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Impact of a low-intensity pedagogical model for integrating MedlinePlus exercises into middle school nutrition lessons.

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Impact of a low-intensity pedagogical model for integrating MedlinePlus exercises into middle school nutrition lessons*†

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Objective: The research developed and pilot-tested MedlinePlus exercises in a diet-related chronic disease prevention (DCDP) middle school lesson unit called "Live."

Methods: MedlinePlus exercises were jointly developed by two middle school family and consumer sciences (FCS) teachers and integrated into the "Live" DCDP lesson unit. FCS classes ($n = 4$) who had participated in a prior "Live" study were chosen to pilot-test the MedlinePlus-supplemented exercises. Evaluation measures included student satisfaction (assessed using an 8-item pre- and posttest questionnaire), knowledge gained, and attitudinal changes (assessed with an abridged version of a previously developed "Live"

questionnaire). Statistical analyses were performed using SPSS.

Results: Of 62 total study participants, 56 (92.3%) said that they were either "somewhat" or "clearly": (a) more likely to use MedlinePlus as a future source for answering questions about their personal health and (b) more knowledgeable about how eating habits can help prevent disease. Selected parameters were improved for nutrition knowledge ($P < 0.01$) and attitudes ($P < 0.01$) related to healthy eating.

Conclusions: MedlinePlus has good potential for efficiently communicating trustworthy diet-related disease-prevention behaviors to adolescents in an existing classroom curriculum.

Highlights

- Computers and the Internet in a school setting provide excellent opportunities to teach youth how to find accurate health information.
- MedlinePlus was viewed as useful by this study's middle school participants.
- A channel for integrating MedlinePlus exercises into middle school curricula is family and consumer sciences (FCS) courses.

Implications

- Health information-seeking skills of youth could be enhanced by integrating MedlinePlus exercises into FCS courses.
- MedlinePlus exercises could be considered as supplements to health subjects included in other middle school classes.

INTRODUCTION

Computers are commonplace in US households today, and basic computer literacy is the standard among US youth [1]. Moreover, virtually all (99%) of US schools currently have access to the Internet, and 87% of them have access at the classroom level [2]. As do adults, adolescents frequently seek health information online [3–5]. According to one study, adolescents often view health information provided via the Internet as salient on the one hand but questionable on the other [5]. This viewpoint is understandable given that Websites are often not reviewed, leading to the dissemination of faulty and unreliable information [6]. Conflicting saliency versus credibility perceptions, if left unresolved, may be a deterrent to applying useful information youth obtain over the Internet. Meanwhile, many preventable risks for leading chronic disease morbidity and mortality can be attributed to exposures during adolescence [7]. Therefore, the public health community should take advantage of youths' Internet health information-seeking patterns by steering them toward trustworthy Websites [4, 8], such as the National Library of Medicine's (NLM's) MedlinePlus [9]. Warner et al. [10] have demonstrated that MedlinePlus is an effective tool to educate high school students about health information resources. However, literature regarding the appropriateness of MedlinePlus for younger adolescents appears not to have been published.

Florida A&M University received NLM funding to develop MedlinePlus exercises to supplement middle school lesson plans on the topic of diet-related chronic disease prevention (DCDP) in 2004. This paper reports results of a pilot trial of a family and consumer sciences (FCS) lesson unit supplemented with MedlinePlus ex-

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Supplemental appendixes are available with the online version of this journal.

Table 1
Framework* used to develop Diet and Disease Prevention “Live”† lesson unit

Lesson activities	Instructional strategies‡					Behavioral change approaches§							
	CL	IL	NE	OCE	AC	GN	PC	SRM	VPI	ACP	LAT	CM	GvsL
Diet and health assessments		X		X				X		X	X	X	
Goal setting, monitoring, and reporting	X	X		X		X	X	X				X	
Homework contests with family	X	X		X		X	X	X	X				
Food preparation and taste testing		X	X			X			X			X	X
Interactive unit reviews	X	X			X				X	X		X	
Story telling	X							X				X	
Diet and disease quiz		X						X				X	
Diet and disease research report	X	X		X					X				

* Framework adapted from Johnson DW, Johnson RT. The process of nutrition education. *J Nutr Educ* 1985 17:S1-2.

† Lesson unit adapted from Rankins J, Weatherspoon L, Cook L, Reed C, Shufford-Law J, Davis Y, Kissinger M, Ralston P. Influences of a chronic disease risk reduction curriculum called “Live” on fat and fiber knowledge and attitudes of black and white adolescents. *J Nutr Educ* 2000 Jan/Feb;32(1):14-20.

‡ Instructional strategies: CL = cooperative learning, IL = inquiry learning, NE = nutrition experiments, OCE = out-of-class experiences, AC = academic controversies.

§ Behavioral change approaches: GN = group norms; PC = public commitment; SRM = social role models; VPI = vivid, personalized information; ACP = active cognitive processing; LAT = learner as teacher; CM = continuing motivation; GvsL = gains vs. loss appeal.

ercises. Perceived readiness of adolescents to use MedlinePlus to find health information was assessed. In addition, pre- and posttest knowledge and attitudes about healthy eating were measured. Study protocols were approved by the Florida State University Institutional Research Board and Leon County Schools Office of Monitoring and Evaluation.

BACKGROUND

Participants and lesson development

Study participants included 113 students taking FCS classes at an inner-city middle school (6th–8th graders) in Florida. The investigators modified a middle school DCDP lesson to incorporate MedlinePlus exercises designed to reinforce and enhance the lesson content. The DCDP lesson was one of a 5-lesson unit module called “Live . . . Eat Less Fat and More Fiber” (“Live”), which was piloted in 1996 in the study school [11].

Overall objectives of the DCDP lesson were to: (a) increase awareness and knowledge about obesity and obesity-related chronic diseases and (b) develop the skills needed to follow a disease-prevention diet and physical activity lifestyle. Lesson content was developed to meet Sunshine State Standards [12]. Curriculum content building was based on a framework called “The Process of Nutrition Education,” encompassing five instructional strategies and eight behavioral change approaches, several of which were included in individual “Live” activities (Table 1) [13]. For example, instructional strategies included activities designed to provide cooperative learning (five activities), out-of-class experiences (four activities), nutrition experiments (one activity), controversial subject matter (one activity), and learning by inquiring (seven activities). Behavioral change approaches were designed to impact group standards (three activities), allow students to publicly attest to their commitment to reducing fat and increasing fiber intake (two activities), and assess benefits and limitations (one activity) of doing so (gains vs. loss appeal). The aim of diet and health risks assessments was to facilitate cognitive processing of information (self-assessments) and learning by teach-

ing others (family members’ assessments). Examples of vivid and personalized information included unit reviews using interactive and colorful *Jeopardy*-type games, contests, foods labs, and research reports. Family and peers were incorporated as role models in five lessons and activities to reinforce desired behavior (continued motivation) in six lessons.

MedlinePlus exercises

“Live” instructional strategies and behavioral change approaches were reinforced in the MedlinePlus exercises, which were conducted in the school’s computer lab. The goal was to teach students how to search MedlinePlus to find information about diet-related chronic diseases and foods or recipes related to reducing disease risk. Exercises were designed to increase students’ knowledge about: (a) diet-related chronic diseases (especially cardiovascular diseases), (b) seriousness of these diseases, (c) family-related susceptibility to chronic diseases, and (d) diet-related disease risks and dietary change needed to reduce chronic disease risk, namely diets lower in fat, higher in fiber, and lower in salt (LF/HF/LS).

Skills needed to set LF/HF/LS diet goals, to practice achieving set goals, and to encourage self, peers, and family members to do likewise were included. Participants were assigned daily homework to review and discuss MedlinePlus activities during a family meal (table talk), and to solicit support from and participation by family members. Similarly, goal-buddy-monitoring and classroom reporting of progress toward goal achievement were intended to motivate peers. The expected impact of the lessons was increased awareness about a variety of reliable health information resources available through MedlinePlus for access now and into the future. The FCS lesson unit complete with MedlinePlus exercises and homework constitutes a ten-day curriculum (Appendix A) [14].

Lessons were implemented through the coordinated field practicum of a community nutrition course taught at Florida State University by the corresponding author (Rankins). Field practicum students were

trained by the community nutrition professor and supervised in implementation planning by nutrition graduate students via an online group discussion board. In the middle school classroom, field practicum students were supervised by nutrition graduate students in a face-to-face and participatory manner. Practicum students introduced each lesson and taught the middle school students how to search MedlinePlus to find information about diet-related chronic diseases and healthy eating. They also helped participants assess nutrient composition of specific foods through the use of MyPyramid.gov.

Practicum students led middle school participants in classroom activities such as selecting goal buddies, monitoring and reporting, selecting snacks for preparation, developing infomercials to market snack choices, and conducting MedlinePlus searches to complete CDCP research papers. Exemplary infomercials were filmed and broadcast over the school's closed-circuit television.

EVALUATION METHODS

Overall satisfaction with the MedlinePlus lessons was assessed using a brief 8-item posttest questionnaire (Appendix B). A Cronbach test of reliability of the instrument [15] yielded an alpha of 0.749, a score within the recommended reliability range [16]. The questions were intended to obtain the students' perceptions (as a result of the MedlinePlus lesson unit) about the value and utility of MedlinePlus as an educational and research tool for promoting health and preventing disease at the individual and family levels. The questionnaire also asked about participants' intentions to use MedlinePlus as a future health information resource.

In addition, a pre- and posttest survey, an abridged version of the validated instrument used in a previous "Live" study, was used to assess general knowledge and attitude gain scores among the study participants [11]. The abridged survey contained two multiple-part questions on general knowledge about healthful eating and seven questions pertaining to attitudes toward eating healthily (Appendix C). One of the nutrition knowledge questions asked that students specify whether it is healthier to eat foods that are low or high in sugar, fiber, cholesterol, fat, and salt. The second nutrition knowledge question asked students to indicate which of nine food choices are good sources of fiber (beans, cheese, whole wheat bread, white bread, whole milk, skim milk, fruit, bran cereal, vegetables); for each of the nine items, students marked "Yes," "No," or "Don't know."

The attitude questions about healthier eating included Likert-scale response options (1 = Strongly disagree, 2 = Agree, 3 = Don't know, 4 = Agree, 5 = Strongly agree). The FCS classroom teacher assigned each participant an ID number, which students recorded on their pre- and posttest questionnaires. Group means and standard deviations were computed using SPSS. Pre- and posttest data were entered into separate files by student ID. The raw data were imported into SPSS, and each question was analyzed to

Table 2
Participant demographics (n = 62)

	N (%)
Age	
11–12	19 (31.0)
13	27 (43.0)
14–15	16 (26.0)
Grade	
6	11 (18.0)
7	32 (52.0)
8	19 (31.0)
Race/Ethnicity	
Black	31 (50.0)
White/Non-Hispanic	25 (40.0)
Hispanic	4 (6.5)
Asian	1 (1.5)
Native American	1 (1.5)
Palestinian	1 (1.5)
Gender	
Male	25 (40.0)
Female	37 (60.0)
Household: children < 18 years old*	
0	13 (20.9)
1–3	43 (69.4)
4 or more	6 (9.7)

* Excluding participant.

compute gain scores between pre- and posttesting. The paired *t*-test was used to assess statistical differences in mean attitude scores on pre- and posttests (attitude change scores). *P* values less than 0.01 were considered statistically significant.

RESULTS

Participant demographics

Of the 113 students, 62 (54.9%) submitted signed informed parental consent forms and signed informed student assent forms and completed both a pre- and posttest. Only these 62 students were included in the research part of the project, even though other students (n = 51; 45.1%) attended class as usual and therefore received the intervention. Table 2 provides participant demographic information. Half of the students were black (n = 31), and nearly 70% (n = 43) reported that 1–3 other youth under 18 years old resided in their respective households. Students' ages ranged from 11–15 years, with most (43%; n = 27) 13 years old.

MedlinePlus satisfaction and impact on knowledge

Eighty to ninety percent of participants (n = 50) responded that they were impacted "somewhat" or "clearly" by 4 of 8 of the MedlinePlus satisfaction variables, while two of the variables impacted relatively fewer students (73%–78%; n = 45–48). Seventy-eight percent (n = 48) of participants said that they had gained skills to use MedlinePlus for researching wellness and disease prevention topics, while 82% (n = 51) reported increased skills to research different diseases (Table 3). Similarly, 73% (n = 45) of participants reported increased understanding of how their family

Table 3
Impact of MedlinePlus lessons: participants' responses (n = 62)

Outcome variables	No response N (%)	No, not at all N (%)	No, not really N (%)	Yes, somewhat N (%)	Yes, clearly N (%)
1. More knowledge about how eating habits can prevent disease	2 (3.3)	0 (—)	2 (3.2)	16 (25.8)	42 (67.7)
2. Better understanding of online MedlinePlus resources	2 (3.1)	4 (6.5)	5 (8.1)	31 (50.0)	20 (32.3)
3. Increased understanding of how family history impacts health	2 (3.3)	2 (3.2)	8 (12.9)	25 (40.3)	25 (40.3)
4. Increased understanding of how my family behaviors impact my health	2 (3.2)	1 (1.6)	14 (22.6)	25 (40.3)	20 (32.3)
5. Increased understanding of how my behaviors impact my health	3 (4.9)	0 (—)	6 (9.7)	19 (30.6)	34 (54.8)
6. Skills to use MedlinePlus to research different diseases	2 (3.2)	1 (1.6)	8 (12.9)	20 (32.3)	31 (50.0)
7. Skills to use MedlinePlus for researching wellness and prevention	3 (4.8)	3 (4.8)	8 (12.9)	20 (32.3)	28 (45.2)
8. Awareness of MedlinePlus as a good source for answering my future health questions	2 (3.3)	2 (3.2)	2 (3.2)	16 (25.8)	40 (64.5)

behaviors impacted their own behaviors, and 85% (n = 53) indicated that they had a better understanding of how their behaviors impacted their own health. Ninety percent (n = 56) of the students responded that they "somewhat" or "clearly" recognized MedlinePlus as a good resource for answering questions about their health now and into the future. In addition, 94% (n = 58) of the students indicated that they were more knowledgeable about how their eating habits can prevent disease.

Nutrition knowledge

Table 4 reports nutrition knowledge before and after the DCDP lesson. Incorrect responses related to foods that have high or low fat, sugar, and fiber content ranged from 3 for fat to 15 for fiber at pretesting. Incorrect responses on the posttest declined by values ranging from 50.0% to 66.7% for all foods except cholesterol, for which the decline was only 12.5%. Between 64.0%–77.0% (n = 40 and 48) of the students incorrectly chose cheese, whole milk, and skim milk as good sources of fiber in the pretest. For good food sources of fiber, more than half (n = 35) of the students failed to identify beans in the pretest, and

Table 4
Pre- and posttest performance on general nutrition knowledge (n = 62)

Options	Participants responding incorrectly at pretest N (%)	Participants responding incorrectly at posttest N (%)	% Improvement posttest incorrect/ pretest incorrect minus 100
Is it healthier to eat these foods that have high or low . . . ?			
Sugar	6 (9.7)	3 (4.8)	50.0
Fiber	15 (24.2)	6 (9.7)	60.0
Cholesterol	8 (12.9)	7 (11.3)	12.5
Salt	6 (9.7)	3 (4.8)	50.0
Fat	3 (4.8)	1 (1.6)	66.7
Which of these foods are good sources of fiber?			
Beans	35 (56.5)	10 (16.1)	71.5
Cheese	48 (77.4)	36 (58.1)	25.0
White bread	34 (54.8)	21 (33.9)	38.3
Whole wheat bread	14 (22.6)	4 (6.5)	71.4
Whole milk	40 (64.5)	30 (48.4)	25.0
Skim milk	45 (72.6)	49 (79.0)	-8.0
Fruit	21 (33.9)	14 (22.6)	33.4
Bran cereal	23 (37.1)	7 (11.3)	69.6
Vegetables	22 (35.5)	7 (11.3)	68.2

roughly 1/3 (n = 21 to 23) failed to identify fruit, bran cereal, and vegetables. At posttesting, the number of incorrect responses for good sources of fiber was substantially reduced for all foods except skim milk. Likert-scale responses were significantly more favorable ($P < 0.01$) for 3 of the 7 attitudinal indicators: availability of healthy food that taste good, eating healthily is not a lot of trouble, and encouragement from friends to eat healthy (Table 5).

DISCUSSION

Results of this DCDP MedlinePlus-supplemented pilot study with middle school teachers and students were consistent with findings of an earlier study involving librarians training high school students to use MedlinePlus [10]. Undergraduate nutrition students were chosen over librarians in the current trial, because the experience served as a field practicum course requirement with a built-in system of supervision, evaluation, continuity of successful outcomes, and self-generated performance rewards—a grade. New undergraduates come into the program each semester, providing for low-cost renewable inputs with practical experiential outcomes that are highly valued by practicum students and teachers. This study and Warner et al.'s study of teaching MedlinePlus to high school students demonstrated that adolescents and teachers find MedlinePlus a useful health information resource after just low-intensity training. Both also used systems-building implementation approaches, which made prospects for sustainability good.

The "Live" DCDP lesson unit focused specifically on improving adolescent knowledge and attitudes about healthy eating for diet and chronic disease prevention, and MedlinePlus exercises were designed to reinforce and supplement this focus. The number of correct responses for 9 of 13 nutrition knowledge questions increased by 50%–71% at posttest, compared to pretest, and there were significant gains in attitude scores ($P < 0.01$). Behavior change was not an expected outcome of the current pilot trial due to its low intervention intensity (10 hours total, 5 of which were devoted to the MedlinePlus exercises). For face-to-face nutrition interventions, 50 hours are considered minimum intensity for achieving behavior change [17]. To the investigators' knowledge, measures of required in-

Table 5
Nutrition attitudes change scores (n = 62)

	Pretest mean \pm SD	Posttest mean \pm SD	Change scores mean \pm SD	P value
There are many foods that are good for you and also taste good	4.18 \pm 0.813	4.52 \pm 0.596	0.333 \pm 0.817	0.002
It is a lot of trouble to eat a healthy diet	2.70 \pm 1.18	2.22 \pm 1.01	-0.483 \pm 1.11	0.001
I believe that eating healthy foods would improve my own health	4.58 \pm 0.561	4.73 \pm 0.548	0.150 \pm 0.755	0.129
My family encourages me to eat healthy foods	4.10 \pm 0.933	4.10 \pm 0.858	0.000 \pm 1.042	1.000
My friends encourage me to eat healthy foods	2.20 \pm 1.00	2.72 \pm 1.25	0.517 \pm 1.396	0.006
I am planning on improving my diet soon	4.33 \pm 0.968	4.48 \pm 1.03	0.150 \pm 1.132	0.309
I am interested in learning more about foods that can improve my health	4.69 \pm 0.799	4.59 \pm 0.937	-0.103 \pm 1.165	0.502

* Mean change scores between pre- and posttests with *P* values < 0.01 are significantly different.

intervention intensity to achieve behavioral change in computer-based or combined computer-based and face-to-face interventions have not been reported.

Limitations of this study included the small sample size of 62 students, short intervention period, and lack of a parallel comparison group and long-term follow-up. While 113 FCS students participated in the lessons, 51 of them could not be included in the pilot trial largely because their parents did not complete consent forms. There is a need to more effectively sensitize parents to the importance of research aimed at improving access to reliable health information and developing strategies to improve their children's food choices. While interventions of longer duration are desirable, they are often not feasible in school settings because of highly structured standard curricula and heavy teacher work loads. Pilot studies such as this one cannot be used to make broad generalizations but can provide justification for larger efficacy studies of longer duration with a comparison group and follow up. In addition to outcome measures, follow-up studies should be designed to provide insight into the intervention process, especially family feedback from activities such as the "table talk" homework and qualitative performance of individual students on MedlinePlus exercises.

CONCLUSIONS

MedlinePlus offers great potential for enhancing the reliability and validity of online health information seeking by adolescents now and into the future. Integrating face-to-face classroom instruction on topics of diet and disease prevention with MedlinePlus exercises is a feasible approach to providing trustworthy information to growing numbers of youth commonly seeking health information on the Internet. Future studies should focus on processes and outcomes for determining the level of intervention intensity required to achieve behavioral change in face-to-face dietary interventions for chronic disease prevention that integrates MedlinePlus exercises.

A research design that incorporates collaboration between nutritionists and librarians is likely the best way forward. In such an arrangement, subject matter would be the responsibility of the nutrition faculty and methods for using MedlinePlus for health information seeking would be the responsibility of library sciences

faculty. Both nutritionists and librarians are well positioned to promote and orient teachers and students to sanctioned Internet sources through nutrition and health information models such as the one presented here. Integration of jointly trained and supervised students from both disciplines in the implementation of intervention research would contribute both to the experiential needs of college students and program training and support needs of participating middle school teachers. The urgency to act is imminent. Nine million children over 6 years of age are overweight or obese, which predisposes them to early onset of mortal chronic diseases [18]. Even so, only 30% of adolescents consume a diet consistent with chronic disease prevention [19]. The expertise of nutritionists and librarians could contribute significantly toward remedying this situation.

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