Nutrition Environment Measures Survey–Vending : Development, Dissemination, and Reliability

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Nutrition Environment Measures Survey–Vending: Development, Dissemination, and Reliability

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Researchers determined a need to develop an instrument to assess the vending machine environment that was comparably reliable and valid to other Nutrition Environment Measures Survey tools and that would provide consistent and comparable data for businesses, schools, and communities. Tool development, reliability testing, and dissemination of the Nutrition Environment Measures Survey–Vending (NEMS-V) involved a collaboration of students, professionals, and community leaders. Interrater reliability testing showed high levels of agreement among trained raters on the products and evaluations of products. NEMS-V can benefit public health partners implementing policy and environmental change initiatives as a part of their community wellness activities. The vending machine project will support a policy calling for state facilities to provide a minimum of 30% of foods and beverages in vending machines as healthy options, based on NEMS-V criteria, which will be used as a model for other businesses.

Keywords: *college/community partnerships; community assessment; environmental and systems change; nutrition; public health laws/policies; rural health; surveys; program planning and evaluation; worksite safety and health*

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INTRODUCTION

Chronic health problems such as type 2 diabetes and cardiovascular disease have reached epidemic proportions and have been attributed in part to the number of adults and children who are overweight or obese. The incidence of diabetes has almost doubled (4.5% vs. 8.7%) across the nation since 1996, and currently, more

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than 63% of the nation's adults are overweight or obese (Centers for Disease Control and Prevention, 2010). Almost a third of low-income children between the ages of 2 and 5 years are overweight or at risk of being overweight (Polhamus, Dalenius, Mackintosh, Smith, & Grummer-Strawn, 2011).

Nutrition environments may contribute to obesity and explain some disparities in health behaviors and outcomes. The nutrition environment broadly consists of those foods available in a community for consumption and is, in turn, affected by food systems that include distribution channels, marketing, and retail (Glanz, Sallis, Saelens, & Frank, 2005). More specifically, in Iowa's food system, although farmers' markets are increasing in number, there has been a decline in the number of grocery stores and an increase in the number of warehouse/megastores and convenience stores (Tagtow & Roberts, 2011). The net result in rural Iowa is a decrease in the number of small local grocery stores offering healthy food options.

To influence rates of overweight and obesity, Iowa's public health community is committing considerable resources to better understand and affect the nutrition environment, particularly in rural communities. A well-established partnership for implementing community nutrition initiatives in Iowa exists between the Iowa Department of Public Health (IDPH) and Iowa State University Extension (ISUE). In 2006, they each identified representatives to attend training in the use of the Nutrition Environment Measures Survey (NEMS). NEMS is used to quantitatively assess the nutrition environment in grocery and convenience stores (NEMS-S; Glanz, Sallis, Saelens, & Frank, 2007) and restaurants (NEMS-R; Saelens et al., 2007). NEMS findings can help communities identify and fill gaps in food accessibility and availability. Public health and extension training participants became certified to train other professionals within their own communities. In 2007, five ISUE Nutrition and Health Field Specialists were trained to conduct NEMS surveys. They in turn examined children's restaurant menus and offerings in convenience stores within six rural Iowa communities that were participating in a pilot intervention of Iowans Fit for Life, a nutrition and physical activity program funded by the Centers for Disease Control and Prevention and implemented by the IDPH. The Nutrition and Health Field Specialists used the NEMS findings to inform their work with local food systems groups formed by the IDPH Iowans Fit for Life Program. Specifically, the community assessment data were used to determine community needs and actions to improve healthy food options in the local environment.

While conducting NEMS ratings in Iowa communities, surveyors observed that vending machines were influential in food choices, especially in small businesses and schools. While the NEMS grocery store/convenience store and restaurant surveys were very useful for most venues, there was no instrument for assessing vending machines. This is particularly noteworthy in Iowa where manufacturing is the largest industry and more than 6,200 manufacturers employ more than 265,000 Iowans (Davis, Brown, Koehn, Shors & Roberts, P. C, 2010). According to the *Automated Merchandiser*'s State of the Vending Industry Report, manufacturing facilities and offices accounted for about 55% of the vending machine locations in the United States in 2010 (Maras, 2011). For many Iowans, vending machines may be the only source of food for sale in their workplace. Without a vending component, the picture of food choices in rural Iowa was incomplete. To fill this gap, a survey instrument needed to be developed that was comparably reliable and valid to other NEMS tools and that would provide consistent findings for businesses, schools, and communities. The tool would benefit IDPH local public health partners implementing policy and environmental change initiatives as a part of their community wellness grant activities. Community coalitions and wellness advocates could use it to improve access to healthy foods and beverages.

METHODS

Development of NEMS-V

The first stage of tool development was an extensive literature review of vending studies and examination of various criteria used for assessing healthy vending offerings. This review process and consultation with NEMS staff resulted in the selection of the Institute of Medicine (IOM) Nutrition Standards for Foods in Schools (IOM, 2007) as the criteria on which the NEMS-V tool was based. Next, components of the tool were identified, with an emphasis on their comparability with the existing NEMS surveys. Over a 6-month period, the draft tool was reviewed, tested, and modified by the NEMS team (initially at Emory University, now at University of Pennsylvania), ISUE Nutrition and Health Field Specialists, and IDPH staff.

While the tool was under development, the partners also voiced and addressed key anticipated challenges. For example, the partnership would not be able to support costs for ongoing NEMS-V–related training. To address this, they focused on the creation of a NEMS-V website with step-by-step instructions and a tutorial on the use of NEMS-V tools and resources. This website development effort was championed by graduate students and, in itself, was a valuable learning opportunity. In addition, the partners identified challenges

when determining whether a particular food item meets the NEMS-V criteria. First, the nutrition facts label is not visible to the consumer before purchase. It is necessary to see the label to determine if the food or beverage is a healthy choice. Second, providing and maintaining a list of healthy foods and beverages would be literally impossible as the industry introduces new products at a rapid rate. In response, a NEMS-V Healthy Choices Calculator was developed and added to the website as a sustainable tool to aid surveyors in categorizing the frequently changing vending food and beverage offerings. A tutorial on the use of the calculator was also developed. Partners can conduct a follow-up assessment as needed after an intervention has taken place to illustrate the improvement in the vending machine selections.

The final version of the assessment tool provides a visual depiction of each vending machine (Individual Vending Machine Graphic) showing green-, yellow-, or red-coded foods and beverages based on IOM standards with modifications from Iowa's Healthy Kids Act. The NEMS-V website (www.nems-v.com) can generate an award certificate for each machine and the location as a whole (bronze award if at least 30% of the food or beverage choice are yellow or green; silver award if at least 40% are yellow or green; gold award if at least 50% are yellow or green and without unhealthy advertising) and a report card for each machine and location as a whole (indicates how many food and beverage items need to be changed to green or yellow choices to earn a bronze, silver, or gold award; provides a checklist of action steps for making healthier choices available in vending machines).

Reliability Testing

NEMS tools originally developed by the NEMS team have undergone rigorous reliability and validity testing (Glanz et al., 2007; Saelens, Glanz, Sallis, & Frank, 2007). To establish the properties of the new NEMS tool, a plan for reliability testing of NEMS-V was developed. According to McKinnon, Reedy, Morrissette, Lytle, and Yaroch (2009), a greater focus on testing for reliability and validity of measures of the food environment may increase rigor in research in this area. Iowa investigators consulted with the developers of the original NEMS tools to ensure comparable reliability and validity testing for a vending food environment survey.

Vending Machine Sample

Vending machines were preselected from machines found in buildings on the State of Iowa Capitol campus. Prior to assigning machines to be assessed, IDPH staff visited the machines and recorded the products to create a master list for determining accuracy of forms completed by the students. Because products change frequently in vending machines, the IDPH staff person accompanying each pair of students updated the master list.

Procedures

Two classes of Drake University undergraduate students viewed the NEMS-V Tools and Healthy Choices Calculator tutorials. The tutorials familiarized the students with each component of the assessment (Vending Location Cover Page, Individual Vending Machine Graphic, Individual Vending Machine Cover Page, and Food and Beverage Recording Sheet) and supporting resources (NEMS-V Directions, Food and Beverage Coding Summary, and Food and Beverage References) available on the website. Before viewing the tutorial, the students received a packet of materials to reference. Twenty students were recruited from the population of students (51) to do a field test of the NEMS-V assessment tool. If students completed two assessments on the same vending machine exactly 1 week apart, they received a $20 gas card as an incentive. The students were divided into 10 pairs, and each pair was assigned one machine. Each pair completed a NEMS-V assessment on the assigned machine on Day 1 and again on Day 8.

On Day 1, the students visited the assigned vending machine and worked individually to complete the Individual Vending Machine Graphic and list the items on Food and Beverage Recording Sheets. After the visit, the student followed the steps to complete the online data entry and generate a report card for the machine as instructed on the tutorial. This could also include the use of the calculator to determine the food or beverage color code. On Day 8, students returned to the same vending machine to do a second assessment (following the same steps as Day 1). Since the student could choose the time of day they would visit the machine, IDPH staff visited the machines once in the morning and once in the afternoon to determine if the master list was still accurate in order to insure correct answers for comparison. After completing the two assessments, the students turned in their materials to their college professor and received their gas card.

Reliability Results

Eight of the 10 pairs (Group A and Group B) of students who participated in the reliability testing were able to complete the two-part assessment. The completed assessments were compared to the master lists.

TABLE 1
NEMS-V Reliability Testing Results

		% of Agreement	κ	*p*
Interrater reliability				
Group A vs. Rater Group B	Valid number out of 304			
Product: pretest	289	98.3	−.006[a]	NA
Product: posttest	294	97.6	−.006[a]	NA
Color: pretest	289	95.2	.56	<.01
Color: posttest	293	95.2	.56	<.01
Test–retest reliability				
Time 1 vs. Time 2	Valid number out of 304			
Product: Rater Group A	289	99.3	−.003[a]	NA
Product: Rater Group B	302	98.3	.44	<.01
Color: Rater Group A	288	99.0	.79	<.01
Color: Rater Group B	301	99.3	.93	<.01

NOTE: NEMS–V = Nutrition Environment Measures Survey–Vending; NA = not applicable.
a.. Because of small cell sizes, kappa values could not be computed for these categories.

Group A student answers for Day 1 were compared to Group B student answers for Day 1 in order to determine interrater reliability. Test–retest reliability compared each student's answer sheets from Day 1 with their answers from Day 8. Percentage of agreement and kappa values were used in the statistical analyses to test the interrater reliability and test–retest reliability. Fleiss (1981) defines kappa value as a measure of agreement between two observers who rate the same thing.

There was high percentage of agreement for both product and color between rater groups (interrater reliability) and time (test–retest reliability; Table 1). Both product and color agreements have reliable results. The color agreement value represents mostly red products since there were limited yellow and green products in the vending machines, which is currently a typical situation.

Dissemination

As a part of the Wellmark Foundation grant, five Iowa regional trainings were offered to instruct participants on the use of NEMS tools including the newly developed NEMS-V. Participants who completed the 2-day trainings were eligible to apply for $500 mini grants for the purpose of using one or more of NEMS tools in their organization or community within the next 6 weeks. Mini grant recipients shared the assessment results with coalitions and/or wellness committees and determined the next steps to change the food environment in the community/worksite. Ten communities successfully completed NEMS-V assessments at various worksites. Taking steps to make changes in worksite vending was often described as more concrete and attainable than changes in grocery stores, convenience stores, and restaurant chains where inventory and offerings are controlled by corporate rather than local management. As a result of the mini grant, one of the communities passed a resolution for county-owned buildings to offer a minimum of 30% of food and beverage items in vending machines as healthy choices based on NEMS-V criteria. Minigrant recipients provided additional feedback on components of the assessment tool, and modifications were made. Modifications included the following:

- Modifying website to store and retrieve data from assessments
- Deleting unnecessary questions from the vending location and machine cover pages
- Adding more categories to the NEMS-V Healthy Choices Calculator
- Correcting online default settings on the vending machine report card and awards certificates

SUMMARY AND CONCLUSIONS

Rates of obesity and diabetes are staggering and healthy food options are decreasing in rural areas. The IDPH and ISUE identified the need for a vending

TABLE 2
NEMS-V Tools and Supporting Resources

NEMS-V Feature	*Item*	*Description*
NEMS-V assessment tool components	Location Cover Page	Demographic characteristics Features of vending machines, such as number and type
	Individual Cover Page	Location in the building Hours of availability Advertising Number of vending slots by color code Award level
	Individual Machine Graphic	Visual portrayal of green-, yellow-, and red-coded foods and beverages
	Food and Beverage Recording Sheet	Product information: name, size, price, category, and color code
	Certificate	Customized and printable award for each machine and location Report for each machine and location
	Report Card	Shows number of food and beverage items that need to be changed to green or yellow in order to improve award level Checklist of action steps for making healthier choices available
NEMS-V assessment resources	NEMS-V Directions	Step-by-step guide for using NEMS-V forms
	NEMS-V Food and Beverage Coding Summary	Description of foods and beverages meeting green, yellow, and red criteria Specific information on serving sizes, calories, fat, sugar, and sodium by color code
	NEMS-V Food and Beverage Reference Sheet	Examples of yellow and green foods and beverages divided into categories such as salty, sweet, entrée, etc.
NEMS-V website components	NEMS-V Tutorial	Fifteen minute online video outlining the background, criteria, and tools needed Viewing recommended before using the NEMS-V tools
	Healthy Choices Calculator	Calculates the color code of vending products using information from the Nutrition Facts label
	Healthy Choices Calculator Tutorial	Five minute online video explaining the use of the Healthy Choices Calculator

NOTE: NEMS–V = Nutrition Environment Measures Survey–Vending.

machine assessment instrument from their experience as trainees in the use of the NEMS. They then partnered with the NEMS research team to develop the NEMS-V assessment instrument and a range of online supporting resources (see Table 2). Overall reliability results of NEMS-V show a positive effect from the tutorial process.

Many national public health programs strive to help make healthy choices easy, safe, and affordable by changing policies, systems, and environments. However, research is still needed to further encourage healthy choices, for example, at the point of sale when making purchases from vending machines. Toward this end, the current partnership is now shifting its focus toward the use a social marketing planning process that is directed toward vending-related policy and environmental changes. The desired outcome of a second Wellmark Foundation grant is that all state-owned buildings, rest areas, and state parks in Iowa use targeted messages and NEMS-V resources in order to motivate consumers to purchase healthy choices in their vending machines. The first step in our study will be to identify the materials to support healthy vending

choices across these contexts. Next, online focus group participants will view vending-related healthy messages and provide feedback. Message placement will be tested and sales data collected in worksites and rest areas. Success will be measured by monitoring sales/profit margins of facilities throughout the state. The project will lead to having a policy in place for state facilities to provide a minimum of 30% of food and beverage choices in vending machines as healthy options based on NEMS-V criteria, which will be used as a model for other businesses across the state.

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