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Healthy Eating for Life English as a second language curriculum: Primary outcomes from a nutrition education intervention targeting cancer risk reduction

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Abstract

We conducted a pre–post feasibility trial of *Healthy Eating for Life*, a theory-based, multimedia English as a second language curriculum that integrates content about healthy nutrition into an English language learning program to decrease cancer health disparities. Teachers in 20 English as a second language classrooms delivered *Healthy Eating for Life* to 286 adult English as a second language students over one semester. Postintervention data are available for 227 students. The results indicated that *Healthy Eating for Life* is effective for increasing fruit and vegetable intake as well as knowledge, action planning, and coping planning related to healthy eating. Participants also achieved higher reading scores compared to the state average.

Keywords

communication; eating behavior; health behavior; health education

The National Cancer Institute (NCI) defines cancer health disparities as “adverse differences in cancer incidence (new cases), cancer prevalence (all existing cases), cancer death (mortality), cancer survivorship, and burden of cancer or related health conditions that exist among specific population groups in the United States” (NCI, 2010b). Individuals susceptible to these health disparities have a higher chance of being diagnosed and dying from preventable and/or generally curable cancers. They tend not to engage in cancer screening behaviors and are diagnosed at later stages of the disease, receive inadequate or no treatment, and suffer from cancer without palliative care (US Department of Health and Human Services (USDHHS), 2004). Modifiable cancer risk factors, such as smoking, leisure time physical inactivity, and obesity, tend to vary by race/ethnicity and socioeconomic status such that minority and medically underserved individuals are more likely to engage in unhealthy lifestyle behaviors (Ward et al., 2004).

Although the two primary factors that contribute to cancer health disparities in the United States are lack of health-care coverage and low socioeconomic status, cancer health disparities may be further explained by limitations in health literacy among individuals from the most marginalized populations. Health literacy is defined as “the degree to which

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individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (USDHHS, 2010). Low health literacy may impact an individual's ability to secure a family doctor, access insurance and payment plans, follow instructions from medical professionals, fill prescriptions, interpret written information and instructions, and communicate effectively with health-care providers. Indeed, low health literacy is related to lower levels of disease-related knowledge, low use of screening and prevention behaviors, and poor health maintenance and outcomes (DeWalt et al., 2004). The problems associated with low health literacy are amplified among those with limited English proficiency.

Building health literacy skills among adult learners may be a means to reducing health disparities (Nutbeam, 2008). One potential setting in which to intervene to improve the health prospects of vulnerable populations is English as a second language (ESL) programs (Diehl, 2011). Including health literacy interventions in ESL programs is consistent with the Comprehensive Adult Student Assessment Systems (CASAS), a nationally recognized set of competencies that set standards for instruction of adult learners. The CASAS standards identify a number of health-related skills as essential for daily functioning (CASAS, 2008).

Despite the consistency between the CASAS competencies and the noted opportunity to intervene in adult education settings, the confluence of adult learning and health has been relatively poorly addressed in research and in practice (Quigley et al., 2009), with two exceptions. Taylor and colleagues conducted a teacher-administered, classroom-based intervention guided by the health-behavior framework (Bastani et al., 1999, 2001) that aimed to improve hepatitis-B-related knowledge and testing among Asian immigrants in Canada (Taylor et al., 2009). In a group-randomized controlled trial, 759 students received 3 hours of either a hepatitis-B curriculum or a physical activity control curriculum. At a 6-month follow-up, participants in the intervention group had significantly higher scores on hepatitis-B-related knowledge compared to controls. Hepatitis-B testing was also higher among intervention participants; however, only 11 percent of the participants in the experimental group reported being tested.

The Language for Health ESL curriculum intervention was based on principles from social learning theories and was designed to teach adult Latino students about healthy eating with a focus on reducing cardiovascular disease (Elder et al., 2000). Elder and colleagues randomized 817 students to receive the teacher-administered Language for Health curriculum or a stress-management control curriculum. Compared to control participants, Language for Health students had greater decreases in the ratio of total high-density cholesterol (HDL) and systolic blood pressure and greater increases in knowledge of a healthy diet as well as self-reported fat avoidance at the post-intervention assessment.

Although both interventions were delivered in an ESL setting, neither study assessed the impact of the intervention on English learning skills. It is unknown whether these interventions were effective at achieving the learning goals of the education program in addition to the health literacy goals or just the latter. Additionally, although the development of both of these interventions was guided by health-behavior theory, neither intervention addressed the most proximal antecedents to behavior change—action planning and coping planning—which researchers have identified as essential components of long-term behavior maintenance (Schwarzer, 2008; Schwarzer et al., 2007).

The present study

We developed *Healthy Eating for Life* (HE4L) with the overall objective of addressing cancer health disparities by increasing fruit and vegetable intake, as well as the psychological antecedents (i.e. intentions, outcome expectancies), behavioral skills (i.e.

action and coping planning), and literacy skills necessary to maintain a healthy diet among at-risk individuals. HE4L is a theory-based, multimedia, teacher-administered curriculum for beginning-level ESL classrooms that serve a predominantly medically underserved, limited-literacy, immigrant population. HE4L addresses all aspects of literacy, including reading, listening, speaking, writing, and numeracy—all of which the Institute of Medicine (IOM) has identified as essential for interventions targeting health literacy (IOM, 2004). The curriculum content was informed by the life skills competencies specified by the CASAS. HE4L focuses primarily on fruit and vegetable intake and other healthy eating behaviors such as eating whole grains, avoiding unhealthy foods, and planning and preparing healthy meals because of the demonstrated impact of these eating behaviors on cancer risk reduction (NCI, 2010a). HE4L also addresses other cancer prevention behaviors, such as talking to the doctor, obtaining cancer screenings, and engaging in regular physical activity. Included in the HE4L curriculum package is an interactive student workbook, a teacher's manual, audio files available on CD, and a soap opera (or telenovela), presented in a DVD format. The multimedia approach to HE4L addresses the IOM's recommendations for including audio, video, and computer technology in addition to print when delivering an intervention (IOM, 2004).

HE4L is grounded in the Health Action Process Approach (HAPA), which has achieved considerable empirical support as an effective model of health-behavior change (Chiu et al., in press; Lippke et al., 2004; Lloyd et al., 2011; Luszczynska and Schwarzer, 2003; Schüz et al., 2006; Sniehotta et al., 2005; Teng and Mak, 2011; Ziegelmann et al., 2006). HAPA is designed to be used as either a stage or a continuum model of behavior change. As a stage model, HAPA consists of a pre-intentional motivational stage and a post-intentional volitional stage. In the motivational stage, risk perceptions, outcome expectancies, and action self-efficacy come together in the formation of an intention. In the volitional stage, the intention is translated into action through post-intentional factors, such as action planning, coping planning, maintenance of self-efficacy, and recovery of self-efficacy. According to the HAPA, individuals will be better suited to adopt a new behavior if they have the requisite efficacy and planning skills. As a continuum model, HAPA suggests that action and coping planning are the proximal antecedents to behavior change in that they play an important role in the translation of intentions to behavior. HAPA has been shown to be applicable to dietary behavior interventions (Kreusukon et al., in press; Renner et al., 2008; Scholz et al., 2009; Schwarzer, 2008; Schwarzer and Renner, 2000; Soureti et al., 2012; Teng and Mak, 2011).

The HE4L curriculum includes a variety of language learning activities focused around healthy eating or other cancer prevention behaviors that are reinforced by the multimedia components of the curriculum. For example, in Unit 3, the students listen to an audio passage in which Brenda, one of the characters from the telenovela, plans and prepares a healthy meal. The activities in the workbook then reinforce vocabulary (by asking students to answer a series of questions about the story content using newly learned words) and grammar (by having students change sentences from the story from the present to the past tense). In this example, HE4L targets nutrition knowledge, outcome expectancies, self-efficacy, and planning skills through the presentation of new vocabulary and nutrition information as well as through observation of the telenovela character successfully planning and preparing a healthy meal.

Formative research, including focus groups and interviews, conducted with ESL students and other key informants prior to the development of HE4L indicated that adult ESL teachers tend not to follow a set curriculum each semester but rather teach to the dynamic needs of their students. As a result, we did not identify one preexisting ESL curriculum that would form the foundation for HE4L. Additionally, given the accumulating evidence for

interventions aimed at increasing action and coping planning skills as a means to facilitate lasting health behavior change (Kreausukon et al., in press; Renner et al., 2008; Scholz et al., 2009; Schwarzer, 2008; Schwarzer and Renner, 2000; Soureti et al., 2012; Teng and Mak, 2011), we elected to create a new ESL curriculum, guided by the HAPA, which could be used in whole or in parts.

This report describes an initial feasibility trial of HE4L. The purpose of the trial was to evaluate the impact of HE4L on key outcomes using a pre–post test design. The key outcomes of interest were fruit and vegetable consumption, nutrition knowledge, outcome expectancies, intentions, and action and coping planning skills in addition to adult literacy scores (focusing on reading and listening skills) derived from standardized test scores from statewide CASAS testing. Although HE4L focused on a wide variety of eating behaviors, we selected fruit and vegetable intake as an indicator of healthy eating because research has found it to be (a) an important component of cancer risk reduction (NCI, 2010a) and (b) a behavior in which there are notable deficiencies for our target population (Patterson et al., 1990). Our community partners would not allow randomization to a control group or wait-list condition.

Method

Participants

Participants ($N = 286$) were recruited at baseline from 20 adult ESL classrooms in nine cities across Connecticut. Complete pre- and post-intervention data and demographic information were collected for 79 percent of the participants ($n = 227$). Among participants with complete data, ages ranged from 18 to 78 years ($M = 37.16$ years, standard deviation (SD) = 12.82). Participants originated from 48 different countries. On average, participants had been living in the United States for 61.03 months (SD = 64.79) and reported completing 10.82 years of education (SD = 3.18). Participants who reported less than 12 years of education indicated that they had not obtained a high school diploma in their country of origin. None of the participants had obtained their high school diploma or equivalent (i.e. general educational development (GED)) in the United States. Additional demographic data are presented in Table 1. Overall, the demographics reported by HE4L students were consistent with state averages for students enrolled in ESL programs in 2011.

Procedures

The Yale University Institutional Review Board approved the research protocol. Recruitment took place in two stages.

Recruitment of organizations—Outreach to potential partners in Connecticut began 10 months prior to implementation. The participating sites included five regional adult education programs, two community colleges, and two nonprofit organizations. The final sample included 18 teachers and 20 classrooms (2 of the teachers had 2 classrooms involved in the intervention). Of the 20 classes, 7 were at the Beginner 1 level (i.e. low beginner), 6 were at the Beginner 2 level, 3 were at the Intermediate level, and 4 were at the multilevel.

Participant recruitment—The ESL classes took place throughout the day and evening. Instructors informed us that their students typically spoke one of the following languages: Spanish, French, Arabic, Chinese, Turkish, Haitian-Creole, and Portuguese. Informed consent documents and surveys were translated and back-translated in these languages. Informed consent was obtained prior to the baseline survey in each student's language of choice (i.e. English or their native language). Any student who consented in English was re-consented at the follow-up to ensure that he or she understood his or her rights as research

participants. The data were collected within 2 weeks of the start of the semester (Time 1) and again at the end of the semester (Time 2), approximately 12 weeks later. Time 2 follow-up data collection occurred across an 8-week period as some classes finished their semester earlier than others. Participants received US\$10 for each survey they completed. All surveys were in the student's language of choice and took approximately 25 minutes to complete.

Implementation—Program managers and teachers attended a full-day HE4L training prior to the start of the semester. Across all classes, the mean number of hours per week of total instruction (including hours devoted to HE4L) was 7.89 (SD = 4.19, range = 2.67–15.00). HE4L was designed in such a way that it could be implemented as a stand-alone curriculum or in conjunction with other curriculum materials (i.e. HE4L could be administered in whole or in part). Teachers who participated in the intervention were asked to use the HE4L curriculum for at least 2 hours of classroom instruction each week. The mean number of hours per week that teachers reported using the HE4L curriculum was 3.84 (SD = 2.86, range = 1.00–12.00). One teacher reported using HE4L exclusively.

Measures

Demographics—The country of origin and length of time in the United States were measured at Time 1. Additional demographic information collected through the State Department of Education (SDE)'s adult education reporting system included age, gender, ethnicity, race, number of months living in the United States, receipt of high school diploma or GED equivalent, years of education completed, employment status, parent/guardian status, reasons for enrollment, and whether the student was new or returning.

Hours of instruction and attendance—The total number of hours of instruction accumulated during the semester was calculated for each class, taking into account the classes missed for holidays. Attendance records for individual students were obtained from the SDE. At the end of the semester, teachers indicated how many hours per week, on average, they devoted to teaching the HE4L curriculum using an online survey.

Dietary recall—Fruit and vegetable intake was assessed using a modified version of a 24-hour dietary recall task (Block et al., 1986; Fitzgerald et al., 2008). Respondents were shown pictures of 18 different fruits and 27 different vegetables and were asked to circle the pictures of the items that they had consumed during the past 24 hours. The number of circled items was summed to create a consumption score for each of the two categories.

Knowledge—Eight questions targeted participants' nutrition knowledge. These questions were selected based on the content of the first two units of materials in the HE4L curriculum. Examples include the following: "Is meat a protein?" or "Is an apple a grain?" Potential responses were "yes," "no," "maybe," or "don't know," and responses were recoded as correct (yes) or incorrect (no, maybe, and don't know). Each participant was assigned a knowledge score based on the number of correct answers.

Outcome expectancies—Three items assessed participants' beliefs that eating more fruits and vegetables would produce positive results: "If I eat more fruits and vegetables this week ...": (1) "... I will have more energy," (2) "... I will feel better about my body," and (3) "... it will make me healthier." Participants rated each statement at Time 1 and Time 2 on a scale ranging from 1 (*disagree a lot*) to 4 (*agree a lot*).

Intentions—At both time points, participants rated the degree to which they agreed with the statement, "I think I will eat more fruits and vegetables this week," on a scale ranging from 1 (*disagree a lot*) to 4 (*agree a lot*).

Action planning—Action planning refers to how an intended behavior will be executed and under what circumstances (Schwarzer et al., 2003). Four items were used to measure action planning behaviors, and respondents rated how often they engage in these planning behaviors on a scale ranging from 1 (*never*) to 4 (*always*): “I usually plan meals for the week before I go shopping”; “I usually write a shopping list to take with me when I shop for food”; “I plan in the morning what I will eat for dinner that night”; and “I prepare to cook dishes, or I cook dishes, at least one day ahead of time.”

Coping planning—This construct refers to the extent to which respondents feel they can overcome barriers to the initiation and maintenance of a new behavior and the extent to which effective coping strategies are adopted (Schwarzer, 2008). Five items were used to measure how well respondents felt they could engage in alternative behaviors that could be used to overcome barriers to eating more fruits and vegetables. Respondents rated on a scale ranging from 1 (*disagree a lot*) to 4 (*agree a lot*) the following statements: “I can eat more fruits and vegetables this week even if ...”: (1) “... my family does not eat fruits and vegetables,” (2) “... I am tired after a long day,” (3) “... I do not have the time,” (4) “... it is easier to make an unhealthy meal,” and (5) “... it is cheaper to make an unhealthy meal.”

Literacy—English language learning was measured using the CASAS reading and listening tests. CASAS tests have been used statewide in Connecticut for more than 14 years and are considered the national standard for assessing the five core functional literacy skills—listening, speaking, reading, writing, and numeracy—in adult education programs (SDE, 2010). We did not employ a measure of overall health literacy as an outcome measure in this study. After an extensive literature search, we were not able to identify a strong measure of overall health literacy, which we felt would accurately demonstrate the learning gains made by HE4L students. Overall literacy is an important component of health literacy. The SDE administers tests for reading and listening among ESL students because these are strong indicators of overall literacy (SDE, 2010). We were able to obtain reading and listening scores from the SDE for students in the HE4L classrooms and believe that these scores are important indicators of literacy and thus indicators of health literacy. Additionally, health literacy involves the abilities to obtain, process, and understand health information (USDHHS, 2010). We believe that improvements in nutrition knowledge, action planning, and coping planning are strong indicators that students obtained, processed, and understood information from the HE4L curriculum.

Results

Attrition and missing data

Two hundred eighty-six participants completed the Time 1 survey. At Time 2, data were available from 79 percent of the participants ($n = 227$). Attendance data were not provided by the SDE for 16 participants, all of whom were in one HE4L class. The teacher of this class, which was affiliated with a community college and not with the state offerings, provided attendance data for these participants.

Thirty-four percent of the HE4L sample ($n = 96$) underwent CASAS pre- and post-curriculum reading testing, and 52 percent of the sample ($n = 148$) underwent CASAS pre- and post-curriculum listening testing. The timing of CASAS testing is determined on an individual basis; it does not occur systematically at the start or end of each semester. The SDE requires that students attend at least 40 hours of ESL instruction (and recommends that they attend 100 hours) before taking a CASAS post-test. The total number of instructional hours for HE4L classrooms during the intervention semester ranged from 37.38 to 240 hours. It is unlikely that students who were in classes that met less frequently or had poor

attendance were eligible to take a post-test. Additionally, students in the class that was not affiliated with the state did not take the CASAS test.

Descriptive statistics

Table 2 presents the descriptive statistics for fruit and vegetable consumption, nutrition knowledge, outcome expectancies, intentions, action planning, and coping planning at Time 1 and Time 2. At Time 1, men and women did not differ on any outcome variables, with one exception: women ($M = 6.18$, $SD = 1.25$) scored higher than men ($M = 5.79$, $SD = 1.24$) on nutrition knowledge ($F(1, 212) = 4.93$, $p = .03$). At Time 1, differences were observed between participants of different racial or ethnic origins for fruit intake ($F(3, 221) = 6.62$, $p < .001$), vegetable intake ($F(3, 220) = 4.31$, $p = .006$), action planning ($F(3, 203) = 8.56$, $p < .001$), and coping planning ($F(3, 202) = 3.78$, $p = .01$). Follow-up tests showed that White participants reported eating more fruits than Black and Hispanic participants. Hispanic participants reported eating more vegetables than Asian participants. Hispanic participants reported lower action planning compared to Asian and Black participants and higher coping planning compared to Asian participants.

Primary analyses

Hierarchical linear modeling (HLM) was used to examine the impact of HE4L in order to account for the nonindependence of participants within classrooms. The outcome variables included the following: fruit and vegetable intake, knowledge, outcome expectancies, intentions, action planning, coping planning, and CASAS test scores for reading and listening. To examine the impact of the curriculum over time, the outcome variables were modeled as a function of hours of instruction, hours of attendance, and the ratio of classroom hours devoted to the curriculum to the total classroom hours. All analyses controlled for the number of months students had been in the United States and their years of education. Baseline fruit and vegetable intake, knowledge, outcome expectancies, intentions, and planning were controlled for in each of the corresponding analyses. Previous research has demonstrated the impact of planning on fruit and vegetable intake (Subar et al., 1995). Because our preliminary analyses indicated differences between participants of varying racial and ethnic background in fruit and vegetable consumption, action planning, and coping planning, all analyses also controlled for participant race. Additionally, because women had higher scores on nutrition knowledge at baseline, the analysis examining the impact of HE4L on knowledge controlled for gender.

We found significant increases in fruit intake ($\gamma = 1.01$, standard error (SE) = .19, $p < .001$), vegetable intake ($\gamma = 1.48$, SE = .28, $p < .001$), nutrition knowledge ($\gamma = .38$, SE = .09, $p < .001$), action planning ($\gamma = .15$, SE = .05, $p = .002$), and coping planning ($\gamma = .16$, SE = .05, $p = .001$) among adults who participated in HE4L. Changes in these outcome variables did not differ as a function of hours of instruction, attendance, or the ratio of classroom hours devoted to HE4L to total hours of instruction. No changes were observed from Time 1 to Time 2 with respect to outcome expectancies or intentions.

Participants had significant increases in CASAS reading scores from pre- to post-curriculum testing ($\gamma = 6.28$, SE = 3.46, $p < .001$), and these scores increased as a function of the total number of class hours attended during the semester ($\gamma = .03$, SE = .01, $p = .025$). Additionally, there were greater increases in reading scores as a function of the ratio of hours devoted to the HE4L curriculum to total class hours ($\gamma = 10.07$, SE = 5.10, $p = .052$). Listening scores also increased significantly from pre- to posttest ($\gamma = 3.12$, SE = .62, $p < .001$). Improvements in listening scores were not affected by hours of instruction, attendance, or the ratio of hours of curriculum instruction to total hours of instruction. According to the CASAS standards, a 4-point gain in reading or listening scores signifies a meaningful

improvement. Of the 96 HE4L participants who underwent pre- and post-curriculum reading tests, 68 participants (70.83%) achieved a reading score gain greater than 4 points ($M_{\text{gain}} = 6.35$, $SD = 8.51$). The data from the SDE for the 2010 academic year indicate that a greater percentage of HE4L students achieved 4-point reading score gains compared to the state average (59%). With respect to CASAS listening scores, of the 148 HE4L students who underwent pre- and post-curriculum tests, 73 students (49%) achieved gains greater than 4 points ($M_{\text{gain}} = 3.25$, $SD = 7.65$). The percentage of HE4L students achieving listening gains greater than 4 points was below the state average of 63 percent.

Discussion

This feasibility study provided preliminary evidence for the effectiveness of HE4L. Adult student participants achieved significant increases in seven of the nine outcome variables of interest, including fruit intake, vegetable intake, nutrition knowledge, action planning, coping planning, reading scores, and listening scores. Perhaps, the most notable finding is the increase in participants' intake of both fruits and vegetables from Time 1 to Time 2. Although self-reported, it is encouraging to see that the intervention had an impact on our target behavior. With respect to the HAPA model variables, the findings related to the impact of HE4L were mixed. Participants did not report significant increases in outcome expectancies or intentions from Time 1 to Time 2; however, the mean scores for each of these variables at Time 1 were very high suggesting a ceiling effect. HE4L students did report significant increases in action planning and coping planning, which is encouraging given that these constructs were key targets of the curriculum. The results of this study confirm findings from previous research, indicating that planning behaviors are important components of dietary behavior change (Kreausukon et al., in press; Renner et al., 2008; Scholz et al., 2009; Schwarzer, 2008; Schwarzer and Renner, 2000; Soureti et al., 2012; Teng and Mak, 2011).

Another notable finding was the improvement in English language learning for HE4L students. Previous health interventions conducted in ESL settings have focused solely on health outcomes and have not considered how the addition of the health curriculum might affect the language learning program (Elder et al., 2000; Taylor et al., 2009). Our initial test of HE4L indicated that health education can be integrated into an ESL curriculum without deleterious effects on language learning. In fact, reading gains for HE4L students were higher than the state average. Although we did not assess improvements in overall health literacy, the improvements that were observed among participants in English literacy skills in addition to improvements in nutrition knowledge and self-reported planning skills suggest that HE4L did positively impact overall literacy and health literacy, factors known to be associated with cancer health disparities.

This study demonstrated the feasibility of integrating a nutrition education intervention into an ESL curriculum. Given that the intervention yielded changes in the expected directions, it appears that the teacher training and subsequent curriculum delivery were successful. Overall, compliance with our instructions to devote at least 2 hours per week to the curriculum was good. Anecdotal reports indicated that enthusiasm for the curriculum was high among teachers who had participated and that teachers wished to implement HE4L in whole or in part in future semesters.

As suggested by previous researchers (Elder et al., 2000), integrating a healthy lifestyle behavior change intervention into an ESL curriculum has a number of advantages. Although some nutritional behavior change interventions have reported substantial attrition (Taylor et al., 2000), we were able to retain a relatively large number of participants over the intervention period (i.e. 79%). Perhaps, this is because participation in the intervention did

not involve any effort beyond what the participants would normally do in their daily or weekly routine. Indeed, our formative research indicated that time is a significant barrier for individuals in this population (Martinez et al., 2012). Additionally, integrating the curriculum into an ESL program that the students were motivated to attend of their own accord may have helped with retention. The current findings suggest that integrating behavior change interventions into activities for which participants have already committed their time may be an effective strategy for facilitating adherence to the intervention.

A primary strength of this feasibility study was the creation of partnerships with community learning centers. Having ESL teachers deliver HE4L also helped to ensure that the intervention-ists were competent and well respected with regard to ESL teaching and that they would be viewed by the students as credible sources. Engaging community partners in the intervention delivery increased the potential for sustainability since the HE4L curriculum could be continued once the research was complete. Because the trained teachers were still employed at the community learning centers, they could continue to deliver (and perhaps train other staff members to deliver) the intervention. Another advantage of partnering with the community learning centers and giving the teachers some control over the intervention implementation was that they were allowed to tailor the curriculum delivery to the learning needs of their students. Because the curriculum was designed to be implemented in whole or in parts, teachers could select the specific activities that best suited their class.

Engaging community partners in the research process also had some inherent limitations. In training teachers to deliver HE4L, we relinquished some control over the curriculum implementation. Once the teachers were trained, we were not able to completely control aspects of delivery, such as which elements were taught and how many hours per week the curriculum was implemented in each classroom. The resources available to each learning center also posed a limitation. For example, when funding for one center was cut, the intervention was cut short. In cases where the teachers used only parts of the HE4L curriculum, we were not able to control which aspects they taught. We could, however, keep a record of which lessons the teachers reported teaching. Therefore, students in different classes could have had notably different experiences with the curriculum.

In the current investigation, HE4L was not compared to a control intervention or to the standard ESL curriculum, with the exception of a comparison between the percentage of HE4L students making at least 4-point gains in reading and listening scores and previous state averages. Although the exclusion of a control group limits our ability to draw definitive conclusions about the relative effectiveness of the curriculum, we are encouraged by the pattern of findings. Subsequent tests of HE4L and similar interventions should include a control condition; thus, willingness to allow randomization to control or wait-list conditions should be required for eligibility among potential community partners.

Another limitation to this research is the absence of long-term follow-up. Given the relative intensity of the intervention, we would expect the changes in social-cognitive factors (i.e. intentions and planning) and healthy eating to last beyond the end of the intervention; however, we did not assess the long-term impact of HE4L. Central to the HAPA model are action and coping planning, which, in combination with self-efficacy and the successful management of barriers and resources, are integral to changing intentions into action and behavior maintenance (Schwarzer, 2008). The model suggests, and research has confirmed, that increasing action and coping planning skills can lead to long-term behavior maintenance (Schwarzer et al., 2007). In the current investigation, HE4L participants achieved gains in both action and coping planning as well as fruit and vegetable intake in a manner consistent with HAPA propositions; however, more research is needed to determine whether these behavior changes are maintained over time.

Previous studies of dietary interventions have used physiological measures, such as blood pressure, cholesterol levels, and waist and hip circumferences, to determine the impact of the intervention (Elder et al., 2000). We elected not to include physiological measures due, in large part, to time constraints in the HE4L classrooms. To determine the impact of HE4L and any associated dietary changes on physiological indicators of health, subsequent tests of HE4L should examine such markers.

Overall, our preliminary investigation indicated that HE4L had a positive impact on healthy eating, action and coping planning, and English language learning. Our findings point to the feasibility of partnering with community ESL programs and training teachers to deliver an integrated health and language curriculum. Ultimately, the results of this investigation provide evidence to warrant a randomized controlled test of HE4L compared to a standard or control curriculum.

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References

- Bastani R, Gallardo NV, Maxwell AE. Barriers to colorectal cancer screening among ethnically diverse high- and average-risk individuals. *Journal of Psychosocial Oncology*. 2001; 19:65–84.
- Bastani R, Maxwell AE, Bradford C, et al. Tailored risk notification for women with a family history of breast cancer. *Preventive Medicine*. 1999; 29:355–364. [PubMed: 10564627]
- Block G, Hartman A, Dresser C, et al. A databased approach to diet questionnaire design and testing. *American Journal of Epidemiology*. 1986; 124:453–469. [PubMed: 3740045]
- CASAS. CASAS Competencies: Essential Life and Work Skills for Youth and Adults. Comprehensive Adult Student Assessment System. The publisher is the Comprehensive Adult Student Assessment System; 2008. This document was retrieved from: <http://www.casas.org/docs/page-contents/competencies.pdf?Status=Master>
- Chiu C-Y, Fitzgerald SD, Strand DM, et al. Motivational and volitional variables associated with stages of change for exercise in multiple sclerosis: A multiple discriminant analysis. *Rehabilitation Counseling Bulletin*. in press Published online 28 March 2012. DOI: 10.1177/0034355212439898.
- DeWalt DA, Berkman ND, Sheridan S, et al. Literacy and health outcomes. *Journal of General Internal Medicine*. 2004; 19:1228–1239. [PubMed: 15610334]
- Diehl SJ. Health literacy education within adult literacy instruction. *New Directions for Adult and Continuing Education*. 2011; 2011:29–41.
- Elder JP, Candelaria JI, Woodruff SI, et al. Results of language for health: Cardiovascular disease nutrition education for Latino English-as-a-second-language students. *Health Education and Behavior*. 2000; 27:50–63. [PubMed: 10709792]
- Fitzgerald N, Damio G, Segura-Pérez S, et al. Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *Journal of the American Dietetic Association*. 2008; 108:960–967. [PubMed: 18502226]
- IOM. *Health Literacy: A Prescription to End Confusion*. Institute of Medicine; Washington, DC: 2004.
- Kreausukon P, Gellert P, Lippke S, et al. Planning and self-efficacy can increase fruit and vegetable consumption: A randomized controlled trial. *Journal of Behavioral Medicine*. 35:443–451. in press. [PubMed: 21822980]
- Lippke S, Ziegelmann JP, Schwarzer R. Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine*. 2004; 12:221–240.

- Lloyd J, Logan S, Greaves C, et al. Evidence, theory and context—Using intervention mapping to develop a school-based intervention to prevent obesity in children. *International Journal of Behavioral Nutrition and Physical Activity*. 2011; 8:73. [PubMed: 21752261]
- Luszczynska A, Schwarzer R. Planning and self-efficacy in the adoption and maintenance of breast self-examination: A longitudinal study on self-regulatory cognitions. *Psychology & Health*. 2003; 18:93–108.
- Martinez JL, Latimer AE, Rivers SE, et al. Formative research for a community-based message-framing intervention. *American Journal of Health Behavior*. 2012; 36:335–347. [PubMed: 22370435]
- NCI. Cancer Trends Progress Report—2009/2010 Update. National Cancer Institute, NIH, DHHS; Bethesda, MD: 2010a.
- NCI. Health Disparities Defined. National Cancer Institute; Bethesda, MD: 2010b.
- Nutbeam D. The evolving concept of health literacy. *Social Science and Medicine*. 2008; 67:2072–2078. [PubMed: 18952344]
- Patterson B, Block G, Rosenberger W, et al. Fruit and vegetables in the American diet: Data from the NHANES II survey. *American Journal of Public Health*. 1990; 80:1443–1449. [PubMed: 2240327]
- Quigley BA, Coady M, Grégoire H, et al. “More universal for some than others”: Canada’s health care system and the role of adult education. *New Directions for Adult and Continuing Education*. 2009; 2009:49–59.
- Renner B, Kwon S, Yang B-H, et al. Social-cognitive predictors of dietary behaviors in South Korean men and women. *International Journal of Behavioral Medicine*. 2008; 15:4–13. [PubMed: 18444015]
- Scholz U, Nagy G, Göhner W, et al. Changes in self-regulatory cognitions as predictors of changes in smoking and nutrition behaviour. *Psychology & Health*. 2009; 24:545–561. [PubMed: 20205011]
- Schüz B, Sniehotta FF, Wiedemann A, et al. Adherence to a daily flossing regimen in university students: Effects of planning when, where, how and what to do in the face of barriers. *Journal of Clinical Periodontology*. 2006; 33:612–619. [PubMed: 16856896]
- Schwarzer R. Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*. 2008; 57:1–29.
- Schwarzer R, Renner B. Social-cognitive predictors of health behavior: Action self-efficacy and coping self-efficacy. *Health Psychology*. 2000; 19:487–495. [PubMed: 11007157]
- Schwarzer R, Schüz B, Ziegelmann J, et al. Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine*. 2007; 33:156–166. [PubMed: 17447868]
- Schwarzer, R.; Sniehotta, F.; Lippke, S., et al. On the Assessment and Analysis of Variables in the Health Action Process Approach: Conducting an Investigation. Freie Universität Berlin; Berlin: 2003.
- SDE. Connecticut Competency System (CCS) Assessment Policies and Guidelines: Fiscal Year 2010-2011. Connecticut State Department of Education; Hartford, CT: 2010.
- Sniehotta FF, Schwarzer R, Scholz U, et al. Action planning and coping planning for long-term lifestyle change: Theory and assessment. *European Journal of Social Psychology*. 2005; 35:565–576.
- Soureti A, Hurling R, Van Mechelen W, et al. Moderators of the mediated effect of intentions, planning, and saturated-fat intake in obese individuals. *Health Psychology*. 2012; 31:371–379. [PubMed: 22142278]
- Subar AF, Heimendinger J, Patterson BH, et al. Fruit and vegetable intake in the United States: The baseline survey of the five a day for better health program. *American Journal of Health Promotion*. 1995; 9:352–360. [PubMed: 10150767]
- Taylor T, Serrano E, Anderson J, et al. Knowledge, skills, and behavior improvements on peer educators and low-income Hispanic participants after a stage of change-based bilingual nutrition education program. *Journal of Community Health*. 2000; 25:241–262. [PubMed: 10868817]
- Taylor V, Teh C, Lam W, et al. Evaluation of a Hepatitis B educational ESL curriculum for Chinese immigrants. *Canadian Journal of Public Health*. 2009; 100:463–466.

- Teng Y, Mak WWS. The role of planning and self-efficacy in condom use among men who have sex with men: An application of the health action process approach model. *Health Psychology*. 2011; 30:119–128. [PubMed: 21299300]
- US Department of Health and Human Services (USDHHS). Report of the Trans-HHS Cancer Health Disparities Progress Review Group: Making Cancer Health Disparities History. USDHHS; Washington, DC: 2004.
- US Department of Health and Human Services (USDHHS). Healthy People 2010. USDHHS; Washington, DC: 2010.
- Ward E, Jemal A, Cokkinides V, et al. Cancer disparities by race/ethnicity and socioeconomic status. *CA: A Cancer Journal for Clinicians*. 2004; 54:78–93. [PubMed: 15061598]
- Ziegelmann JP, Lippke S, Schwarzer R. Adoption and maintenance of physical activity: Planning interventions in young, middle-aged, and older adults. *Psychology & Health*. 2006; 21:145–163. [PubMed: 21985115]

Table 1

Frequency statistics for baseline demographic variables

	<i>n</i> (%)
Gender	
Female	139 (61)
Male	88 (39)
Race/ethnicity	
Asian	51 (23)
Black	28 (12)
Hispanic	51 (23)
White	28 (12)
Employment status	
Employed	96 (43)
Unemployed, not seeking employment	72 (32)
Unemployed, actively seeking employment	58 (25)
Parent of a school-aged child	
Yes	85 (37)
No	142 (63)
ESL student status	
New	96 (42)
Returning	131 (58)
ESL participation goals	
Improve basic skills	227 (100)
Community related (e.g. gain right to vote)	153 (67)
Employment related (i.e. gain or retain employment)	48 (21)

ESL: English as a second language.

Participants could endorse multiple ESL participation goals. We have indicated the number of participants who endorsed each goal.

Table 2

Descriptive statistics

	Time 1		Time 2	
	<i>M</i> (SD)	<i>α</i>	<i>M</i> (SD)	<i>α</i>
Fruit intake	3.64 (2.81)		4.69 (3.08) ^a	
Vegetable intake	5.99 (4.46)		7.50 (4.63) ^a	
Knowledge	6.01 (1.31)		6.40 (1.32) ^a	
Intentions	3.29 (.78)		3.39 (.75)	
Outcome expectations	3.60 (.52)	.70	3.61 (.68)	.85
Action planning	2.46 (.77)	.73	2.62 (.73) ^a	.74
Coping planning	3.05 (.70)	.78	3.21 (.69) ^a	.83

SD: standard deviation.

^aSignificant change from Time 1 to Time 2 ($p < .05$).