**Introduction:** The relationship between an individual's sense of self-efficacy, motivation to change, and the implementation of improvement programs has been reported. This research reports the relationship among self-efficacy, motivation to change, and intent to implement continuing medical education (CME) activity learnings.

**Methods:** The measure of individual sense of self-efficacy was a 4-item scale. The measure of motivation was a 4-item scale following on the work of Johnson, et al. The self-efficacy scale has been confirmed for structure, and together the 2 scales provide indicators of 3 underlying variables—2 self-efficacy constructs and a motivation variable. In addition, a global intent to implement measure was collected.

**Results:** Preliminary analysis demonstrates a significant relationship between a self-efficacy construct, the motivation to change construct, and global intent to change. Specifically, the sense of efficacy in effecting change in the practice environment is predictive of a high level of motivation to change, which, in turn, is predictive of formation of an intent to change practice patterns.

**Discussion:** Further inspection of the motivation to change construct suggests that it mediates the self-efficacy constructs' effect on intent. This is consistent with an earlier report on the relationship among self-efficacy, barriers to change, and stated intent. This new finding suggests that the proximal construct motivation completely masks an important underlying causal relationship that appears to contribute to practice change following CME: self-efficacy. A focus on the participants' sense of self-agency may provide a path to practice change.

**Key Words:** self-efficacy, theory-planned behavior, theory-social learning, commitment to change

**Introduction**

Continuing medical education (CME) has served as the basis for most postgraduate medical education among practitioners. Reviews of the literature on the effectiveness of CME interventions have found differences linked to the type of learning activity (eg, didactic, audit, and feedback). Interestingly, they have also found substantial variation in effectiveness in studies of the same type of learning activity applied in different contexts. This suggests that other variables are influencing effectiveness.

There has been a significant amount of work on the construct of motivation as an intervening variable between learning and practice change. In addition, issues like commitment to change and barriers to implementation have been identified as potential intervening variables between learning and implementation of practice. Other issues such as learning style as well as teaching style have also been reviewed. However, we need a better understanding of these and other variables that contribute to changing behavior. Also important is an understanding of the relationships among those variables.

Many theoretical perspectives have informed medical education, including learning theory, cognitive psychology, and humanistic and social cognitive theory. Of the theoretical models that have been employed, particularly relevant are the social cognition models. These models underlie much of health psychology and change theories. One such theory is the Transtheoretical Stages of Change Theory. The model
Social cognitive learning theories of behavioral change posit that our actions, learning, and functioning are the results of a continuous, dynamic, reciprocal interaction among three sets of determinants: personal, environmental (situational), and behavioral. These models have been particularly effective in predicting behavioral change where the choice is difficult either because of the emotional content or because the behavior requires the compliance of others.

One such model is the Health Action Process Approach model of Schwarzer. The authors have been using this model connected to the Theory of Reasoned Action model by Fishbein and Ajzen as a general guide for investigating these potential intervening variables (see FIGURE 1). In prior work, the authors have found significant effects of motivation, self-efficacy, and barriers to implementation, among others in the formulation of intent to change and/or practice change. Theories such as the Theory of Reasoned Action, Social Cognitive Theory, and, as mentioned, the Health Action Process Approach (HAPA) all explore the intervening variables between knowledge and action. They confirm the importance of intent to change as well as self-efficacy in understanding behavior change.

The current study focuses on the relationship among three variables in the middle of such a model. The first variable, reported by many as an effective intervening variable between knowledge and practice change, is motivation to change (see, for example, Fox and Miner and Reed, Schifferdecker, and Turco). The second variable, one we and others have reported as an effective mediator, is self-efficacy. The variable employed as the outcome measure is intent to change practice, as this has been reported to be a good measure of practice change. Each of these variables has its own literature as related to CME.

**Methods**

Motivation to change is one of the more studied intervening cognitive variables in the CME literature. There are many models and theories that focus on this, including the Transtheoretical or Stages of Change Model. This model consists of 4 core constructs, including stages of change as well as processes of change. In essence, this model postulates that motivation is not binary but rather a created internal state. It is viewed as ranging from precontemplative to a state of maintenance where the behavior has occurred. A number of authors have investigated the utility of this model in the CME literature. The recent article by Johnson and colleagues utilized secondary behavioral measures as indicators of the individual learner’s motivational state within the transtheoretical construct. They found that the further along the motivational progression an individual was, the more likely change was made and then maintained. A related area of research is commitment to change with a number of studies demonstrating the usefulness of commitment to change in promoting behavioral changes.

Self-efficacy as an intervening cognitive state between knowledge acquisition and behavior has a long history among learning theorists. While self-efficacy is part of the Transtheoretical Model of Change, Bandura and colleagues are preeminent among those who have studied the importance of this construct. It is less studied within the CME literature. The authors have employed this construct in several studies and have found that the variable appears to be robust.

While any of the variables that have been demonstrated in other settings to measure processes that are active between learning or knowledge acquisition and behavioral change merit study, the authors were particularly interested in motivation and self-efficacy. It should be noted that this is one study in a series of studies that will look at other relationships in this causal chain. The current study specifically focuses on the relationship between motivation and self-efficacy, and the variable intent to change, which is theoretically more proximal to practice change.

Evaluation of many of these intervening variables has been incorporated into the standard evaluation process used as part of CME programming accredited through Rush University Medical Center (RUMC). The data were collected from a single didactic RUMC CME activity focused on human immunodeficiency virus (HIV). Consistent with our CME practices, participants in the activity were surveyed prior to and after completion of the activity. These results are 1 element of a larger evaluation of activity.

**Scales**

The measure of an individual’s sense of self-efficacy was a 4-item scale explicitly built for CME/continuing professional development (CPD). This scale was a heavily modified version of the Perceived Competence Scale of Smith.
and colleagues.\textsuperscript{20} The scale was entered into a factor analysis, and each individual in the study was assigned a score on each of the 2 factors identified. The scale was confirmed as to structure.\textsuperscript{17}

The measure of motivation was also a 4-item scale and was derived from measures used by Rush in its CME/CPD programs. The approach used and items selected followed on the work of Johnson and colleagues.\textsuperscript{24} A set of behavioral correlates of implementation were taken as markers of general motivation. Intent to change was measured as a single, global, Likert-scaled item.

**Approach**

Two sequential sets of analyses were undertaken. The first was a series of regression studies that employed JMP (Version 9, SAS Institute, Cary, NC). The purpose of these analyses was to determine the existence of relationships among the 3 constructs motivation to change, self-efficacy, and intent to change. A second element of these analyses was a series of principal-components factor analyses to extract the core measures of the constructs motivation to change and self-efficacy.

The direct analysis then served as the guide to the second set of simultaneous analyses to determine the relationships among the variables. As the independent variables were not directly observed and likely intercorrelated, the analyses were undertaken as a series of structural equation estimations. The focus of these estimations was not to confirm the scales but rather to observe the interrelationships between the 2 constructs self-efficacy and motivation to change and the directly assessed construct intent. We have previously confirmed structure and reported this elsewhere.\textsuperscript{17} Also, the intent was not to produce a generalized measurement tool but effectively employ extant measures. The second set of analyses was undertaken as a series of path analytic studies employing MPlus 7 (Muthen & Muthen, Los Angeles, CA). The purpose of these analyses was to determine the nature of the pattern of effects among the 3 constructs.

**Results**

These data reflect the responses of 51 participants in a CME activity accredited by Rush University Medical Center. The participants were a subgroup of 123 participants in the activity. These participants returned both a preparticipation and a postparticipation questionnaire. They were 34% female and 66% male, with a mean age of 45.5 years.

**Regression and Factor Analytic Results**

Intent to change was regressed on the individual-level variables of motivation to change and self-efficacy. The relationship was found to not meet traditional levels of significance ($p > .05$, $F = 1.55$, $df = 8/29$). The relationship of interest involves the relationship of the constructs motivation to change and self-efficacy to the formulated intent. To follow this construct further, estimates of the construct using the individual variables as indicators were undertaken.

Four indicators of self-efficacy were employed. They were subjected to a principal components factor analysis. Two components were extracted with eigenvalues greater than 1. The first factor had primary loadings from 3 variables, the second from 1. TABLE 1 presents the factor loadings. For identification purposes, factor 1 was labeled P efficacy or Personal Efficacy, and the second factor was labeled R efficacy or Results Efficacy. Cronbach’s alpha was 0.4, as would be expected with a multiple factor solution; together, the 2 factors accounted for 74% of the variance.

Respondents were scored based on the factor scoring coefficients. Intent to change was regressed on their scores for both P efficacy and R efficacy. The regression was significant ($p < .05$, $F = 3.67$, $df = 2/29$). Further inspection of the regression found the relationship with P efficacy to be significant ($p < .05$, $t = 2.37$), while the relationship with R efficacy did not meet the traditional level of significance.

Four indicators of motivation to change were also employed. They demonstrated a high intercorrelation (Cronbach’s alpha = 91). They were subjected to a principal components factor analysis. One component was extracted with an eigenvalue greater than 1, consistent with $\alpha$. The primary factor loadings are presented in TABLE 2. Respondent scores were generated using the factor scoring coefficients. Intent to change was regressed on their scores for motivation. The regression was significant ($p < .05$, $F = 5.78$, $df = 1/33$).

To further explore the relationships, intent to change was then regressed on P efficacy, R efficacy, and motivation to change. The regression was significant ($p < .05$, $F = 3.17$,

\textbf{TABLE 1. Rotated Factor Loadings for Self-Efficacy}

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I find that it is difficult to translate information from scientific meetings to direct patient care.</td>
<td>-0.576868</td>
<td>0.128469</td>
</tr>
<tr>
<td>I succeed in changing patient regimens and my clinical practice according to the latest available data.</td>
<td>0.680898</td>
<td>0.161045</td>
</tr>
<tr>
<td>Typically, changing patient regimens has not been as successful as I would like.</td>
<td>-0.050425</td>
<td>0.630329</td>
</tr>
<tr>
<td>I am as able to change my practice patterns in response to new data as my colleagues.</td>
<td>0.746651</td>
<td>-0.329263</td>
</tr>
</tbody>
</table>
TABLE 2. Motivation Factor Loadings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I frequently employ the clinical data from the International AIDS Conference on the potential benefits of antiretroviral (ARV) versus potential risks in selecting ARV therapy for ARV-naïve patients when currently treating my patients.</td>
<td>0.8756374</td>
</tr>
<tr>
<td>2. I frequently use clinical data presented from the International AIDS Conference on efficacy, avoidance of toxicity, and adverse events in selecting ARV therapy for ARV-naïve patients when currently treating my patients.</td>
<td>0.9974074</td>
</tr>
<tr>
<td>3. I frequently use study results regarding the medical management of HIV-positive patients from the International AIDS Conference in my clinical practice.</td>
<td>0.7686701</td>
</tr>
<tr>
<td>4. I frequently use data presented from the International AIDS Conference on viral hepatitis in my clinical practice.</td>
<td>0.7376513</td>
</tr>
</tbody>
</table>

When tested individually, no single coefficient was significant.

The composite variable, motivation to change, was then regressed on $P_{\text{efficacy}}$ and $R_{\text{efficacy}}$ variables. The relationship was significant ($p < .001$, $F = 5.75$, df 2/35). Individual tests revealed that the relationship between motivation to change and the individual variable $P_{\text{efficacy}}$ was significant ($p < .01$, $t = 3.24$), while the relationship between motivation to change and the variable $R_{\text{efficacy}}$ failed to meet traditional levels of significance.

Path Analytic Results

Based on these results, 3 alternative models were tested as potential causal paths. The 3 alternatives explored were paths from motivation to change and $P_{\text{efficacy}}$ to intent to change, paths from $P_{\text{efficacy}}$ to motivation to change and motivation to change to intent to change, and paths from motivation to change to $P_{\text{efficacy}}$ and $P_{\text{efficacy}}$ to intent to change.

The models did replicate the findings of the traditional factor analytic studies as to structure, with the 4 motivation to change indicators reflecting a latent variable and 3 of the 4 self-efficacy variables indicating a latent variable consistent with $P_{\text{efficacy}}$. The issues of interest were the potentially causal relationships and their patterns.

The most saturated model with a path estimated directly from each latent variable, motivation to change and self-efficacy, to the explicit variable, intent to change, yielded results with a significant intercorrelation between self-efficacy and motivation to change, but the path coefficients between these latent variables and intent to change was nonsignificant ($p < .05$, chi-square 33.9, df 18).

The second model relaxed the requirement of a path between self-efficacy and intent to change while maintaining the path between motivation and intent to change. This model also estimated a causal path between self-efficacy and motivation to change (see FIGURE 2). The results in this case found significant path coefficients between motivation to change and intent to change as well as between self-efficacy and motivation to change ($p < .01$, chi-square 36.3, df 19).

The third model relaxed the requirement of a path between motivation to change and intent to change while maintaining the path between self-efficacy and intent to change. This model also estimated a causal path between motivation to change and self-efficacy. The results in this case found an improvement in chi-square over the first model; however, the improvement was less than in the second model. In addition, the path between self-efficacy and intent to change was not found to be significant in this model ($p < .05$, chi-square 34.2, df 19).

Discussion

The results indicated that a measure of motivation to change showed a significant relationship to intent to change practice. This finding is consistent with the Theory of Planned Behavior, which states that attitude toward behavior, subjective norms, and perceived behavioral control, together shape an individual’s behavioral intentions and behaviors. The relationships between attitudes and subjective norms to behavioral intention, and subsequently to behavior, has been confirmed in many studies.
This finding is also consistent with the broader health and CME literatures demonstrating the value of commitment to change in promoting behavioral/practice changes. It should be noted that the dependent variable in this study was intent to change, not commitment to change. It is possible, even likely, that if specifically modeled, commitment to change has elements of both the construct motivation and intent to change. The commitment to change literature predicated that motivation is clearly related to the formulation of intent.

The analyses of the raw data did not find a significant relationship between the individual items and the criterion variable. This indicates that the relationship is not a simple one where the measures themselves are direct measures of the variables of interest. This finding, taken together with the later findings from the abstracted measures of the unobserved variables, is support for the existence of the unobserved variable of interest. This finding, taken together with the later findings from the abstracted measures of the unobserved variables, is support for the existence of the unobserved variables as active intervening processes that change the intention of the learner.

This work extends these findings in that we used an indirect behavioral indicator of motivation to change. The scale is an extension of the work by Johnson et al. 2012. This abstracted, unobserved variable evinced a strong correlation to stated intent to change. The approach used in the current study has the advantage that the behavioral indicator is clearly distinct from the criterion variable intent to change. The variables chosen by Johnson et al., while perhaps more face valid, might, in some instances, be viewed as alternative wording of the same construct rather than the separate variable motivation to change if intent to change is used as the criterion.

Self-efficacy relates to one’s beliefs in the capability to organize and execute the courses of action required to produce given attainments. It has an extensive literature within the broader field of learning. Bandura’s work might be said to provide one of the bases of the motivation-to-change literature. In the current study, self-efficacy, using a measure heavily based on Smith and colleagues, was found to be an effective second-order variable. It appears to be active between the acquisition of learning and the generation of intent to change practice. This relationship, however, is mediated by motivation to change. This finding is also consistent with the prior literature. A number of theorists, among them Fishbein, Schwarzer, Wallston, and others have argued for a learning model that has a sequence of cognitive processes beginning in knowledge acquisition and ending in behavioral change.

This finding adds to earlier findings of these authors on the relationship between self-efficacy and perceived barriers to implementation. In that case, the authors found a significant relationship between self-efficacy and the degree to which individuals reported barriers, and then between barriers and reported intent to change. Consistent with Mazmanian et al., information about barriers alone does not increase the likelihood of implementation of practice change: “Successful change may depend less on the information associated with clinical effectiveness and barriers than on other factors that influence physicians’ performance.”

There are a number of limitations to the current study. First, results are based on a relatively small group of individuals. It is possible that these findings are idiosyncratic to the nature of the activity and/or the individuals within the study. Perhaps more important, the finding introduces a new method of assessing the degree of motivation to change. As previously noted, this method has both strengths and weaknesses. It remains to be seen whether others are able to replicate these findings. Finally, while intent to change is an indicator of practice change, it is not the same as a direct measurement of practice change. The degree to which these findings are themselves efficiently related to practice change remains to be tested.

These concerns, nonetheless, do not diminish the finding that in two studies self-efficacy, a well-researched variable within the field of cognitive models of learning, has been shown to be a powerful second-order variable as it relates to the formulation of intent to change practice subsequent to a CME activity. These findings are noteworthy not only because the study demonstrates that self-efficacy is an important variable, but also because it demonstrates the limitation of a standard regression analysis where there is an ordered path of cause. The proximal variable tends to absorb all the explanatory variance, while secondary variables may show up as having insignificant coefficients, thus hiding a potentially critical variable in understanding the cognitive processes involved. Thus, for example, one may believe that the limitation in the efficacy of the CME activity is the motivation of the learner, whereas the true limitation may be that learners do not view themselves as being effective agents of change. These findings suggest that methods of addressing...
activity participants’ sense of self-efficacy may well be important in improving the efficacy of CME.

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