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RESEARCH PAPER

Perceived control moderated the self-efficacy-enhancing effects of a chronic illness self-management intervention

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Objective: Identifying moderators of the effects of self-efficacy-enhancing interventions could improve their efficiency. We examined the effects of a home-based variant of the Chronic Disease Self-Management Program on self-efficacy, and explored the moderating effects of perceived control over self-management (PCSM).
Methods: In a randomized controlled trial, patients ($N = 415$) aged > 40 years with various chronic conditions plus basic activity impairment and/or significant depressive symptoms were randomized to one of three groups: intervention provided in homes or by telephone, *v.* usual care control. We used mixed effects linear models for repeated measures to examine effects on self-management self-efficacy at 6-month follow-up and explore moderation by PCSM.
Results: Only the home intervention had a significant self-efficacy-enhancing effect (Wald test, $\chi^2 = 13.8$, $p = 0.008$; effect size $= 0.3$). The effect was moderated by PCSM, considered as a continuous [effective in subjects with lower PCSM (Wald test, $\chi^2 = 13.4$, $p = 0.009$)] or categorical (effective only for subjects in the lowest tercile) variable.
Conclusions: People with lower PCSM appear more likely to experience enhanced self-efficacy from chronic illness self-management training than those with higher PCSM. These findings, although preliminary, suggest that office-based measurement of PCSM might identify those chronically ill patients likely to benefit most from self-management training.

Keywords: Chronic disease, Perceived control, Self-care, Self-efficacy, Telephone

INTRODUCTION

Self-efficacy, a key element of Bandura's social cognitive theory of behaviour, comprises an individual's perceptions regarding their ability to successfully execute actions required to achieve valued outcomes.[1] Interventions can bolster patient self-efficacy, which in turn mediates[2] improvements in a number of health behaviours and chronic illness outcomes.[3–13]

The best-researched self-efficacy-enhancing healthcare intervention is the Stanford Chronic Disease Self-Management Program (CDSMP),[8,9] which seeks to provide patients with the self-efficacy and skills to better self-manage their chronic medical conditions, regardless of specific diagnosis. Studies have demonstrated that the CDSMP enhances subjects' self-efficacy for chronic illness

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self-management tasks, thereby improving a number of self-management behaviours and functional health outcomes.[8,9,12–14]

However, little is known regarding moderators of the effects of the CDSMP — factors that indicate for whom, or under what conditions, the intervention works.[2] Considerable amounts of time and expertise are required to train and oversee the lay personnel who deliver the CDSMP. Identifying moderators of its effects could help healthcare providers and administrators determine which patients are most likely to benefit from the CDSMP, thereby increasing its efficiency, or ratio of clinical benefit to delivery effort.[15]

According to social cognitive theory, one putative moderator of the self-efficacy-enhancing effect of the CDSMP is perceived control over chronic illness self-management — an individual's perceptions regarding the 'changeableness or controllability' of self-management tasks.[16] Bandura has suggested that even when all of the 'tools' for achieving a given health behaviour are objectively present, people who perceive little control over the behaviour may display lower self-efficacy for attaining the behaviour than those who perceive it to be largely within their control.[16] Qualitative data from focus groups conducted with chronically ill patients have provided some support for this assertion.[17] However, no randomized controlled trials (RCTs) have explored the potential moderating effect of perceived control on the self-efficacy-enhancing effect of healthcare interventions, including the CDSMP.

To address this research gap, the Homing in on Health (HIOH) self-efficacy-enhancing intervention — a home-delivery variant of the CDSMP — was developed and is being evaluated in an ongoing RCT. The original CDSMP is provided to small groups of individuals in centralized locations. The aim of the one-to-one, home-delivered adaptation was to make the CDSMP content available to those not readily able to participate in the original program, due to functional limitations, transportation problems, or discomfort with group settings. The overall goals of the project were to determine whether in-home and/or telephone versions of HIOH would enhance self-efficacy and, thereby, improve health outcomes for persons with chronic conditions at 1 year of follow-up.

In this study, baseline (pre-intervention), 2- and 4-week (during intervention), 6-week (immediate post-intervention) and 6-month follow-up data from the ongoing RCT were employed to: (1) test whether the HIOH interventions would lead to significant improvements in chronic illness self-management self-efficacy; (2) determine whether persons with relatively lower perceived control over chronic illness self-management tasks at baseline would have lower baseline self-efficacy than those with higher perceived control, consistent with social cognitive theory; and (3) explore whether low perceived control over self-management at baseline would moderate the self-efficacy-enhancing effects of HIOH at 2, 4 and 6 weeks and 6 months — either reducing the effectiveness of the intervention or, since low-control individuals might have the greatest room for self-efficacy improvement, enhancing its effects.

METHODS

The study activities described were conducted from July 2004 through September 2007. The UCD Institutional Review Board approved the study protocol.

Study Setting, Sample Recruitment, and Randomization

A convenience sample of subjects was recruited from the 12 offices and 70 family physician and general internist practices in the University of California Davis Primary Care Network, which spans a 50-mile radius around Sacramento, California. Prior self-management interventions that improved health outcomes had an effect size for self-efficacy of around 0.3. In sample size

calculations conducted before this study, an effect size of 0.2 was employed conservatively, since HIOH was an untested CDSMP variant. A sample of 120 subjects per group (360 total) was required to provide a power of 0.80 to detect an effect size of 0.2.

The study co-ordinator obtained permission from physicians in participating offices to contact their patients. Billing code information was used to identify those aged 40 years or older who self-reported having one or more of the following chronic illnesses: arthritis, asthma, chronic obstructive pulmonary disease, congestive heart failure, depression, and/or diabetes mellitus. These diseases were targeted because they are the most common symptomatic chronic medical conditions in primary care. The age cut-point was chosen to help improve the efficiency of subject recruitment, since the target chronic conditions are more common, and more likely to cause functional impairment, in people over the age of 40 years. Finally, the same inclusion criteria were employed in the original CDSMP studies, so their use facilitated comparisons with those studies. Mass-mailed study announcements and direct telephone calls were employed to recruit patients who met these criteria. Study announcement flyers were posted in study offices as an additional method of recruitment.

The study co-ordinator used a standard script to screen interested patients for additional eligibility criteria: ability to speak and read English; residence in a private home with an active telephone; adequate eyesight and hearing to participate via telephone and read study materials; and at least one basic activity impairment, as assessed by the Health Assessment Questionnaire,[18] and/or a score of 4 points or greater, suggestive of clinically significant depressive symptoms, on the 10-item version of the Center for Epidemiologic Studies Depression Scale.[19] The requirement for participants to have some basic activity impairment and/or active depression symptoms was based on findings of pre-study focus groups[17] and discussions with Lorig and colleagues, developers of the CDSMP. Both indicated that such individuals would be least likely to participate in the original CDSMP but still willing and able to participate in a one-to-one, home-delivered variant of the program. Basic activity impairment might make travelling to centralized CDSMP sessions difficult or impossible, and the adverse cognitive effects of depression, such as decreased motivation, and perceived stigma, might preclude participation in centralized group sessions.

A study nurse visited eligible individuals in their homes. She used a standardized interview checklist, augmented by clinical judgement, to ensure they were medically stable for participation in the study (all were). The nurse also obtained informed consent, administered the baseline study questionnaire (see Measures), and finally implemented randomized allocation in blocks of 12 subjects via sealed opaque envelopes containing slips of paper printed with group assignments. Subjects received $75 on study completion.

Procedures

Subjects randomly assigned to either HIOH intervention group received the intervention via either home visits or telephone calls.

Study intervention

The CDSMP has been described in detail previously (http://patienteducation.stanford.edu/programs/cdsmp.html).[8,9] It aims to bolster patient self-efficacy for self-managing their chronic medical conditions, regardless of specific diagnosis. The original CDSMP is provided by pairs of non-healthcare professionals, called facilitators, who have personal experience with chronic health conditions. The facilitators deliver the intervention to groups of eight to ten participants in six weekly sessions, using an interactive, participatory format.

The overall aim of the CDSMP is to help participants master six fundamental self-management tasks: solving problems,

making decisions, utilizing resources, forming a patient–provider partnership, making action plans for health behaviour change, and self-tailoring.[20] Participants are given frequent opportunities to practise and receive feedback on their performance of these tasks. Specific topics covered include exercising safely, coping with difficult emotions, communicating effectively with family and healthcare providers, using relaxation and cognitive symptom management techniques, and taking medications.

The HIOH intervention was essentially identical to the CDSMP in content. However, it differed from the CDSMP in terms of delivery process, since one trained layperson provided the intervention to one participant, and setting, since it was provided in subjects' homes or via telephone. In HIOH, group activities employed in the original CDSMP, such as collective brainstorming to solve health behaviour change problems, were not possible. Instead, one-to-one analogues were substituted, such as joint trained layperson/participant generation of lists of potential solutions to health behaviour change problems.

The four non-healthcare professionals who delivered the HIOH intervention were called 'health coaches' rather than facilitators. They underwent an intensive, highly scripted 4.5-day-long training process, very similar to the training received by the original CDSMP facilitators. Training was conducted by the study project co-ordinator and a Stanford CDSMP team member, both certified CDSMP Master Trainers. The four coaches used a single written script to provide the HIOH programme to subjects in both experimental groups, to ensure identical content. The same health coach delivered all six sessions to each of their assigned participants. All intervention subjects were also given identical laminated, spiral-bound booklets, with each page designed to help quickly illustrate, summarize or reinforce key HIOH teaching points. Further details about HIOH are available from the authors.

At quarterly intervals, the study nurse audited the fidelity of the health coaches' delivery of the intervention and provided corrective feedback as indicated. Health coaches also completed a written log following all sessions, indicating whether or not they had covered the main teaching points in the script and the time devoted to each.

Usual care control group

Usual care control group subjects received an initial home visit from the study nurse, with identical content to that described for intervention subjects, and completed the same baseline, 2-, 4- and 6-week and 6-month post-intervention telephone questionnaires as intervention subjects. They otherwise received whatever care was delivered by their usual healthcare providers, with no intervention by study personnel.

Measures

Baseline

Self-efficacy was measured using a previously validated 33-item scale.[21] Respondents rated their confidence for performing various chronic illness self-management tasks and skills, including but not limited to maintaining social/recreational activities, getting regular exercise, coping with symptoms, obtaining help from others and community resources, and communicating with physicians. A 1–10 Likert response scale was employed and a summary average score was derived (range 1–10, higher scores = greater self-efficacy). The full 33-item scale was employed in analyses [Cronbach's alpha (α) = 0.96 in our study], rather than 1 or more of its ten subscales, since the goal was to measure overall chronic illness self-management self-efficacy.[20]

Perceived control over chronic illness self-management was assessed using a five-item measure developed for this study (Cronbach's $\alpha = 0.74$), with item stems derived from a previously validated measure.[22] Items were: (1) 'How much personal control do you have over your

self-management behaviors?' (2) 'How much of doing self-management behaviors is beyond your control?' (3) 'To what extent do you see yourself as being capable of self-management?' (4) 'How much is self-management beyond your ability?' and (5) 'How much difficulty do you experience in managing your condition?' A 1–7 Likert response scale was employed, with items 2, 4 and 5 reverse coded and a single summary score derived (range 5–35, higher scores = greater perceived control over self-management).

Follow-up measures

At 2- and 4-week (during the intervention for HIOH subjects), 6-week (immediately post-intervention) and 6-month follow-up, telephone interviewers, blinded to subject group allocation, readministered the 33-item measure of self-efficacy, the primary outcome in these analyses, to all subjects.

Analyses

Stata (version 10.0, StataCorp, College Station, TX) was used for analyses. The main effects of the intervention on self-efficacy were examined using mixed effects linear models for repeated measures,[23] with self-efficacy at each time-point as the dependent variable, and study group, time period (baseline, 2, 4 and 6 weeks, and 6 months) and the interaction between time period and study group as the independent variables. The mixed effects model adjusted for the nesting of the five self-efficacy measurements on each subject via random intercepts.

To explore the moderating effects between perceived control over self-management and the intervention, an additional set of analyses was conducted, including all possible interactions among time, study group, and perceived control, and their main effects. Perceived control was included as a continuous variable in one analysis, and trichotomized by tercile in a second analysis (low = 8–25, medium = 26–30, and high = 31–35). The categorical approach was used to explore possible non-linear effects of perceived control over self-management.

The findings in this report stem from analyses that included only subjects with data at each collection point. We conducted additional analyses using the last non-missing value carried forward imputation technique, with findings similar to those presented (data not shown). Since no significant effect of phone-delivered HIOH on self-efficacy was observed, to make the presentation of moderator analyses clearer, the usual care control and phone study groups were combined and compared with the in-home HIOH group.

RESULTS

Figure 1 shows the flow of subjects through the RCT. Of 782 individuals evaluated for participation, 415 (53%) were randomized. Other than intervention sessions missed by early home and phone intervention drop-outs (Fig. 1), 100% of HIOH intervention sessions were completed. Figure 1 also shows the number of subjects completing the study questionnaires at baseline, 2, 4 and 6 weeks, and 6 months.

The Table 1 summarizes participant characteristics, by study group, including self-efficacy scores through 6 months; 321 (77%) were female, the mean age was 60 years (range 41–95), and a majority reported two or more chronic conditions. There were no significant differences among the three study groups, in any of the baseline characteristics, or between those completing and those not completing the 6-month self-efficacy measure. Baseline self-efficacy and perceived control scores were moderately correlated (Pearson's $r = 0.56$, $p < 0.01$).

The Table 1 also shows that self-efficacy increased for all three groups over time. However, the mean increase (mean of 2-, 4- and 6-week and 6-month scores) in the home group [mean increase = 0.36, 95% confidence interval (CI) = 0.16–0.56], as compared with the mean increase in

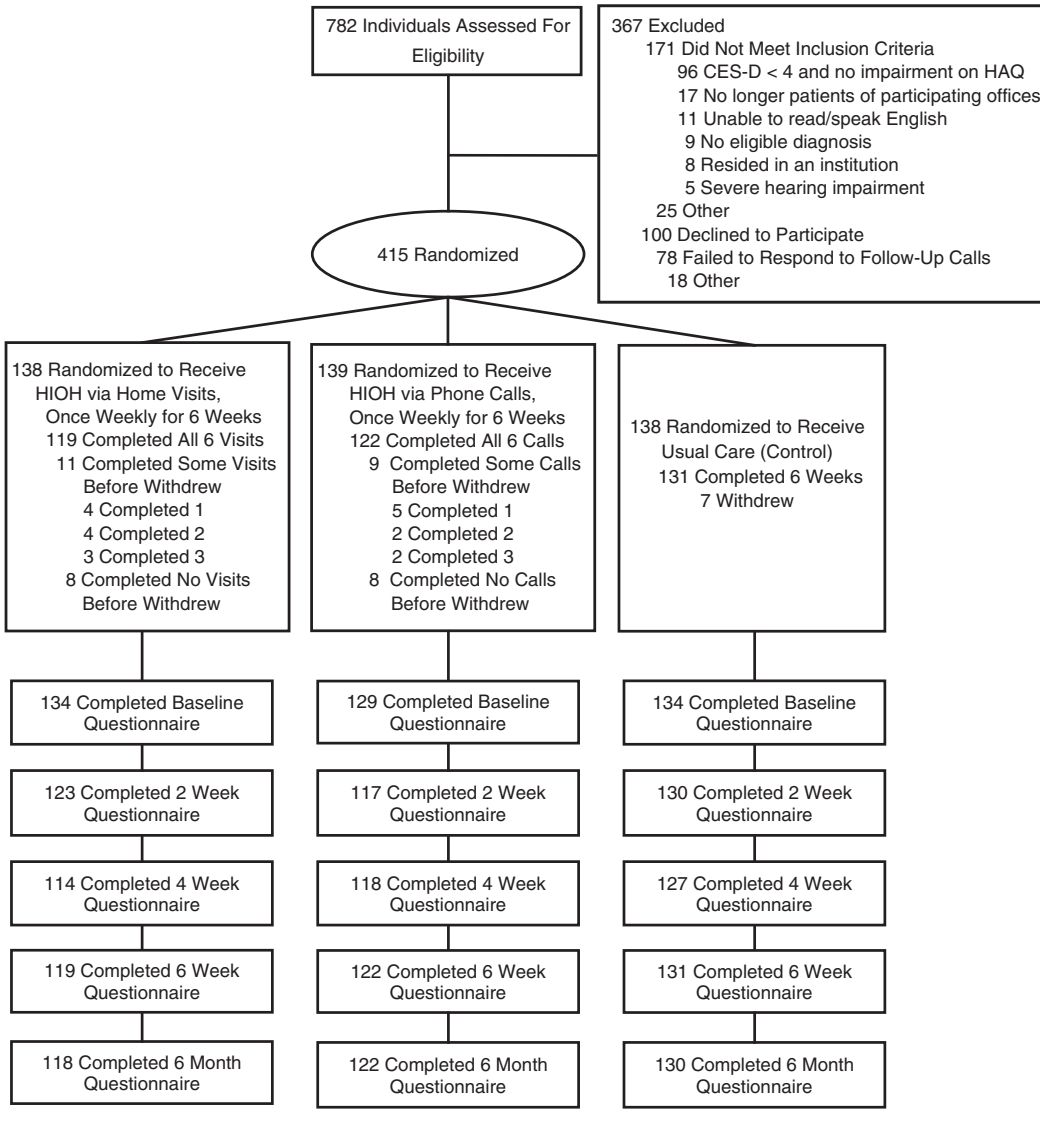

FIG. 1. Flow of participants through the trial.

the other two groups combined (mean increase = 0.12, 95% CI = 0.00–0.23), was significantly greater (*t*-test, $t = 2.24$, difference = 0.24, 95% CI = 0.03–0.46, $p = 0.03$). The mixed effects linear model confirmed the main effect of the home intervention (Wald test, $\chi^2 = 13.8$, degrees of freedom = 4, $p = 0.008$): the difference for the home group *v.* usual care control and phone groups combined was statistically significant at both the 6-week and 6-month time-points.

The mixed effects model including the perceived control/intervention interaction as a continuous variable revealed a significant moderating effect of perceived control (Wald test, $\chi^2 = 13.4$, degrees of freedom = 4, $p = 0.009$), such that the intervention was more effective in those with lower perceived control. This moderating

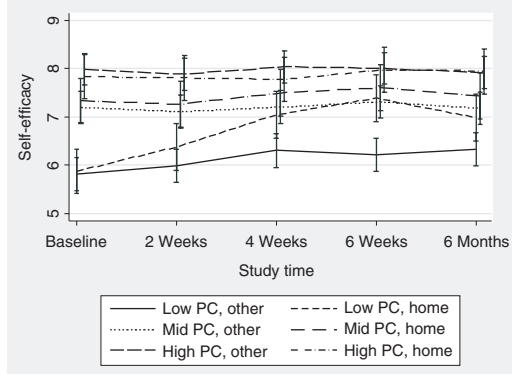

FIG. 2. Mean (and 95% confidence intervals) self-efficacy scores by study group [home *v.* other (phone and control combined)], time, and perceived control tercile. PC, perceived control.

effect was confirmed in an analysis treating perceived control as a categorical variable, divided by terciles: the home intervention was effective only in those in the lowest tercile (Fig. 2).

DISCUSSION

Summary of Findings

In this study, in-home but not telephone delivery of the HIOH modification of the CDSMP led to significantly enhanced participant self-efficacy for self-managing chronic conditions by 6 weeks of follow-up, persisting until 6 months. This significant effect of the intervention on self-efficacy is consistent with the findings of prior studies of the original CDSMP,[8,9,12–14] and the effect size of 0.3 is also similar to that observed in the other studies. If the 6-month self-efficacy-enhancing effects of the home intervention are shown to be associated with clinical benefits at 1 year of follow-up, then in-home HIOH might be employed to reach individuals unable or unwilling to participate in the original CDSMP. Since interventions enhancing self-efficacy have shown that self-efficacy enhancement mediates improvements in patient health behaviours and outcomes,[3–11] this finding probably has clinical as well as statistical significance.

Given the shorter mean session time for the phone *v.* in-home HIOH group, it appears that the process of conveying the scripted intervention content varied between the intervention groups, which could in part explain the lack of effect in the phone group. In person, face-to-face interaction may also have facilitated a more powerful working relationship between coaches and participants than did telephone calls.

It was also found, as suggested by social cognitive theory,[16] that subjects with low baseline perceived control over chronic illness self-management tended to have lower self-efficacy for accomplishing self-management tasks at baseline. Finally, the study findings provide evidence that perceived control moderates the self-efficacy-enhancing effects of the in-home HIOH intervention. Specifically, only those subjects in the low-perceived-control tercile benefited from the intervention.

From a theoretical standpoint, one might expect individuals with low perceived control over self-management to be least likely to respond to an intervention such as HIOH, viewing self-management tasks as largely beyond their control, despite intensive peer coaching. However, there are two possible explanations for the contrary findings. First, while such individuals endorsed low perceived control over self-management relative to our other study subjects, they had

TABLE 1. *Characteristics of participants*

Characteristic	Home ($N=138$)	Telephone ($N=139$)	Usual care control ($N=138$)
Age, years, mean (SD)	59.8 (11.2)	61.2 (11.6)	60.1 (11.7)
Gender, No. (%)			
Female	108 (78)	109 (78)	104 (75)
Male	30 (22)	30 (22)	34 (25)
Race/ethnicity, No. (%)			
Non-Hispanic, White	103 (75)	110 (79)	115 (83)
African-American	20 (15)	11 (8)	15 (11)
Hispanic	8 (6)	5 (4)	5 (4)
Asian	4 (3)	5 (4)	2 (1)
Pacific Islander	2 (1)	4 (3)	0 (0)
Declined to answer	1 (1)	4 (3)	1 (1)
Education level, No. (%)			
Non-high-school graduate	1 (1)	2 (1)	4 (3)
High-school graduate	18 (13)	18 (13)	18 (13)
Some college	53 (38)	50 (36)	58 (32)
College degree	42 (30)	41 (30)	39 (28)
Any graduate education	24 (17)	24 (17)	18 (13)
Declined to answer	0 (0)	4 (3)	1 (1)
Income level, No. (%)			
$<20,000$	20 (15)	19 (14)	19 (14)
20,000–39,999	21 (15)	23 (17)	25 (18)
40,000–59,999	24 (17)	15 (11)	19 (14)
60,000–79,999	18 (13)	22 (16)	24 (17)
80,000–99,999	6 (4)	9 (7)	9 (7)
$>100,000$	16 (12)	18 (13)	13 (19)
Declined to answer	33 (24)	33 (24)	29 (21)
Marital status, No. (%)			
Married	79 (57)	79 (57)	76 (55)
Widowed	14 (10)	15 (11)	19 (14)
Divorced	31 (23)	30 (22)	35 (25)
Never married	14 (10)	12 (9)	7 (5)
Declined to answer	0 (0)	3 (2)	1 (1)
Chronic conditions, No. (%)			
1	55 (40)	72 (51)	43 (31)
2	51 (37)	40 (29)	65 (47)
3	18 (13)	21 (15)	21 (15)
>4	14 (10)	6 (4)	9 (7)
Specific diagnoses, No. (%)*			
Arthritis	83 (60)	73 (52)	77 (55)
Depression	59 (43)	64 (46)	70 (51)
Diabetes	64 (46)	50 (36)	58 (42)
Asthma	34 (25)	25 (18)	39 (28)
COPD	15 (11)	11 (8)	17 (12)
CHF	17 (12)	17 (12)	14 (10)
Perceived control, mean (SD, range)	27.3 (5.7, 12–35)	26.2 (6.3, 8–35)	27.8 (6.0, 9–35)
Self-efficacy, mean (SD, range)			
Baseline	7.0 (1.8, 2.7–10.0)	7.0 (1.7, 2.5–10.0)	7.1 (1.8, 2.5–10.0)
2 weeks	7.2 (1.6, 3.4–10.0)	7.1 (1.6, 3.0–10.0)	7.0 (1.8, 2.7–10.0)
4 weeks	7.4 (1.5, 3.2–10.0)	7.3 (1.7, 2.9–10.0)	7.2 (1.8, 2.4–10.0)
6 weeks	7.6 (1.5, 3.1–10.0)	7.2 (1.8, 2.7–10.0)	7.2 (1.9, 2.5–10.0)
6 months	7.5 (1.6, 2.8–10.0)	7.2 (1.8, 2.9–10.0)	7.2 (1.7, 2.2–10.0)

COPD, chronic obstructive pulmonary disease; CHF, congestive heart failure.
*Percentages exceed 100 because many participants had more than one condition.

nonetheless volunteered to participate in the study, and so were not an intractably 'hard to reach' low-control subgroup. Second, because the low-perceived-control tercile also had relatively low self-management self-efficacy scores at baseline, low-control individuals had the most room for improvement in self-efficacy.

Implications for Clinical Practice

Regardless of explanation, the study findings are encouraging, suggesting that at least a subset of individuals with low levels of perceived self-management control are amenable to, and indeed may benefit most from, self-efficacy-enhancing interventions. They also suggest that these clinically proven, yet time- and resource-intensive self-efficacy-enhancing interventions,[3–11] might eventually be more precisely targeted to those most likely to benefit, increasing intervention efficiency or ratio of clinical benefit to delivery effort.[15] Chronically ill individuals with relatively low levels of perceived control over self-management tasks might be identified through periodic office-based screening with a short, simple perceived control measure such as the one employed here, and then be specifically invited to participate in self-management programmes such as the CDSMP or HIOH.

Study Limitations

These exploratory findings have a number of limitations. Although the ethnic/racial mix of the study sample closely mirrored that of the region in which the study was conducted, most participants were White, and there was a preponderance of women and married individuals. The extent to which our findings may be generalizable to individuals with other characteristics remains unclear.

The observed relationship between self-efficacy and perceived control could at least in part represent unmeasured confounding. RCTs that stratify subjects within groups by perceived control level are now necessary to explore further the potential moderating effect of perceived control on self-efficacy-enhancing interventions.[24] Additionally, the measure of perceived control was developed for this study. While the item stems employed derived from a previously validated measure,[22] and the measure had face validity and demonstrated reliability, further work is needed to derive norms before it could be used in clinical practice.

The perceived control measure was also moderately correlated with our self-efficacy measure ($r = 0.56$), raising the question of whether the two measures might be tapping different elements of a single construct. However, studies examining this question have concluded that self-efficacy and perceived control, as conceptualized by Bandura, are distinct, though related, constructs.[25–27] The moderate correlation between measures in the current study is consistent with this conceptualization.

Finally, we measured perceived control over self-management at baseline only, but it is plausible that perceived control could change in response to the intervention. Future studies might further explore this issue.

Implications for Future Research

In conclusion, individuals with lower perceived control over chronic illness self-management appear to be more likely to experience enhanced self-efficacy at up to 6 months of follow-up in response to a home-delivery version of the CDSMP than are individuals with higher perceived control. Future studies regarding self-management self-efficacy training should measure perceived control and stratify subjects within study groups by control level, to explore further its potential moderating effect.

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