Diffusion of an Integrated Health Education Program in an Urban School System: Planet Health

Jean L. Wiecha,1 PhD, Alison M. El Ayadi,1 MPH, Bernard F. Fuemmeler,2 PhD, MPH, Jill E. Carter,3 EoM, MA, Shirley Handler,3 EoD, MS, Stacy Johnson,3 MA, Nancy Strunk,3 RN, MS, Debra Korzec-Ramirez,3 MS, RD, CDN, and Steven L. Gortmaker,1 PhD
1Harvard School of Public Health, Department of Society, Human Development and Health; 2National Cancer Institute, Health Promotion Research Branch; 3Boston Public Schools

Objective Assessed the feasibility, acceptability, and sustainability of Planet Health, an interdisciplinary, integrated health education curriculum implemented in six public middle schools. Methods Workshops on Planet Health implementation were attended by 129 teachers (language arts, math, science, and social studies) over three school years (1999–2000, 2000–2001, and 2001–2002). Questionnaires were administered post-implementation and in the fall and spring of each year. Outcomes were dose, acceptability, feasibility, and intent to continue use. Results The average number of lessons taught per teacher per year was 1.7 to 3.1, compared to a goal of 2 to 3. Each year, teachers reported high acceptability and perceived feasibility of the intervention, and the majority indicated they intended to continue using the curriculum. Conclusions Planet Health was feasible and acceptable in a participatory research model involving a public school–university partnership, and it was also sustainable independent of the research effort.

Key words school-based health promotion; obesity prevention; diffusion; dissemination; community-based participatory research.

The epidemic of obesity in the United States is of paramount public-health importance. The prevalence of overweight children and adolescents (body mass index ≥ 95th age- and sex-specific percentile) doubled between 1976 and 1994 to 13% and increased to 15.5% in 2000 (Ogden, Flegal, Carroll, & Johnson, 2002; Troiano, Flegal, Kuczmarski, Campbell, & Johnson, 1995). As treatments for obesity are minimally successful in the long term (Chesney & Thurston, 2001), effective and replicable prevention strategies are urgently needed (U.S. Department of Health and Human Services, 1996).

School-based overweight prevention programs offer substantial promise for youth, as 97% of U.S. children attend school daily (Kann et al., 1995). Moreover, school and school-system infrastructures can support delivery of standardized health messages. Recent school-based randomized controlled trials have demonstrated success in reducing the prevalence and incidence of childhood obesity by decreasing children’s television viewing (Gortmaker et al., 1999; Robinson, 1999), by improving their dietary behaviors, and by increasing their physical activity, which can contribute to weight management (Luepker et al., 1996; Perry, Kelder, Murray, & Klepp, 1992; Perry et al., 1990).

Nonetheless, few schools are implementing evidence-based overweight prevention and control strategies. Challenges to adoption include reconciling the importance of teaching health with a school’s primary academic mission, addressing curriculum constraints that reflect standardized testing requirements, and ensuring teacher competency with new health material (Hallfors & Godette, 2002). Potential barriers for implementation and sustainability are inadequate resources, high staff turnover, difficulty integrating
health education material into existing curriculum, and pressure to offer visible innovations that may not be evidence based (Smith, McCormick, Steckler, & McLeroy, 1993).

Theories of diffusion of innovation provide frameworks for addressing these challenges. These theories address the process by which individuals of a social system (such as a school) communicate, decide about, and act on innovations (Rogers, 2002). Research in diffusion focuses on adoption and implementation rather than on outcomes, as in efficacy research (Berwick, 2003; Oldenburg & Parcel, 2002; Rogers, 1983; Sorensen, Emmons, Hunt, & Johnston, 1998). Since the rewards of prevention are often distant, preventive innovations are often adopted slowly (Hallfors & Godette, 2002; Rogers, 2002). However, specific characteristics may be built in that can enhance their appeal. Diffusion theory posits that adoption is more likely when innovations are perceived to have

- **relative advantage**: the innovation is better than the status quo;
- **compatibility**: the innovation is consistent with current values;
- **low complexity**: the innovation is not difficult to understand and use;
- **observability**: the results of the innovation are noticeable to others; and
- **trialability**: the innovation can be tried out on a partial or temporary basis (Rogers, 2002, 2003).

The overall impact of preventive interventions depends strongly on a product that appeals to a broad range of potential users; is adaptable to local needs; can be used by individuals with diverse levels of expertise and training; and can produce replicable and long-lasting effects at low cost (Glasgow, Lichtenstein, & Marcus, 2003). In schools, diffusion of a new innovation occurs in phases:

1. planning and dissemination to encourage adoption;
2. adoption and commitment to initiating a program;
3. implementation; and
4. maintenance (Rohrbach, D’Onofrio, Backer, & Montgomery, 1996).

Program advocates and adequate training to enhance user competency facilitate adoption, use, and maintenance (Rogers, 2003), as does perceived feasibility of the innovation (Caravella, Pretasky, Detert, & Oganowski, 1996).

In the current study, we report on the adoption and implementation of the *Planet Health* curriculum and discuss sustainability. The purpose of this project was to use community-based participatory research methods and diffusion theory to study curriculum adoption and implementation by Boston Public Schools and by teachers.

**Planet Health**

*Planet Health* is an integrated, interdisciplinary middle school curriculum designed as an overweight prevention program focused on four health goals: increasing physical activity, decreasing television viewing, improving diet through increased fruit and vegetable intake, and moderating fat intake (Carter, Wiecha, Peterson, & Gortmaker, 2001). *Planet Health*’s four health goals are integrated into 32 classroom lessons in the major subjects (language arts, math, science, and social studies) that vary in difficulty for sixth- through eighth-grade students. In addition, there is a two-week television reduction unit and a behavioral self-assessment lesson. For physical educators, 30 micro-units (brief lessons) and student-fitness self-assessments complement the classroom component. A student can experience the entire classroom curriculum if 10 to 12 lessons are taught per year of middle school, or 2 to 4 lessons per teacher per year. The curriculum meets many state educational standards for the four major subjects.

The curriculum’s design incorporates several theories of health behavior and learning, including behavioral choice theory (Epstein et al., 1995), which posits that offering a range of positive options facilitates behavior change; and social–cognitive theory (Bandura, 1977, 1986), which recognizes that behavior is influenced by social, environmental, and personal attributes. Pedagogically, *Planet Health* uses constructivist learning theory (Phillips, 1995), in which students learn through activation of prior knowledge and through active, student-centered learning.

In a randomized controlled field study, *Planet Health* was effective among girls in reducing obesity prevalence, increasing obesity remission, increasing fruit and vegetable consumption, and reducing increment in energy intake relative to girls in the control schools. Among boys and girls, it was effective in reducing sedentary behavior (i.e., television viewing) and increasing knowledge of curriculum-related messages (Gortmaker et al., 1999). A recent analysis also showed *Planet Health* to be cost-effective (Wang, Yang, Lowry, & Wechsler, 2003).
Methods

Procedure

We describe the perceived acceptability, feasibility, and use of *Planet Health* among classroom teachers in six middle schools in Boston, Massachusetts. Too few physical education teachers were involved (6) for meaningful analysis of this component. All procedures were approved by the institutional review boards at the Harvard School of Public Health and at the Boston Public Schools (BPS).

Community-Based Participatory Research Methods (CBPR)

Community-based participatory research (CBPR) is a method of conducting public health research purported to enhance potential for translating research findings into sustained social, policy, or programmatic change (Green, Daniel, & Novick, 2001). In CBPR, researchers and community stakeholders are equitably involved in the research process, from planning through interpretation of results (Israel, Schulz, Parker, & Becker, 1998). Tenets of diffusion of innovations research dovetail with frameworks for CBPR: research partners can build in relative advantage and compatibility, define trialability, ensure project visibility, and build leadership and support for the innovation throughout the project.

The Harvard Prevention Research Center (HPRC) and BPS established a project advisory board at the outset of the study, consisting of key BPS administrators and staff and HPRC personnel. The board met regularly to review study design; set study goals and objectives; review protocols and instruments; and, later, review progress and findings. This group set a joint goal of seeking resources to make *Planet Health* available to all middle schools in Boston, pending study outcomes. Among these, relevant to this analysis, were evidence for positive impact on the teaching and learning climate; teacher acceptance and intent to continue; consistent dose delivery from year to year by teachers; availability of technical assistance; and evidence that the curriculum was flexible, adaptable, and affordable.

A pilot study was conducted in 3 public middle schools during the 1998–1999 school year. In the 1999–2000 period, with funding available for 6 schools, 2 pilot schools (one left following an organizational overhaul) and 4 additional middle schools began the 3-year study (during school years 1999–2000, 2000–2001, and 2001–2002). The 4 new schools were recruited by BPS administrators from among 22 public middle schools in Boston. They met the following criteria: presence of strong health and physical education programs, principal support, commitment to interdisciplinary projects, teacher availability for training, and greatest proportion of students qualifying for free or reduced meals.

Each school determined which clusters and teachers would implement the curriculum. About 21% of sixth- to eighth-grade teachers at five schools chose to implement, and all of nine sixth- to eighth-grade teachers at the sixth (and smallest) school. Principals were encouraged to tailor the selection of clusters and teachers to fit their programmatic needs. Enrollment at the study schools ranged from 401 to 741. Although racial and ethnic distributions varied among schools, overall less than 10% of students were White (9.1%) or Asian (7.5%), and the largest groups were either African American (54.7%) or Hispanic (27.2%) in each school. In the school enrolling 401 students, only 75 were in Grades 6 to 8. Numbers of students receiving the classroom component of *Planet Health* were estimated using the percentage of teachers participating as a proxy for percentage of the school participating. These calculations yield estimates of 835 in 1999–2000, 895 in 2000–2001, and 1,045 in 2001–2002.

Implementation

Each year, at each school, HPRC staff conducted a 3-hr fall workshop on the use of *Planet Health* and a 2-hr spring technical assistance workshop. In addition, program staff were available for ongoing technical assistance, although few requests were made.

Each school selected a *Planet Health* specialist (a teacher or an administrator) to coordinate school-based planning and data collection. BPS recruited a citywide specialist to coordinate the school-based specialists and to liaison between BPS and HPRC. HPRC staff provided all specialists with a stipend of $2,500 per year (equivalent to other BPS-funded teacher-coordinator positions) and reimbursed teachers for attending trainings at union rates.

Measures

HPRC developed six survey instruments that were delivered to teachers, administrators, and *Planet Health* specialists. Primary outcome measures were developed based on diffusion of innovation theory. The major data sources reported on here are based on the fall survey (completed after attending the fall training) and on the spring survey (filled out at the end of the school year). Table 1 lists measures of feasibility, acceptability, and sustainability and their corresponding survey response categories from the fall and spring surveys.

Dose comprised the amount and distribution of lessons delivered. On the classroom-lesson survey, teachers
were asked at midyear and year-end to indicate the specific lessons they taught and the classes that received the lessons. Classroom teachers were instructed at the training workshops to teach 2 to 3 lessons per year, for a total classroom dose per student of 8 to 12 lessons per year, assuming delivery in the four major subjects (language arts, math, science, and social studies). This schedule assumed that students entering middle school in sixth grade could receive full delivery of the 34 classroom lessons by the end of eighth grade.

Barriers to implementation and sustainability were assessed through a qualitative survey of the Planet Health specialists and administrators at each school.

### Participants

In all, 129 classroom teachers were trained in Planet Health; 69 in fall 1999, 75 in fall 2000, and 87 in fall 2001 (total sums to more than 129 because of repeating involvement by some teachers). The proportions of participating teachers representing each subject, averaged across schools and years, were as follows: language arts, 38.7%; math, 36.3%; science, 25.0%; and social studies, 27.4% (total sums to more than 100% because some teachers taught multiple subjects). Most Planet Health

### Table I. Perceived Feasibility, Acceptability, and Sustainability of Planet Health Among Teachers Completing Annual Surveys in the Fall and Spring of Each School Year and Interschool Ranges by School Year 1999–2002

<table>
<thead>
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<tr>
<td></td>
<td>%</td>
<td>Interschool Range</td>
<td>%</td>
</tr>
<tr>
<td><strong>Fall measures of feasibility:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion responding very ¹</td>
<td></td>
<td></td>
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<tr>
<td>Confident I can teach the health content</td>
<td>78.4</td>
<td>(60.0–100.0)</td>
<td>86.1</td>
</tr>
<tr>
<td>I look forward to teaching Planet Health</td>
<td>84.2</td>
<td>(75.0–100.0)</td>
<td>86.1</td>
</tr>
<tr>
<td>Confident I can choose lessons that suit my classroom</td>
<td>89.5</td>
<td>(75.0–100.0)</td>
<td>83.3</td>
</tr>
<tr>
<td>Confident I can adapt lessons to meet my needs</td>
<td>89.2</td>
<td>(50.0–100.0)</td>
<td>91.7</td>
</tr>
<tr>
<td>Number of lessons I’m expected to teach is reasonable</td>
<td>86.8</td>
<td>(75.0–100.0)</td>
<td>88.9</td>
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<tr>
<td><strong>Spring measures of feasibility:</strong></td>
<td></td>
<td></td>
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<tr>
<td>Proportion responding agree or strongly agree ²</td>
<td></td>
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<tr>
<td>Felt competent to teach the health content</td>
<td>97.4</td>
<td>(90.0–100.0)</td>
<td>97.2</td>
</tr>
<tr>
<td>Sense of team spirit among teachers</td>
<td>78.4</td>
<td>(60.0–100.0)</td>
<td>68.6</td>
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<tr>
<td>We had adequate planning time</td>
<td>71.1</td>
<td>(50.0–100.0)</td>
<td>66.7</td>
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<tr>
<td>The school administration was supportive</td>
<td>85.3</td>
<td>(75.0–100.0)</td>
<td>78.9</td>
</tr>
<tr>
<td>Sense of overall competence with Planet Health (% moderate to high)</td>
<td>97.2</td>
<td>(66.6–100.0)</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Spring measures of acceptability:</strong></td>
<td></td>
<td></td>
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<tr>
<td>Proportion responding agree or strongly agree ²</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Planet Health was effective in teaching subject-specific skills</td>
<td>—</td>
<td>—</td>
<td>91.4</td>
</tr>
<tr>
<td>Planet Health was a positive addition to my curriculum</td>
<td>97.3</td>
<td>(66.7–100.0)</td>
<td>97.1</td>
</tr>
<tr>
<td>Enjoyed using student-centered teaching technique</td>
<td>100.0</td>
<td>—</td>
<td>97.1</td>
</tr>
<tr>
<td>Used a student-centered teaching technique in 1 or more other classes (% responding yes)</td>
<td>80.6</td>
<td>(40.0–100.0)</td>
<td>65.6</td>
</tr>
<tr>
<td>Was able to adapt lessons to meet my needs</td>
<td>97.4</td>
<td>(75.0–100.0)</td>
<td>97.1</td>
</tr>
<tr>
<td>Was able to choose lessons that fit my curriculum</td>
<td>94.7</td>
<td>(75.0–100.0)</td>
<td>97.1</td>
</tr>
<tr>
<td>Overall effect on my teaching (% positive) ³</td>
<td>83.3</td>
<td>(33.3–100.0)</td>
<td>93.1</td>
</tr>
<tr>
<td>Overall effect on students (% positive) ³</td>
<td>100.0</td>
<td>—</td>
<td>94.4</td>
</tr>
<tr>
<td>Overall effect on my health habits (% positive) ³</td>
<td>86.1</td>
<td>(66.7–100.0)</td>
<td>88.6</td>
</tr>
<tr>
<td>Sustainability ⁴</td>
<td>100.0</td>
<td>—</td>
<td>88.6</td>
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¹Response categories: not at all, somewhat, very.

²Response categories: strongly disagree, disagree, agree, strongly agree.

³Response categories: positive effect, no effect, negative effect.

⁴Response categories: yes, no, undecided.
teachers were female (74% to 83%), and mean years of teaching experience were 7.3 to 8.2.

Data Collection and Analysis
When possible, missing data were solicited from respondents. Response rates were defined as the proportion of teachers attending the workshops who filled out surveys (and who were presumably implementing the curriculum). For the fall survey, response rates were 76%, 1999–2000; 68%, 2000–2001; and 70%, 2001–2002. Spring survey response rates were 72%, 1999–2000; 70%, 2000–2001; and 64%, 2001–2002.

For each year, we present data on acceptability, feasibility, and dose from teachers who completed both fall and spring surveys (1999–2000: n = 38, 2000–2001: n = 36, 2001–2002: n = 46). Respondents comprised, respectively, 55%, 48%, and 53% of all classroom teachers attending trainings for the three school years. Thus, the analysis cohort for each year includes teachers in their first year of utilization and teachers with experience. First-year users’ fall surveys are considered preimplementation measures. First-time users comprised, on average, 55% of respondents over the three years.

Chi-square tests were used to assess the presence of bias introduced by restricting the analyses to individuals with both a fall and spring survey. Each year, the tests detected no differences among response distributions when individuals in the analysis cohorts were compared to those who were excluded. We observed minor differences between teachers who were first-time users and those who were repeat users. Results are presented in the following section. Dose delivery (number of lessons taught) was estimated from individuals in the analysis cohort who reported on these measures (n = 37, 1999–2000; n = 34, 2000–2001: n = 44, 2001–2002:). We estimated average lesson delivery time at 1 hr.

Results
Feasibility and Acceptability
Teachers found Planet Health to be feasible and acceptable (Table I). Fall items addressing perceived competence and preparedness indicated that most respondents looked forward to implementing Planet Health each year, felt confident that they could choose lessons that suited their classrooms and could adapt lessons to meet their needs, and felt comfortable with the number of lessons they were expected to teach each year. Despite being major-subject teachers, most reported feeling confident that they would be able to teach the health concepts in Planet Health.

In spring assessments of perceived feasibility, teachers felt capable and competent teaching the health content. A smaller majority of teachers agreed that extrinsic assets to implementation were present, including team spirit, adequate planning time, and administrative support.

Planet Health received consistent high ratings on acceptability measures based on concepts of compatibility, relative advantage, broad applicability, and observability. Nearly all reported that Planet Health was a positive addition to their curriculum. They also believed that the curriculum was effective in teaching subject-specific material (e.g., language arts or mathematics skills) in the 2 years this measure was used, that they were able to choose lessons to fit their curriculum, and that they could adapt lessons to meet their needs. Evidence of broad applicability was also present: most teachers reported using teaching techniques from Planet Health in other classes and reported a perceived positive overall effect on their teaching and on their students. Finally, the majority of teachers reported that Planet Health had positive effects on their own health habits.

Differences Between First-Time Users and Repeat Users
On most measures of feasibility and acceptability, length of experience with Planet Health made no difference. First-time users were less likely to have had more than 5 years of teaching experience at their school (44.9% vs. 78.8%, p = 0.0002) and were less likely to perceive a positive effect of the curriculum on their ability to connect with their students (66% vs. 86% of experienced users, p = 0.02).

Dose of Intervention Delivered
Teachers delivered dose levels consistent with program intent, indicating that the curriculum can be implemented as planned and can be implemented consistently over time. The mean numbers (with the interschool ranges) of unduplicated lessons taught by teachers were 1.7 (1.0–2.3) in 1999–2000, 3.1 (1.0–4.1) in 2000–2001, and 2.8 (2.1–3.9) in 2001–2002—compared to an aim of 2 to 3 per year, per teacher, set in the workshops. Some teachers taught the same lesson to multiple classes; mean deliveries per lesson taught were 1.7 (1.2–2.2) in 2001–2002. Given an average per-lesson delivery time of 1 hr, each teacher spent 2.9 hr (1.5–4.4), 6.2 hr (1.0–7.4), and 4.8 hr (2.8–7.0) teaching Planet Health during each school year, respectively. Each student attending four major-subject classes with a participating teacher received on average approximately 6.8, 12.4, and 11.2 hr of instruction each year, respectively.
Although varying proportions of the 34 Planet Health classroom lessons were taught at least once each year, students were exposed to over 70% of all lessons at five of the six schools over the 3-year study period. Teachers at two of these schools taught 71% of the lessons, whereas 77%, 85%, and 94% of the lessons were taught at the others. Teachers at the sixth school taught 47% of the lessons. Follow-up interviews at this school showed that teachers had identified a set of preferred lessons they were comfortable with and were implementing them with successive classes of students rather than broadening their range of lessons.

Challenges and Assets to Diffusion

Interviews with four to six Planet Health specialists and five to six school administrators each year identified several challenges to schools: a shortage of planning time; difficulty integrating additional material into a mandated curriculum; and perceived lack of curriculum reinforcement in the school meals programs, the school vending machines, and the child’s home. School system attributes were also cited as challenges. Teacher attrition due to transfers, retirements, career changes, and school closings affected continuity from year to year.

Nonetheless, high proportions of teachers annually reported their intent to continue in the following year (78–100%; Table I). Program assets reported by school administrators were the availability of HPRC staff for training and technical assistance, the presence of school-based coordinators to organize interdisciplinary planning, and teacher stipends for attendance at the trainings. School administrators perceived strong benefits to using Planet Health, including not only health benefits to students but also benefits to teaching and learning, accruing from the interdisciplinary and integrated nature of the curriculum and from the exposure to new teaching methods. All administrators felt that participation was a positive experience overall.

Discussion

The purpose of this study was to assess and report on the adoption, implementation, and sustainability of Planet Health, an integrated school health curriculum, in six urban public schools. Teachers, regardless of years of experience with the curriculum, gave it consistent high ratings on characteristics associated with adoption, including compatibility, relative advantage, broad applicability, and observability. Perceived competence was high as well. Trialability was not measured directly, but the flexible approach to commencing implementation allowed principals to begin with a small number of teachers. Dose was most consistent with program intent during the second and third years. To the best of our knowledge, this is one of the few studies to actually report on using community-based participatory research (CBPR) methods to study diffusion subsequent to efficacy and cost-effectiveness evaluation.

Persuasive indicators of success in CBPR are efforts by the nonacademic partner to sustain the innovation after the research ends. BPS ultimately obtained federal grant funds to sustain and expand Planet Health. Since the pilot year, no schools have ceased implementation.

Limitations of this study derive from the descriptive design, the subjective nature of the measures, and the small sample sizes within schools. Some teachers did not complete survey instruments, despite the ongoing efforts of HPRC staff and school coordinators, thus reducing the cohort of fall and spring survey respondents each year. Fortunately, this did not appear to bias our findings. Although teachers reported broad perceived feasibility and acceptability of Planet Health, we could not assess the impact of social desirability on response patterns. Nonetheless, the lack of variability in the positive direction of responses and the BPS post-study commitment to obtain maintenance funding are strongly suggestive of a truly positive experience with this innovation at the system, school, and teacher levels. Although we did not test the psychometric properties of our measures, future studies of diffusion constructs would be enhanced by deeper understanding of measurement validity. Because of small sample size, we were also limited in our ability to describe adopter characteristics using multivariate methods. With a larger sample, we might have had more power to detect teacher characteristics that influenced program perception and use. Finally, although we adhered to principles of community-based participatory research in the design and implementation of the study, the study does not constitute a test of these methods.

Limitations also exist with respect to fidelity of the intervention to the original design. Teachers reported delivering the desired number of lessons (dose), which was slightly below the average teacher delivery dose in a prior efficacy trial (3.5 lessons per year; Gortmaker et al., 1999). It could be that as dose was slightly lower in Year 1 versus Years 2 and 3, the flexible approach that facilitated adoption may also have affected initial implementation levels as schools “tried on” the curriculum. In addition, we did not measure the fidelity of teachers’ delivery to the intervention design. This is typically ascertained by classroom observation (Perry et al.,
1997), but in diffusion and dissemination trials this may not be feasible due to limited resources. Previous studies have shown that teacher self-report slightly overestimated percentage of intervention delivered when compared with observation (Perry et al., 1997). Thus, a continuing need exists to monitor implementation and use, once efficacy has been established (Hoelscher et al., 2001) and implementation has stabilized following adoption.

The generalizability of the results reported here may be limited. The HPRC provided significant programmatic support for adoption and implementation during the study. Thus, our experience may be most relevant to other large urban school districts where a university or private sector partner can assist with curriculum adoption and implementation. Replication efforts are needed.

In conclusion, planning for diffusion by assessing innovation characteristics is an effective method by which to assess the acceptability and feasibility of a health education innovation. Use of community-based participatory research methods may enhance this process. A flexible approach may facilitate adoption. Further work on how best to evaluate diffusion of efficacious curriculum is needed to facilitate widespread school-based promotion of children’s health.

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