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An Internet-Based Virtual Reality Intervention for Enhancing Self-Esteem in Women With Disabilities: Results of a Feasibility Study

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Abstract

Purpose: To examine the feasibility of an online self-esteem enhancement group program for women with disabilities. **Method**: A sample of 19 racially and ethnically diverse, community-living women with physical disabilities, 22-61 years old, participated in a 7-session interactive group intervention (extending Hughes et al., 2004) in the 3-D, immersive, virtual environment of SecondLife.com, using avatars with voice and text communication. Baseline and post-intervention questionnaires were administered online. Criteria for determining feasibility were: 1) enrollment, 2) engagement, 3) acceptability, and 4) improvement on measures of self-esteem, depression, self-efficacy, and social support. **Results**: We attained our enrollment goal and engagement exceeded expectations. Acceptability was positive; participants gave "helpful" and "enjoyable" ratings of 3.21 and 3.27, respectively, (mean on Likert scale of 1-4 with 4 = high) to five intervention components – session materials, group sharing and discussion, relaxation exercises, action planning, and group excursions. Significant increases from baseline to post-intervention were found on the Rosenberg Self-Esteem Scale (p = .02; Cohen's d = .60) and the Center for Epidemiologic Studies Depression Scale-10 (p = .005; Cohen's d = .74), with a trend toward significance on the Generalized Self-Efficacy Scale (p = .08; Cohen's d = .42). The intervention did not significantly affect the measure of social support. **Implications**: An intervention to enhance self-esteem may have a corollary benefit on depressive symptomatology. Offering psycho-educational, small group interventions using online virtual worlds shows promise for circumventing disability-related and environmental barriers to accessing mental

health services experienced by women with mobility limitations, and should undergo further development and testing.

KEY WORDS: women; disability; self-esteem; intervention; virtual reality

Impact

- This is the first systematic examination of a mental health intervention for women with physical disabilities offered in an Internet-based virtual reality environment. We demonstrated feasibility in terms of enrollment, engagement, and acceptability by users, as well as positive outcomes, based on both quantitative and qualitative data.
- A virtual reality self-esteem enhancement intervention for women with physical disabilities, based on the face-to-face version developed by Hughes et al. (Hughes, Taylor, Robinson-Whelen, Swedlund, & Nosek, 2004), yielded improvements in self-esteem and depressive symptomatology, with a trend toward improvement in generalized self-efficacy.
- The strong, positive response by participants to qualitative measures of satisfaction, quality of intervention implementation, and outcomes indicate potential for further developments and testing of mental health interventions offered in online virtual reality media.

Background

Self-esteem has been acknowledged as an important element of psychological well-being for more than 100 years. (James, 1890; Maslow, 1987; May, 1953). Mruk (Mruk, 2006) refers to self-esteem as "…the lived status of one's competence at dealing with the challenges of living in a worthy way over time" (p. 28). A product of the lived experience, self-esteem is complex and can be considered either a fluid "state" of being or a characteristic "trait" at any point in time. While, as a static trait, self-esteem protects the self against life stressors, dynamic self-esteem is a social gauge that responds to situational circumstances and challenges (Mruk, 2006). The current study approaches self-esteem as a dynamic, and thereby changeable, state.

There is evidence that women with disabilities have significantly lower self-esteem than women without disabilities (Duvdevany, 2010; Nosek, Hughes, Swedlund, Taylor, & Swank, 2003). Considering only studies addressing self-esteem in women with disabilities (some using cross-disability samples, others focusing exclusively on rheumatic diseases, spinal cord injury, or multiple sclerosis), there is evidence for an association of low self-esteem with unhealthy behaviors (Chang et al., 2009; H. Y. Lee, Suh, & Kim, 2005), decreased sexuality (Hassouneh-Phillips & McNeff, 2005; Koch, Kralik, & Eastwood, 2002; Kreuter, Siösteen, & Biering-Sørensen, 2008; Xibillé-Friedmann, Alvarez-Fuentes, Flores-Flores, Gudiño-Quiroz, & Cruz-Valdez, 2005), less supportive relationships (Hassouneh-Phillips & McNeff, 2005), parental overprotectiveness (Manuel, Balkrishnan, Camacho, Smith, & Koman, 2003; Nosek et al., 2003), and abuse (Hassouneh-Phillips, 2005; Hassouneh-Phillips & McNeff, 2005; Hassouneh-Phillips, McNeff, Powers, & Curry, 2005). Additionally, the self-esteem of women with disabilities has been linked with their quality of life (Duvdevany, 2010), perceived physical health (Cornwell & Schmitt, 1990; Gidron, Levy, & Cwikel, 2006), and severity of disability (Crigger, 1996;

Kaminski & Hayslip, 2006). Qualitative studies have identified strong, positive self-esteem as important for women to deal effectively with the challenges of disability (Hwang, Kim, & Jun, 2004; Nosek, Howland, Rintala, Young, & Chanpong, 2001).

Evidence links low self-esteem with depression among people in the general population (Brown, Andrews, Harris, Adler, & Bridge, 1986). Meta-analysis of longitudinal data supports a vulnerability model, indicating that low self-esteem is a risk factor for depression (Kuster, Orth, & Meier, 2012; Orth, Robins, Trzesniewski, Maes, & Schmitt, 2009; Sowislo & Orth, 2013). Low self-esteem could also be a consequence of mental health disorders, such as depression, anxiety and panic (Morton, Roach, Reid, & Stewart, 2012). Studies have found an association between low self-esteem and depression among stroke survivors (Smith, Egbert, Dellman-Jenkins, Nanna, & Palmieri, 2012), women with HIV (Simoni, Montoya, Huang, & Goodry, 2005), and women with physical disabilities (Hughes et al., 2004; Xibillé-Friedmann et al., 2005).

Literature on self-esteem supports its association with social connectedness, such that a sense of connectedness promotes high self-esteem and shared social identity in supportive social contexts (R. M. Lee & Robbins, 1998). Individuals with physical disabilities often perceive barriers to social interaction, which impede the formation of positive social connections (Soleimani, Negarandeh, Bastani, & Greyson, 2014). Consequently, a lack of social connections and social identity can generate low self-esteem in individuals with disabilities (Forgeron, Evans, McGrath, Stevens, & Finley, 2013). However, social connectedness in environments that promote coping and empowerment related to disability may positively influence self-acceptance (Obst & Stafurik, 2010).

Researchers and advocates have called for safe, inclusive self-development interventions in which women with disabilities serve as mutual role models to enhance visibility and empowerment (Deegan & Brooks, 1985; Duvdevany, 2010; Fine & Asch, 1988; Saxton, 1985). When interacting in groups with other women living with disabilities, participants are more likely to experience a learning climate free of invasion, shaming, humiliation, and trespassing behaviors and gestures (Beattie, 1987). Such groups offer women opportunities to share information about resources and together confront ableism, sexism, and other internalized oppressions (Saxton, 1985).

Interest in the development and testing of self-esteem interventions has grown over the past 10 years across many countries, with programs ranging in duration from one day (Chadwick, Smyth, & Liao, 2014) to 10 weeks (Tirlea, Truby, & Haines, 2015). Two focused on the needs of girls (Apinuntavech, Panichpong, Shuaytong, Suparp, & Ngoenwiwatkul, 2009; Tirlea, Truby, & Haines, 2013) and one on women with Turner Syndrome (Chadwick et al., 2014). Several drew on the cognitive behavioral therapy approach to self-esteem enhancement by Melanie Fennell (Fennell, 2006).

Despite the significant role played by self-esteem in the health and wellness of women with disabilities, our literature search uncovered documentation of only one empirically-based self-esteem enhancement intervention for women with physical disabilities. The six-week "Self-Esteem Enhancement Workshop for Women with [Physical] Disabilities" (henceforth referred to as the "original workshop") was developed and its efficacy tested by researchers at the Center for Research on Women with Disabilities (Hughes et al., 2004). This intervention was an adaptation of a six-session, weekly group intervention previously developed for women in general that focused on self-esteem and relationships (McManus, Redford, & Hughes, 1997). We added

content derived from literature on self-esteem, depression, self-efficacy, social connectedness, and disability. The intervention is grounded in self-efficacy theory (Bandura, 1986, 1997), feminist disability theory (Garland-Thomson, 2003), feminist psychology (Jordan, 2010), and independent living philosophy (Nosek & Fuhrer, 1992). The behavioral and behavior change components of the workshop were patterned after the Chronic Disease Self-Management Program developed by Lorig and colleagues (Lorig et al., 1999). The goal of the self-esteem workshop was to increase self-esteem, self-efficacy, social connectedness, and decrease depressive symptomatology. This group intervention consists of a series of six, two hour-long, weekly, peer-led, highly structured sessions designed to offer women with physical disabilities an opportunity to enhance their self-esteem in a context of connectedness. Important elements of the workshop include (a) discussion of the impact of gender and disability role socialization; (b) information and activities related to self-empathy, self-esteem, self-care, and management of emotional health; (c) communication and assertiveness training; (d) structured activities to enhance self-efficacy; and (e) activities to promote mutual social support and connectedness.

The workshop was administered by staff at centers for independent living (CILs) across the U.S. The efficacy of the workshop was supported in a randomized two-group (intervention versus usual care) study using a pre-post design (N = 102, 51 per group). Compared to participants in the control group (i. e., those receiving regular CIL services), participants in the intervention group showed significantly greater improvements on two measures of self-esteem, a measure of general self-efficacy, and a measure of depression. Although the intervention group showed an increase and the control group showed a decrease in social connectedness, the differences did not reach statistical significance. The authors (Hughes et al., 2004) of the article on this earlier self-esteem workshop expressed the opinion that social connectedness may not

have significantly increased in the intervention group as expected because the participants may have already been socially connected before beginning the program. Women able to attend a face-to-face weekly group program may be less socially isolated due to having fewer barriers to transportation and, therefore, have the ability to get out of their homes for purposes of social connection. They also noted the importance of reaching more women with severe physical disabilities, minority women, and those who live in rural settings.

The current study uses a refined and expanded version of the original intervention curriculum based on feedback gathered from project staff, facilitators, and post-intervention interviews with the original participants. We sought, however, to circumvent some of the barriers experienced by women who have more severe physical disabilities, live in more remote areas, and face other barriers to participating in face-to-face workshops (such as problems managing transportation, pain, fatigue, child care) by offering a small group self-esteem enhancement intervention over the Internet. Project staff decided against using telephone-based conference calls, because that mechanism was viewed as too impersonal and offering limited strategies to stimulate participant engagement. The expense involved in purchasing WebCams and reliable programs for participants and project staff, plus the lack of anonymity precluded the use of videoconferencing. We chose to use the virtual world of Second Life® (Linden Lab, 2011), which is accessed by downloading a free program at www.Secondlife.com to a hard drive on a computer.

Second Life is a 3-D, immersive computer-simulated environment (Calongne, 2008). The world consists of islands that can be rented and built out by more experienced individuals who can create 3-D simulated objects or purchase landscapes, landscaping items, buildings, furniture, animated vehicles, animals, and all manner of game and experiential simulations from vendors in

Second Life. Universities use Second Life to simulate classroom environments and offer students immersive learning experiences (Calongne, 2008). Health professionals are using Second Life as a 3-D computer generated virtual environment to simulate various scenarios; for example, a hospital environment to help patients with intellectual disabilities learn better (Hall, Conboy-Hill, & Taylor, 2011) and a home environment to help occupational therapists learn how to access a client's function in a home environment (Sabus, Sabata, & Antonacci, 2011).

Those who are new to Second Life can register without cost and select a pre-fabricated avatar from a gallery or create their own from a menu of characteristics. An avatar is a three-dimensional cartoonlike representation of themselves that they can manipulate to walk, run, jump, fly, sit, lie down, swim, dance, etc. using arrow keys or on-screen navigational controls (Boulos, Hetherington, & Wheeler, 2007). Avatars can be given a wide variety of body characteristics, hairstyles, clothing, and accessories. Communication with other avatars occurs by text or voice. There are 39 million registered users of Second Life internationally and up to approximately 50,000 online at any given time on about 1700 square kilometers of virtual land (Shepherd, 2014). Specific programs can be offered on parcels of land with restricted access. Participants have the option of giving their avatar a visible disability or assistive devices (wheelchair, crutch, cane, etc.). This virtual world offers people with significant mobility limitations opportunities for movement and social engagement that can only be imagined in real life (Stewart, Hansen, & Carey, 2010), as well as the unique experience of experimenting with alternative forms of embodiment and presence in a social context.

Second Life has been used as a medium for disseminating health information (Beard, Wilson, Morra, & Keelan, 2009), a venue for offering health promotion interventions (Annang, Muilenburg, & Strasser, 2010), and delivering clinical services, particularly psychotherapy

(Gorini, Gaggioli, Vigna, & Riva, 2008). Little research has been done, however, on virtual group-based interventions (Watson, Grant, Bello, & Hoch, 2008). Studies show that behaviors from virtual worlds can translate effectively to the real world (Beard et al., 2009; Georgieva, 2011; Morie, Haynes, Chance, & Purohit, 2012). Within the field of rehabilitation, virtual reality has primarily been used for its value in simulating physically therapeutic environments with intended outcomes of restoring, maintaining, or improving physical functioning and independence (Holden, 2005; Lange et al., 2010; Obdržálek, Kurillo, Han, Abresch, & Bajcsy, 2012; Rizzo et al., 2011; Wilson, Foreman, & Stanton, 1997).

The dual purposes of the current study were, first, to modify our original face-to-face self-esteem intervention curriculum (Hughes et al., 2004) so that all of its components could be replicated in Second Life; and second, to test the feasibility of offering the Self-Esteem Enhancement intervention in Second Life. We examined the literature on pilot studies of Internet-based interventions for variety of chronic conditions to identify variables used to determine feasibility. We found reports on studies of interactive web-based programs (Clark et al., 2013; Glasgow et al., 2011; van Zutphen, Milder, & Bemelmans, 2009), web-based programs that interact with wearable monitoring devices (L. J. Ware et al., 2008), applications for mobile phones or digital assistants (Sorbi, Mak, Houtveen, Kleiboer, & van Doornen, 2007), and eHealth software platform, including a virtual clinic (Jennings, Powell, Armstrong, Sturt, & Dale, 2009; Robben et al., 2012; Schrader et al., 2014). Although none reported testing a web-based small group workshop like ours, we found variables that had been used successfully to operationalize feasibility. These factors included: 1) enrollment of participants, 2) engagement in terms of attendance and attrition, 3) improvement on outcomes of interest, specifically, self-esteem, self-efficacy, social support, and depression, and 4) acceptability of training,

intervention, and support from facilitators and other participants, and comparison with face-to-face programs.

Methods

Development of the Self-Esteem in Second Life Intervention

Intervention Development

We adapted our existing face-to-face self-esteem intervention curriculum based on feedback from original workshop participants (Hughes et al., 2004), new focus groups of women with physical disabilities from metropolitan and rural areas, and advisors to the current project. The Self-Esteem in Second Life (SESL) intervention consists of seven group sessions in Second Life, with homework, Second Life "adventures," and action plans to be completed between sessions. The purpose of Session 1 is to orient the women to the program, and to Second Life. The participants and leaders introduce themselves, and the participants are invited to talk about how they feel about having an avatar, and moving around in Second Life. There is also a discussion about confidentiality, and respectful interaction. The leaders give an outline of all 7 sessions, and let the women know what is expected of them: preparing for each session and continuing work on the action plan, arriving on time and staying until the end of the session, filling out questionnaires, and actively participating in discussion. Women are also introduced to important processes in this session, such as setting goals and formulating action plans. The last session allows the women to review what they have learned about self-esteem, and reflect on the workshop experience. They also discuss continuing their action plans, and the leaders give them important reminders about their change process, such as being patient with themselves during the change process. Table 1 describes the content of each session.

The purpose of the Second Life adventures (i. e., excursions to meditation sites or recreational venues and other locations outside our island in Second Life) was to replicate the buddy activities from the original face-to-face program, to offer informal social interaction opportun with ities among group members outside of the structured sessions, and to help them become more comfortable navigating in Second Life. As with the original workshop, each session ends with goal setting and action planning, and each subsequent session starts with a review of participants' success in completing their action plans. For example, one participant set as her goal getting out of the house more often. Her action plan for the week was to take her dog for a walk on Monday, Wednesday, and Friday. She set her confidence level at 7 (on a scale of 1-10, with 10 being extremely confident). At the beginning of the next session, she told the group that due to the rain on Wednesday and Friday, she could only implement the plan on Monday, but she did get to talk to a neighbor that day and went to church on Sunday. Other popular action planning topics were reaching out to an old friend within the week, spending some time reading each day, cleaning up a messy work area, doing a relaxation exercise on three days in the coming week, and practicing specific assertiveness skills with a spouse or child. The most substantial changes made to the original intervention were: a) increasing the intervention from six to seven sessions to allow more time for adequate coverage of the content, and b) as urged by focus group members, expanding content regarding personal safety in relationships.

Development of the Private Island in SL

We developed a private and secure parcel of a Second Life tropical island dedicated to this project. This setting contained a variety of venues for group meetings, each with an interactive whiteboard for showing PowerPoint slides during group sessions or between sessions.

Throughout the island we included additional navigational kiosks, media displays, and whiteboards with access to Internet resources. We also incorporated features designed to create a fun and engaging atmosphere, such as a beach with the sights and sounds of the ocean, a cave with a nearby waterfall, and a swimming pool with a sunken bar and hot tub. Other features available through Second Life include the ability to modify the environment (dim the lights for relaxation exercises), teleport to other venues for self-esteem-building adventures (e.g., horseback riding), offer rewards (virtual clothes, jewelry, etc.) for completing tasks and meeting goals, and offer easy opportunities for socialization and mutual support outside of group sessions.

Development of the Second Life Training Component

Given the novelty of virtual environments, we developed a training program to prepare study participants to use Second Life. The group facilitators led the training, which allowed for rapport building even prior to the first session. Participants were emailed a link to download the Second Life program and the *Quick Start Guide* (Porcher, Goe, Nosek, & Nosek, 2010) and *The Newbie Woman's SL Survival Kit* (SL Left Unity Feminist Network, 2009). Based on feedback from the beta test, we enhanced the training program and added a third training session. The first two training sessions were conducted individually using the telephone as necessary, followed by entry into Second Life. The training introduced basic avatar manipulation and navigational skills, communicating by text and voice, setting landmarks, and accessing the inventory. The additional session gave participants a chance to practice these skills in a small group of avatars within Second Life prior to the initiation of the intervention. Participants who were experienced Second

Life users received all of the training materials and a tour and orientation to the project's private island prior to the first group session.

Beta Test of the Self-Esteem in Second Life Intervention

Four women with physical disabilities who were not previous Second Life users beta-tested the orientation and intervention, completed an online evaluation after each session, and participated in a post-intervention interview. Feedback from the beta-testers has been published elsewhere (Nosek et al., 2011).

Although participant feedback was generally positive, several suggestions for improvement were offered by the beta testers, group facilitators, and project team members. In addition to expanding the number of Second Life training sessions from two to three, we created an abbreviated guide to common navigational functions in Second Life. We also decided to assist participants in creating their own avatar for use in Second Life, rather than offering them a collection of avatars from which they could choose as we had done in the beta test. This encouraged more personalized feelings of embodiment and ownership of the avatar. Key modifications to the intervention and procedures included: 1) incorporating more discussion and sharing in the early sessions to promote group rapport; 2) modifying group excursions with facilitators as tour guides to promote confidence and offer reassurance to new Second Life users; and 3) providing hard copies of the materials (i.e., exercises, homework assignments, and action plan forms) to accommodate participants who find them more accessible than the electronic copies provided in Second Life.

Pilot Test of the Self-Esteem in Second Life Intervention

Overview of Pilot Study Design

We conducted the pilot study to test the feasibility of the Self-Esteem in Second Life (SESL) intervention using a pre-posttest design. After recruiting a small sample of women with diverse physical disabilities, we trained them to use Second Life, offered the SESL intervention, asked them to complete pre- and post-intervention questionnaires, and asked them to provide evaluation and feedback. We used four criteria to operationalize "feasibility" in this pilot test: 1) enrollment, reaching our goal of 30 participants; 2) engagement, achieving no more than 30% attrition; 3) improvement, specifically on measures of self-esteem, self-efficacy, social support, and depression; and 4) acceptability, a mean rating of least 2.5 (on a scale of 1-4 with 4 high) on all intervention evaluation items.

Recruitment, screening, eligibility, and enrollment.

Approval was obtained from the first author's Institutional Review Board (IRB). Participants were recruited through the project advisors, the Center for Research on Women with Disabilities (CROWD) contact list of individuals and organizations, and resources within Second Life including the GimpGirl Community (Cole, 2013) and Virtual Ability (Krueger, 2013) where project staff posted electronic flyers and gave presentations about the study. Women interested in the study contacted the study office via a toll-free phone number, e-mail, the CROWD website, or by sending a message to the recruiter within Second Life.

To determine eligibility, a member of the research staff interviewed potential participants by telephone. The interviewer first explained the study, followed by questions to verify that the woman understood the study. If she correctly answered these questions, the interviewer proceeded with a four-page comprehensive screening interview that included questions about each eligibility criterion. To be eligible, women had to be 18 years of age or older and self-report

having a physical disability or chronic health condition (endorsing at least one from a list of nine physically disabling conditions, or "other") for at least one year duration that interfered with mobility, self-care, or home management. Eligibility also required the ability to use a computer, access to a computer and high-speed Internet connection that met Second Life minimum computing requirements, and willingness to use or obtain an e-mail account. Women were ineligible if they: a) did not understand English well enough to participate in typed or voice online discussions and complete online questionnaires in English; b) had a significant cognitive impairment that would significantly limit their ability to give informed consent, participate in the intervention, or complete study assessments (could not list two things the study was about or two things they would be asked to do as a participant); c) reported misuse of alcohol or other drugs; d) had an active psychosis or other severe psychiatric disability that would make the group intervention format inappropriate (questions about suicidal ideation or plans, believing others could hear your thoughts, and hearing or see things that others could not hear or see), or e) had a significant visual or hearing impairment that would limit participation in the virtual intervention.

An IRB-approved electronic informed consent process provided detailed information about the study and what participation entailed. Women responded to an online questionnaire to determine their understanding of the study and participation requirements. The project staff then met with the eligible women by phone or in Second Life to review the consent form. Women providing oral consent were emailed the consent form and a link that invited them to consent or decline participation electronically. For anyone with questions, the email, consent form, and link included contact information for a member of the project staff. Once electronic consent was confirmed, the project staff sent participants a user-specific link to the study pre-test in Survey

Monkey (SurveyMonkey, 2011) and a computer headset to use during the study, and scheduled the orientation and training sessions in Second Life.

Measures.

Demographic and disability-related information was collected only at pre-test. The outcome measures (self-esteem, self-efficacy, social support, and depression) were included in both the pre- and post-intervention questionnaires, which participants completed online. After the final session, participants were sent a link to an online evaluation survey.

Demographic and Disability Characteristics. General demographic information included age, race, ethnicity, household income, employment status, education level, and relationship status. Disability-related questions assessed the type, age at onset, duration, and severity of disability. The health condition identified by respondents as most limiting determined their primary disability. Use of assistive devices and need for assistance with activities of daily living (ADLs, such as bathing, dressing) and/or assistance with instrumental activities of daily living (IADLs, such as shopping, preparing meals) determined disability severity. The Physical Function subscale of the Medical Outcomes Study Short-Form-36 (SF-36) (J. E. Ware & Sherbourne, 1992) was also used to measure the severity of physical limitations. This subscale asks respondent to indicate the extent to which they are limited (“a lot,” “a little,” or “not at all”) in each of 10 activities, such as bathing or dressing oneself, walking one block, and climbing several flights of stairs. Responses are transformed so that subscale scores range from 0 to 100, with higher scores indicating a higher level of physical functioning.

Self-esteem. Because self-esteem was the primary outcome of interest, we measured it with both the Rosenberg Self-Esteem Scale (RSE) (Rosenberg, 1965) and the Hudson Index of

Self-Esteem (ISE) (Hudson, 1982). The RSE is a 10-item measure used previously among women with disabilities (Hughes et al., 2004) with lower overall scores reflecting greater self-esteem. The scale demonstrated good internal consistency in this sample (Cronbach coefficient alpha = .88). The ISE consists of 25 items, rated on a 5-point scale, reflecting high and low self-esteem. Scores are summed and transformed to a 0-100 scale, with lower scores reflecting greater self-esteem. To aid interpretation in this study, the two measures were scored so that higher scores reflect greater self-esteem. The ISE demonstrated high internal consistency (Cronbach's coefficient alpha = .95), and the two scales were highly correlated with one another (r = .89).

Depression. Depression was measured with the Center for Epidemiologic Studies Depression Scale-10 (CESD-10) (Andresen, Malmgren, Carter, & Patrick, 1994), a 10-item short form of the 20-item CES-D (Radloff, 1977), which is designed to measure symptoms of depression. Andresen et al. (Andresen et al., 1994) reported that the 10-item scale demonstrated good predictive accuracy when compared to the 20-item version. A cutoff value of 10 (range, 0-30) was found to classify individuals consistent with the cutoff of 16 for the full-length scale. The scale demonstrated good internal consistency (Cronbach's coefficient alpha = .85).

Self-Efficacy. Self-efficacy was evaluated using the Generalized Self-Efficacy Scale (GSES) (Jerusalem & Schwarzer, 1992), a 10-item scale measuring how strongly respondents believe in their ability to respond to novel or difficult situations and to manage the associated obstacles. Item responses range from 1 (not at all true) to 4 (exactly true) with a score range from 10-40. Used previously in studies of women with disabilities (Hughes, Robinson-Whelen, Taylor, & Hall, 2006; Hughes et al., 2004), the measure demonstrated strong internal consistency in the current pre-test sample (Cronbach's coefficient alpha = .91).

Social Support. Social support was measured using the 8-item Emotional/Informational Support subscale of the Medical Outcomes Study Social Support Survey (MOS-SS) (Sherbourne & Stewart, 1991) which assesses how often emotional and informational support is available. This subscale was administered because it was expected to change more in response to an online group intervention than other aspects of support (e.g., tangible support, affection support). This subscale has been used previously with women with disabilities (Robinson-Whelen et al., 2014) and demonstrated strong internal consistency in the current pre-test sample (Cronbach's coefficient alpha = .94).

Evaluation Survey. The evaluation survey asked participants to rate the intervention in general (poor to excellent) and the extent to which they: a) felt supported by group facilitators and other group members, b) made positive changes in their lives over the course of the intervention, and c) found meeting in Second Life to be stressful. Participants were asked to rate how helpful and how enjoyable different aspects of intervention were, and to compare Second Life and face-to-face interventions on a number of characteristics (convenient, enjoyable, opportunities for social interactions and social connections). Finally, open-ended items asked a) what they liked/disliked, b) what barriers made attendance and full participation difficult, and c) what additional suggestions and comments they had. Women who completed the three-session Second Life training were asked to rate it on difficulty, appropriateness of the length of the training, and how adequately it prepared them to use Second Life. Participants also answered open-ended questions about what they found helpful/unhelpful and what other suggestions they might offer to improve the training experience.

Results

Enrollment – Study Participants

Off the 59 women who expressed interest in the study and participated in a screening interview, 23 were determined to be ineligible and three did not complete the interview process. The primary reasons for ineligibility were the lack of access to high speed Internet or a computer meeting minimum Second Life requirements. An examination of group differences revealed that the 33 eligible women did not differ from the remaining 26 in either age or disability duration.

All 33 eligible women verbally agreed to enroll in the study, completed the electronic informed consent, and were sent a link to the pre-intervention questionnaire (27 women completed it). Nineteen of the 33 women completed the three Second Life training sessions, attended at least one of the SESL sessions and completed the post-intervention questionnaire and evaluation; 10 dropped out of the study prior to participating in the intervention (due to health issues, n = 3; family health issues, n = 1; unexpected life events, n = 3; computer problems, n = 1; difficulty learning to use Second Life, n = 1; and no reason given, n = 1); and 4 did not respond to our attempts to schedule initial or follow-up training sessions. The 19 women who did and 14 women who did not proceed on to the SESL intervention were similar on most demographic and disability characteristics; however, women who participated in the intervention were somewhat younger (M = 43.21 [10.54] years versus 53.38 [20.46] years; t = 1.33, df = 8.61, p = .22), more likely to have a college degree (68.0% versus 38.0%), and had higher household income (M = $30,220 [$27,781] versus $14,521 [$4,677]; $\chi^2(1) = 2.23$, p = .13).

Using as baseline the 27 who completed the pre-intervention questionnaire, the attrition rate was 29.6%. If we include all women who enrolled in the study (N = 33) as baseline, the attrition rate would be 42.4%.

Sample description. Participants included 19 women with a wide variety of long-term mobility impairments. More than half of the women required assistance with activities of daily living, such as eating, bathing, dressing, or getting around the house. The women's ages ranged from 22 to 71 years. (Descriptive data are detailed in Table 2.) The majority of the women were Caucasian, most were unmarried, and educational level varied with 13 women having completed college or more. The majority of the women were unemployed, and income varied substantially across the sample with household income ranging from $7,680 to $90,000. Most were frequent Internet users and all but two of the participants had a home computer. Seven participants had been recruited through Second Life, which they reported using on a regular basis.

Engagement – Participation

Attendance in the intervention varied: Eight of the women (42.0%) attended all seven sessions, six (32.0%) attended six sessions, two women (10.0%) attended five sessions, and three women (16.0%) attended three or fewer sessions. Thus, the majority (84.0%) of the women attended more than half of the sessions. Participation in the optional Second Life excursions also varied, with six women (32.0%) attending all six excursions; seven women (36.0%) attending four or five excursions; and three women (16.0%) attending three or fewer excursions. All 19 attended at least one of these optional excursions. Most who missed sessions or excursions did so sporadically. However, one participant chose to discontinue participation in the program after attending only two sessions, stating that it was more important to her to spend time with family and friends in the “real world.”

Outcomes

Because the study used a within-subjects design, paired t-tests were conducted to evaluate change over time on our outcomes of interest. Given the small sample, it is important to consider both effect sizes and significance tests.

Self-Esteem. Changes from pre- to post-intervention in both the RSE and the ISE were evaluated. Paired t-tests of the RSE revealed a significant difference between pre- (M = 19.84, SD = 5.75) and post-intervention scores (M = 22.21, SD = 4.87; t = -2.62, df = 18, p = .02), constituting a moderate effect size (Cohen's d = .60). Changes over time on the ISE (Pre M = 67.32, SD = 18.95; Post M = 71.13, SD = 16.27; t = -1.59, df = 18, p = .13) revealed a 3.81 point increase over time. This increase, which was not statistically significant, represents a small to moderate increase, Cohen's d = .36.

Generalized Self-Efficacy. A similar pattern was observed on GSES scores. There was a trend toward improved scores from pre- to post-assessment (Pre M = 29.79, SD = 5.70; Post M = 31.53, SD = 4.29; t = -1.84, df = 18, p = .08). This represents a small to moderate effect size (Cohen's d = .42).

Social Support. Scores on the Emotional and Informational Support subscale of the MOS Social Support Scale increased only slightly from pre- to post-intervention (Pre M = 19.79, SD = 6.47; Post M = 20.74, SD = 5.83; t = -1.07, df = 18, p = .30). This small change was not statistically significant, representing a small effect size (Cohen's d = .25).

Depression. Changes from pre- to post-intervention scores on the CESD-10 were statistically significant (Pre M = 11.44, SD = 6.36; Post M = 7.81, SD = 3.38; t = 3.21, df = 18, p = .005), and represented a moderate to large effect (Cohen's d = .74). There was also a reduction in the number of women whose depression scores exceeded the cut-off score of 10 or higher which indicates risk for clinical depression (pre, n = 9; post n = 7). Most importantly, at pre-test,

6 of the 19 participants (32.0%) had depression scores indicating severe depressive symptomatology (score = or > 15) while none of the participants exceeded a score of 14 at post-test.

Acceptability – Participant Feedback

The 19 participants completed an online evaluation of the program on a form that included open-ended questions and Likert-type items, with the 12 newcomers to Second Life offering feedback on the training as well. Most of the new Second Life users (*n* = 10, 83.3%) rated the training as "excellent" or "good;" however, a third (*n* = 4) described Second Life as "somewhat difficult" to learn, and only seven of the twelve (58.3%) felt "very prepared" to participate in the Second Life sessions after completing the training. Additional training time was not necessarily seen as the solution since most (*n* = 8, 66.7%) indicated that the length of the training was "about right," while 3 (25.0%) indicated that the training was "a little too short."

Participants' average rating of the intervention on a scale 1-4 (with 4 high) was positive overall (M = 3.16) with 16 of the 19 women rating the intervention as either "excellent" or "good." Participants indicated that they felt supported by the group leaders (M = 3.68) and other participants (M = 3.26) and rated the intervention as "not very stressful" (M = 3.21). Most (*n* = 12, M = 2.63) endorsed making some or a lot of important positive changes in their life. Participants gave "helpful" and "enjoyable" ratings to five intervention components – session materials, group sharing and discussion, relaxation exercises, action planning, and group excursions. The average rating for "helpfulness" across all components was 3.21, with action planning rated as the most helpful (M = 3.63). The average rating for "enjoyability" across all components was 3.27, with group discussions rated as the most enjoyable (M = 3.58).

Responses to the open-ended questions provided a wealth of information and suggestions for offering group interventions in Second Life (see Table 3). Aspects of the intervention that participants liked best included action planning, discussions with women in similar situations, the convenience of not having to leave your home, excursions to off-island venues, and filling a personal need. When invited to share what they disliked about the intervention, participants mentioned frequent technical problems, difficulty adjusting to virtual reality and its absence of disability, and problems during discussions and excursions.

Several items in our post-intervention evaluation asked participants to compare programs in Second Life to face-to-face programs. Second Life was rated as being much more or somewhat more convenient by 18 out of 19 participants and much more or somewhat more enjoyable by 12 participants. Most participants reported the Second Life intervention offered either more social interaction opportunities (n = 9) or the same social interaction opportunities (n = 8) as a face-to-face intervention, with only 2 indicating that they thought there were more social interaction opportunities in a face-to-face intervention. When asked to compare the opportunities for lasting social connections, opinions were more evenly split with 8 reporting no difference; 6 believing face-to-face interventions offered more such opportunities; and 5 indicating that a Second Life intervention offered more opportunities for lasting social connections.

Discussion

This is the first systematic examination of a mental health intervention for women with physical disabilities offered in an Internet-based virtual reality environment. We demonstrated

feasibility in terms of enrollment, engagement, and positive outcomes, as well as acceptability by users, based on both quantitative and qualitative data.

Enrollment

We exceeded our goal of enrolling 30 participants (33 women provided informed consent) but with considerable difficulty. Inadequate technological resources prevented participation by about half of the women who expressed interest. Access to computers and high-speed Internet services is available mostly to women with disabilities who tend to be younger and have higher levels of education and higher incomes (Fox, 2011). We are confident, however, that as access to these resources becomes more affordable and common in the general population it will also become more available to women with disabilities, making participation in this type of intervention more feasible. Compared to current technological barriers, unfamiliarity with virtual worlds was a negligible factor in the enrollment process. Indeed, most women were very interested in an opportunity to participate in this type of new experience and avenue for social networking.

Engagement

Of the 33 women enrolled, 19 (57.6%) became engaged in the intervention to some extent. Nearly half of the participants attended all seven sessions and a third were involved in extracurricular activities. In future studies we will expand our operationalization of engagement to include observed participation in excursions, and self-report of other activities in Second Life in addition to the regular small group sessions, conversations initiated with other participants and

other residents in Second Life, and attempts to modify the appearance of one's avatar or obtain new clothes, accessories, or animations.

Outcomes

Statistically significant improvements were found on measures of self-esteem and depressive symptomatology. As noted earlier, because self-esteem was the primary focus of the intervention and our primary outcome of interest, we measured this construct with both the Rosenberg Self-Esteem Scale (RSE) (Rosenberg, 1965) and the Hudson Index of Self-Esteem (ISE) (Hudson, 1982). The RSE primarily evaluates global self-esteem, or self-concept developed over a lifetime, while the ISE measures more situational self-evaluation in direct comparison to others (Corwyn, 2000; Hughes, et al., 2004). We found a statistically significant improvement on the RSE with a moderate effect and also a non-significant improvement on the scores of the ISE with a small to moderate effect. Non-significant improvement in ISE scores may indicate greater influence of intrinsically derived self-esteem, rather than self-esteem shaped from context-specific comparison. We believe the significant finding on the RSE may be a result of the focus of the intervention on enhancing both self-worthiness (e.g., activities related to connecting to and caring for self) and self-competence (e.g., self-efficacy training via goal setting, action planning, feedback, and problem solving) (Mar, DeYoung, Higgins, & Peterson, 2006). The RSE likely tapped into changes in those components, particularly given the two-factor model proposed by Tafarodi and Swann (Tafarodi & Swann, 1995) who found that items on the RSE loaded on competence and worthiness. We also believe that through extensive peer interaction and the positive participant ratings of these group discussions, our intervention supports women with disabilities in mutually strengthening their competence at living a worthy

life of self-acceptance and self-esteem. This is important given the societal discriminatory mandate that people with disabilities struggle on a daily basis to overcome significant barriers to accessible health care, education, safety, transportation, recreation, intimate relationship, housing, employment and other symbols of equality and privilege. Our intervention was designed to support the growth of positive self-esteem of women within their shared social context of disability.

Our findings are consistent with the feminist theory of growth in connection, which posits that people grow through the relationships in their lives, in connection to others (Miller & Stiver, 1997). Change can occur through mutual empathy, characterized by mutual respect and openness, and can lead to growth for all in the relationship. This model draws, in part, on Relational-Cultural Therapy (RCT), which has been shown to have positive treatment outcomes with many conditions, including grief and eating disorders, and RCT psychoeducational groups that include educational components and address relational awareness have been used successfully in many settings (Jordan, 2010).

These findings also corroborate those from our earlier study (Hughes et al., 2004) testing the face-to-face version of this intervention with a larger sample. In that study, however, we did find statistically significant improvements on the second measure of self-esteem, that is, the ISE. In the present study, we found positive changes on scores of the ISE from pre to post-test; however, the improvements did not reach the level of significance. We expect to find significant changes on both measures with a larger sample in a randomized, controlled trial of this intervention in Second Life.

We found the greatest improvement on the measure of depressive symptomatology (CESD-10) (Andresen et al., 1994) with a moderate to large effect size (.74), which was even

larger than the effect (.59) found with our previous larger sample. We are curious if perhaps the added virtual group activities (e.g., shared excursions in Second Life) involving greater opportunities for social engagement and support, additional time with the facilitators, or participation in more interesting and novel activities may have contributed to greater mutuality or behavioral activation and, in turn, to greater reduction in scores on the CESD-10. As noted earlier, these positive changes involved the reduction in the number of women whose depression exceeded the cut-off on the measure. More importantly, we found that all six of the participants whose scores fell in the range of severe depressive symptomatology at pre-test experienced a reduction in depressive symptoms, with none of them in the severely depressed range at post-test. This finding suggests clinical significance. Although the current sample size was too small to examine possible mediation effects of self-esteem on the relation between the intervention and depression, findings from our earlier face-to-face intervention study suggested that self-esteem mediated the intervention effect on depression (Hughes et al., 2004). Given the emphasis of the intervention on participants' confidence for goal attainment, we found the small to moderate increase on self-efficacy to be encouraging especially given the small sample size. Finally, although social support was not a primary outcome of interest, the non-significant and small increase in social support was not surprising, given the multiple opportunities in this program for participants to connect with one another and create action plans for extending social support and social networks.

Acceptability

In general, participants found the online intervention to be acceptable and enjoyable. The criterion of a mean rating of least 2.5 (on a scale 1-4 with 4 representing more positive ratings)

was exceeded on all evaluation items. Responses were the most variable on the item asking about the stress of learning to use Second Life. Almost all participants rated attending an intervention in Second Life as more convenient than attending a face-to-face workshop, giving us strong encouragement to continue this line of research.

Directions for Future Research

Sufficient groundwork has been laid for a full clinical trial of the Self-Esteem in Second Life intervention with a large sample in which participants are randomly assigned to experimental or control groups. It would also be important to compare directly the outcomes and cost-effectiveness of the intervention delivered in Second Life to a traditional face-to-face format.

We plan to refine the intervention for the next round of testing, incorporating comments from the posttest and resolving known problems. One set of activities that caused some confusion and difficulty were the off island excursions. In future testing, we will clarify the purpose of these activities and integrate them with greater relevance to each session.

We strongly recommend continued research on Internet-based mental health interventions despite the fact that high-capacity computers and high-speed Internet (broadband) are only beginning to penetrate the market of people with disabilities. Within the next 20 years, high-capacity computers and high-speed Internet will likely be as common throughout society as cell phones are now. The current study was designed to prepare an intervention that would take advantage of these expected advances in affordable and common-use technology. Unfortunately, it was necessary to develop the intervention with the technology available to participants today. Research has shown that people with disabilities, people living in remote areas, and those with

low income have significantly less access to the high-speed Internet than people in the general urban and suburban population (Fox, 2011). A substantial challenge for this study was not necessarily identifying women who had access to computers and the Internet, but recruiting and enrolling women with physical disabilities who had access to computers with sufficiently advanced graphics cards and high-speed Internet available via cable or DSL, not dial-up connections, that would provide the requisite capacity for using the Second Life platform. Future research must accept these challenges and budget sufficient funds to implement countermeasures.

Findings from other studies suggest that interventions aimed at increasing self-esteem could be useful in reducing the risk of depression, particularly if future research supports the hypothesized causality of the vulnerability effect of low self-esteem on depression (Orth, Robins, & Roberts, 2008; Sowislo & Orth, 2013). This pilot study provides preliminary evidence that an intervention designed to enhance self-esteem in women with physical disabilities also has positive effects on depressive symptomatology, suggesting a possible mediating role for self-esteem. This evidence offers great promise as a potential clinical (Nosek, Hughes, & Robinson-Whelen, 2008) and community strategy for reducing the extremely high disparities in rates of depression among women with disabilities (Nosek et al., 2006). Additional research, including longitudinal studies, could help either confirm or refute the statement of Baumeister and colleagues (2003) who concluded after reviewing self-esteem literature that "self-esteem is not a major predictor or cause of almost anything" (p. 37).

The current study starts us on the path toward asking whether or not Internet-based, virtual interventions are as effective as face-to-face interventions. Research designed to test this question will require that the presentation of self-esteem information and participant interaction

opportunities are as comparable as possible between virtual and real life settings. While it is enticing to take advantage of the capacity for online interventions to reach more isolated women in both urban and rural areas, strategies should be taken to ensure that samples are comparable across settings. Further testing of this intervention will also require more than two time points and a rigorous examination of the extent to which improvements are maintained over time. Finally, it would be interesting to examine gender differences and differences between people with and without disabilities in response to virtual reality environments and the impact they can have on expressions of self-esteem.

Conclusions

The exploration of virtual worlds as media for offering health promoting interventions for the general population is in its infancy. Our study is groundbreaking in this regard for the field of disability and rehabilitation research. We have shown that offering a mental health intervention for women with physical disabilities is feasible in the virtual world of Second Life and provides an enjoyable and adventuresome new experience. Feasibility is likely to improve substantially as advanced computer equipment becomes more affordable and easier to use and as high-speed Internet becomes more readily available. Within the past five years, the explosion in popularity of Internet-connected handheld devices, such as tablet computers and smartphones, presents yet another avenue for exploration in offering these interventions. The expansion of possibilities for online communication, social networking, and information dissemination is likely to benefit many people in the disability community.

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