminary descriptive studies such as the current study, more rigorous measures should be employed in clinical outcome studies (Taylor & Kielhofner, 2006). Furthermore, a measure of the unique ways in which occupational therapists interact with their clients may provide valuable information on the association between client-centered communication and adherence with home programs. The Clinical Assessment of Modes (CAM; Fan & Taylor, 2016), which was developed to specifically assess communication styles of

occupational therapists, was published after data were collected for this current study. Based on the Intentional Relationship Model, the CAM offers four versions, each designed to assess the therapeutic encounter from one of four perspectives: the client's preferred method of communication style (CAM-P), the client's actual experiences (CAM-E), the therapist's self-report (CAM-T), and an assessment from an observer (CAM-O; Fan & Taylor, 2016). Each of these four perspectives may yield important information on the therapeutic alliance and its impact on adherence with home programs.

Finally, a narrative inquiry approach to qualitative methodology might be employed to explain clients' experiences and decisions with regards to their home programs. Such investigations would provide rich insight into how prescribed home programs either fit or did not fit with the complex fabric of clients' lives and may be helpful in identifying other barriers to or facilitators for adherence.

Implications for occupational therapy

This study attempted to identify some of the client, provider, intervention factors, and contextual factors that may present as barriers to and facilitators for adherence with home programs. While the results of this study are limited in providing clinically-based, empirical support for the *Ecological Model of Adherence*, this model provided a very useful framework to organize the existing literature on adherence with occupational therapy home programs and identify potential factors that present as barriers to and facilitators for adherence with home programs. Occupational therapy researchers and practitioners should be mindful of the myriad of factors that could positively or negatively impact adherence when designing and prescribing home programs.

The results of this study suggest that occupation-based home programs may have a powerful impact on facilitating adherence. When designing home programs for clients in preparation for discharge, occupational therapists utilize a wide variety of intervention strategies to improve outcomes. Strategies often include a mix of preparatory activities (such as gross and fine motor therapeutic exercise, stretching activities to increase joint active range of motion, techniques to reduce muscle tone, activities to facilitate sensorimotor reeducation), purposeful or value-added activities, and occupation-based activities. It may be important, however, that the client be made explicitly aware of the linkages between preparatory or purposeful activities and its intent to address specific client-identified occupational performance problems. It may also be helpful to include those linkages on patient education handouts.

In addition to the factors measured in this study, there are other potential areas that may influence adherence with home programs that were not explored. These include the clients' motivation to participate, the home program's potential disruption to clients' routines, and additional or perceived additional burdens to the caregiver. Participants in this study who were not adherent with their home programs cited these as reasons for abandoning it. It is important that occupational therapy practitioners be mindful of clients' values and priorities when designing and prescribing home programs. Additionally, it may be important for occupational therapy practitioners to further their understanding of these factors and the potential impact on adherence with home programs through continuing education.

The findings of this study also reinforce the need for occupational therapy educators to instruct students about the problem of nonadherence and the importance of identifying and addressing potential barriers to adherence when developing and instructing clients in home

programs. In curricular instruction, it may important to include a discussion of the roles that client, provider, intervention, and contextual factors have on adherence with home programs.

Deliberate consideration of the various factors that may present as barriers to and facilitators for adherence with occupational therapy home programs, regardless of the specific type of intervention recommended, is an important step in the occupational therapy process (Radomski, 2011). A thorough investigation of the strength and direction of associations that these factors have with adherence would have tremendous implications for occupational therapy education, research, and practice.

Summary

Occupational therapists incorporate many different intervention strategies when designing home programs to promote clients' successful health management and maintenance. Client adherence with these home programs is crucial to extending treatment outcomes once clients leave direct service. Many barriers to and facilitators for adherence with home programs have been identified in medical, psychological, and occupational therapy literature, but the investigation of these factors has remained specific to the intervention strategy being recommended. A more comprehensive discussion of the factors that predict adherence with occupational therapy home program recommendations in chronic disease management was undertaken.

The aim of this study was to investigate the clinical applicability of the *Ecological Model of Adherence* by evaluating potential associations between reported adherence with a home program and several person, provider, intervention, and contextual factors. Of the 10 variables studied, a home program's congruence with client-identified occupational performance problems demonstrated a high, positive, and statistically significant correlation with reported adherence,

two months following discharge. This finding suggests that home programs that are designed to incorporate the occupational performance areas reported by participants to be problematic in the COPM are strongly associated with continuance of the home program. The length of time reported by participants engaged in home program recommendations also demonstrated a high, positive, and statistically significant correlation. In comparison to clients with home programs that include preparatory or purposeful activities, clients who are engaged in occupation-based home programs may, by necessity, require more time to complete them.

While the results of this study provided limited empirical support for using the *Ecological Model of Adherence* to identify and examine the numerous factors that may impact client adherence with home programs, there may still be important associations between these factors and adherence. Additional research may yet provide support for using the *Ecological Model of Adherence* when investigating the complex mechanisms that influence client adherence with home programs. Furthermore, it may potentially improve occupational therapists' understanding of important person, provider, intervention, and contextual factors that influence clients' success with chronic disease management, thereby advancing clinical outcomes and the overall health and well-being of our clients.

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Appendix

Structured interview script

Tell me about your home program

1. To the best that you remember, describe in detail what you were instructed to do:

2. Is this something that you want to do, or need to do?
 Thoroughly Somewhat A little Not at All

3. How often are you doing your home program?

4. Were you taught how to make your home program harder when it became easy to do?
 Thoroughly Somewhat A little Not at All

5. Were you taught when to stop doing your home program?
 Thoroughly Somewhat A little Not at All

6. Were you given a chance to practice your home program with the student therapist watching?
 Thoroughly Somewhat A little Not at All
 (skip Question #6 and continue to Question #7)

7. When you were practicing with the student therapist, were you provided feedback that you found useful?
 Thoroughly Somewhat A little Not at All

8. How complicated was the home program to follow?
 Thoroughly Somewhat A little Not at All

9. How much time did it take to complete the home program in any given session?
 less than 10 minutes
 10 to 20 minutes
 20 to 30 minutes
 greater than 30 minutes

10. Were there any unpleasant side effects that happened to you because of the home program, but that did not expect?

- yes (go to Question #10)
 no (skip Question #10 and go to Question #11)

11. What were they?

12. Do you still do your home program *as it was taught to you*?

- yes (go to Question #12 then STOP)
 no (skip Question #12 and go to Question #13)

13. What is the one main reason you continue your home program?

1. Did you make changes to your home program?

- yes (go to Question #14 then STOP)
 no (skip Question #14 and go to Question #15)

14. What was the one main reason you changed your home program?

15. Did you stop doing your home program?

- yes (go to Question #16)
 no (skip Question #16 and STOP)

16. What was the one main reason that you stopped doing your home program?

[STOP. This is the end of the interview.]

Table 1

Summary of empirical studies describing factors that influence adherence with home programs in occupational therapy, 1999 – 2017, organized by the *Ecological Model of Adherence*.

Study	Sample	Population	Follow-up interval	Method	Intervention type	Rate of adherence; operationalization	Person factors	Provider factors	Intervention factors	Contextual factors
Chen, Neufeld, Feely, & Skinner, 1999	<i>N</i> = 63 Age range: 23 to 88 years <i>M</i> = 47.8 years	UE impairment (nerve compression syndrome, shoulder injuries, fractures)	1 week to >1 year	Mailed questionnaire	Therapeutic exercise	35% were fully compliant Patient report compared to chart review: percentage of recommended exercises performed	Perceived self-efficacy; internal health locus of control		Fit with existing routines	Assistance with child-care needs; support from spouse/family
Cumming, Thomas, Szonyi, Frampton, Salkeld, & Clemson, 2001	<i>N</i> = 121 Age range: not provided <i>M</i> = 77 years	Older adults living at home	12 months	In-home observation compared to chart recommendations	Home modification and falls prevention	65% adherent with at least half of recommended changes Number of recommendations with full or partial adherence divided by total number of recommendations	Belief that home modifications prevent falls			Help from relatives
DeForge, Cormack, Byrne, Hillier, Mackenzie, & Gutmanis, 2008	<i>N</i> = 63 Age range: not provided <i>M</i> = 79.1 years	Older adults following orthopedic surgery (hip/knee) and others identified as frail; Specialized Geriatric Unit	3 months	Telephone interview	Multi-disciplinary recommendations (additional appointment, medications, equipment, exercise, further treatment, community services)	Full adherence ranged between 14% (disposal of expired medications) to 100% (wound care & diabetes mgmt) Adaptive equipment (69% to 91% fully adherent) Home exercise program (59% fully adherent, 31% partially adherent) Self-reported rates of adherence (0 = no adherence, 1 = partial adherence, 2 = full adherence)	Age, functional performance (Functional Independence Measure, Berg Balance Scale, Mini Mental State Exam, Geriatric Depression Scale), perceived necessity/value of recommendations, motivation, patient and caregiver agreement with recommendations.	Healthcare provider support/assistance	Number of recommendations, complexity of recommendations, time required to acquire recommended devices, fit with existing routines	Availability of transportation, availability of caregiver/family support, degrees of caregiver burden, physical environment, equipment design

Table 1 (continued)

Summary of empirical studies describing factors that influence adherence with home programs in occupational therapy, 1999 – 2017, organized by the *Ecological Model of Adherence*.

Study	Sample	Population	Follow-up interval	Method	Intervention type	Rate of adherence; operationalization	Person factors	Provider factors	Intervention factors	Contextual factors
Dooley & Hinojosa, 2004	<i>N</i> = 40 Age range: not provided <i>M</i> = 77.08 years	Alzheimer's dementia	1 to 6 months	Telephone interview	Family caregiver training	Caregivers followed 65.1% of recommendations; all caregivers followed at least one strategy at least part of the time Number of strategies followed divided by number of strategies recommended				Degrees of caregiver burden
Fuller, 2012	<i>N</i> = 18 Age range: 24 to 78 years <i>M</i> = 59.8 years	Adults with chronic conditions (cerebrovascular accident, traumatic brain injury, spinal cord injury)	7 months	Telephone interview	Occupation- and activity-based versus preparatory activity	Occupation- or activity-based: 16% ("entirely"), 11% ("mostly"), 26% ("a little bit"), 47% ("not at all") Preparatory activity: 27% ("entirely"), 15% ("mostly"), 27% ("a little bit"), 31% ("not at all")	Age; motivation to participate		Number of treatment recommendations; appropriateness or perceived necessity of recommendation; match with client; incorporation into daily routines	Availability of transportation; availability of funding to access materials/resources; family support; time schedules
Hammond & Freeman, 2004	<i>N</i> = 65 Age range: 44 to 59 years <i>M</i> = 52 years	Rheumatoid arthritis	4 years	Observation of task performance	Joint protection	28.59% utilized correct techniques Joint Protection Behavior Assessment: 20 tasks scored as percentage of times correct technique observed	Physical function		Number of training sessions attended	
Sandford, Barlow, & Lewis, 2008	<i>N</i> = 76 Age range: 17 to 66 years <i>M</i> = 30 years	Post tendon repair surgery	4 weeks	Mailed questionnaire	Splint wear	32.9% did not remove splint prior to recommendation	Gender			

Table 1 (continued)

Summary of empirical studies describing factors that influence adherence with home programs in occupational therapy, 1999 – 2017, organized by the *Ecological Model of Adherence*.

Study	Sample	Population	Follow-up interval	Method	Intervention type	Rate of adherence; operationalization	Person factors	Provider factors	Intervention factors	Contextual factors
Stewart, Bhagwangee, Mbakaza, & Binase, 2000	<i>N</i> = 23 Age range: 18 to 52 years <i>M</i> = 33.5 years	Adults with burn injuries	Recovery period (unspecified)	Questionnaire	Pressure garment use for scar management	Varied depending on factors studied; client self-report		Instructions on wear	Garment type, garment comfort, garment cosmesis	
Thomas, Pinkelman, & Gardine, 2010	<i>N</i> = 9 Age range: 46 to 84 years <i>M</i> = 66 years	Post total hip replacement	3 months to 4 years	Telephone questionnaire	Adaptive equipment	72% “always” used device	Improvement of medical condition	Adequacy of instruction; involvement in decision-making process		Presence of environmental restrictions; levels of social support
White, 2013	<i>N</i> = 18 Age range: 33 to 76 years <i>M</i> = 60.8 years	Adults with chronic conditions (stroke, traumatic brain injury, Parkinson’s disease, osteoarthritis, multiple sclerosis, brachial plexus injury, spinal cord injury)	Not reported	Telephone or in-person survey	Occupation-based versus activity-based versus preparatory activity	Across all intervention types: 41% (“entirely”) 30% (“mostly”) 20% (“somewhat”) 9% (“not at all”)	Memory, interest/ motivation		Enjoyability, perceived benefit, number of recommendations made, time required, matching occupational goals, degree of challenge beyond capacity	

Table 2
 Summary of literature reviews describing factors that influence adherence in occupational therapy, 2000 – 2017, organized by the *Ecological Model of Adherence*.

Study	Population	Follow-up interval	Method	Intervention type	Rate of adherence; operationalization	Person factors	Provider factors	Intervention factors	Contextual factors
Clay & Hopps, 2003	Not described	Not described	Informal review of medical and behavioral psychology literature, methods not described	Not described	Not described	Sex, race/ethnicity, culture, age, socioeconomic status, health beliefs and behaviors, psychological factors (self-esteem, self-efficacy, social functioning, locus of control, level of adjustment, depression)	Job satisfaction, empathy, consistency, specialty, willingness to answer questions, follow-up appointments, number of tests ordered, number of clients seen in a week, assessment of patient’s lifestyle and routine, evaluation of complexity and location necessary for treatment regimen, involvement of patient in design of treatment regimen, identification of specific factors in treatment regimen that produce the desired effect, design of treatment to minimize deviation required from normal lifestyle and routine	Deviation required from normal routine, level of compliance necessary for sufficient improvement, presence or absence of adverse side effects, amenability to assistive technology, aversive tasks in administering treatment, technical skills needed, complexity of treatment regimen, duration of treatment administration, face validity of treatment, self-awareness needed to implement treatment, level of noticeable improvement, acute versus chronic treatment	Support system, distance from residence, specific site necessary for treatment, generalizability of treatment environment to living environment, architectural barriers, ease of equipment use
Kraskowsky & Finlayson, 2001	Over 55 years Hospitals, retirement community, general community settings, home health agencies and service organizations	3 to 9 months	Systematic review 1980-1998 14 studies N = 11 to 14,210 Canada, UK, US, Sweden	Adaptive equipment	47% to 82% adherence with decreasing use over time Use within first month after discharge predictive of later use Rates of use determined by number of aids used divided by number of aids owned	Age, gender, education, marital status, income, severity of health condition, perceived need of device, functional improvement, locus of control	Adequacy of training, appropriateness of prescription; pre-prescription home visits	Equipment suitability, fit with client, length of time since discharge, time required, drawing unwanted attention, perceived symbolism of device; time spent receiving training	Living arrangement, fit with environment, effectiveness of device, equipment durability, ease of use

Table 2 (continued)

Summary of literature reviews describing factors that influence adherence in occupational therapy, 2000 – 2017, organized by the *Ecological Model of Adherence*.

Study	Population	Follow-up interval	Method	Intervention type	Rate of adherence; operationalization	Person factors	Provider factors	Intervention factors	Contextual factors
Wessels, Dijcks, Soede, Gelderblom, & DeWitte, 2003	Not described	Not described	Informal review, methods not described	Adaptive equipment	Rates not provided “not used at all,” “not used full time,” “not used voluntarily,” “not used at time of questioning,” “not used frequently,” “not used for a substantial part of the day,” “not used at any given point post discharge,” “average use is low,” “not been used at least three times since prescription,” “not used correctly,” “not used for all the activities it was prescribed for”	Age, gender, diagnosis, client expectations of self and of equipment, acceptance of disability, emotional maturity, inner motivation, striving for independence, progression of disability, severity of disability, change in severity of disability, use of multiple devices	Adequate instruction received, involvement in decision-making process; presence of follow-up service	Time lapse between decision-making and acquisition,	Social support, physical environment, correct installation or adjustment, quality of device, portability, ease of use
Wielandt & Strong, 2000	Ages 2.5 years to 93 years Spinal cord injury, arthritis, cerebral palsy, orthopedic conditions, lower back pain, visual impairment, cognitive impairment, stroke	2 weeks to 11 years	Systematic review 1963-1996 31 studies N = 8 to 502 UK, US, Canada, South Africa, Australia	Adaptive equipment	35% - 100% operationalization not discussed	Age, choice, gender, living arrangement, perceived benefit/value, satisfaction with equipment, change in physical status, perceived embarrassment, motivation, self-confidence, preference for human assistance, preference for alternative method, psychosocial issues	Assessment considered appropriate by client, home visit conducted, adequacy of training, location of training, training includes caregiver, involvement in decision-making process	Aesthetics, considered appropriate by client, prompt delivery, number of training sessions provided	Home environment, living arrangement, perceived adequacy of equipment

Table 3

Association Between Factors and Reported Adherence (N = 12)

Measure	Range	<i>M</i>	<i>SD</i>	<i>r_{bs}</i> (10)	<i>p</i> -value	95% CI	<i>r_φ</i> (1)	<i>p</i> -value
Person-related factors								
GSES †	21 – 40	31.75	5.15	.10	.75	[-.39, .96]		
PROMIS								
Physical function	-2.35 – .78	-.91	.83	.15	.63	[-.71, .70]		
Anxiety	-1.09 – 2.27	.13	1.26	-.16	.63	[-.84, .56]		
Depression	-1.16 – 2.50	-.06	1.31	-.11	.74	[-.85, .55]		
Fatigue	-1.66 – 2.10	-.09	1.26	-.13	.69	[-.88, .51]		
Sleep disturbance	-1.83 – 1.23	.01	.88	.21	.52	[-.42, .90]		
Social roles	-2.33 – .75	-.45	.93	.26	.42	[-.41, .95]		
Pain interference	-.89 – .86	-.13	.72	.37	.23	[-.34, .99]		
Provider-related factors								
CAT	89.33 – 100	96.78	4.27	‡				
Instruction							.55	.31
Intervention-related factors								
Client-identified problem							.63	*.028
PEMAT-P								
Understandability	50 – 82.35	68.51	12.58	.34	.29	[-.39, .96]		
Actionability	40 - 100	63.06	17.14	.13	.68	[-.62, .79]		
Treatment complexity							.40	.60
Time commitment required							.82	*.017
Adverse side effects							‡	
Context-related factors								
MSPSS	60.71 - 100	85.62	11.77	.13	.69	[-.68, .73]		

Note. GSES = Generalized Self-Efficacy Scale; PROMIS = Patient Reported Outcome Measurement Information System; CAT = Communication Assessment Tool; PEMAT-P = Patient Education Materials Assessment Tool – Print Materials; MSPSS = Multidimensional Scale of Perceived Social Support

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

† GSES normative sample of adults living in the U.S. ($N = 1594$, $M = 29.48$, $SD = 5.13$; Schwarzer 2014)

‡ Due to the low power of the study and clustering of data, correlation was not calculated

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