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Permalink
https://escholarship.org/uc/item/136023px

Journal
American Journal of Medical Quality, 29(6)

ISSN
1062-8606

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Publication Date
2014

DOI
10.1177/1062860613506252

Peer reviewed
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*American Journal of Medical Quality* published online 29 October 2013
DOI: 10.1177/1062860613506252

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What is This?
Collaborative Practice Improvement for Childhood Obesity in Rural Clinics: The Healthy Eating Active Living Telehealth Community of Practice (HEALTH COP)

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Abstract
This study assessed the impact of participation in a virtual quality improvement (QI) learning network on adherence to clinical guidelines for childhood obesity prevention in rural clinics. A total of 7 primary care clinics in rural California included in the Healthy Eating Active Living TeleHealth Community of Practice and 288 children seen in these clinics for well-child care participated in this prospective observational pre-post study. Clinics participated in a virtual QI learning network over 9 months to implement best practices and to exchange strategies for improvement. Following the intervention, documentation of weight assessment and counseling increased significantly. Children who received care from clinicians who led the implementation of the intervention at their clinic showed significant improvements in nutrition and physical activity. Virtual QI learning networks in geographically dispersed clinics can significantly increase clinicians’ adherence to guidelines for childhood obesity and improve access to recommended care for rural and underserved children.

Keywords
obesity, child, quality improvement, telemedicine, education, continuing
HEALTH COP was a virtual QI learning network involving 7 rural clinics. Its goal was to improve childhood obesity prevention through implementation of evidence-based practices and QI strategies.

The study team hypothesized that clinicians at rural clinics participating in HEALTH COP would increase their frequency of weight assessment and counseling for nutrition and physical activity at health maintenance visits. The study team also hypothesized that children seen at participating clinics would significantly improve their short-term nutrition and physical activity behaviors. Finally, the study team assessed whether weight assessment and counseling was related to selected patient characteristics such as age, race/ethnicity, parental education, and socioeconomic status.

**Methods**

**Design**

A prospective pre-post design (Figure 1) was used to evaluate the feasibility and effectiveness of the intervention, HEALTH COP, in improving assessment of weight status, counseling on nutrition and physical activity, and short-term nutrition and physical activity behaviors in children seen at participating clinics. Approval to conduct this study was obtained from the University of California Davis Institutional Review Board.

**Setting**

Although all participating clinics provided care to underserved and disadvantaged patients, there was considerable diversity in the populations they served. For example, one clinic was located in Imperial County, at the California-Mexico border. This is a primarily agricultural area where 77% of residents are of Hispanic or Latino origin and only 59% of adults are high school graduates. Another clinic was located in Humboldt County, near the California-Oregon border. The local economy is based on tourism, lumber, and fisheries; 78% of residents are European-American, and 85% of adults are high school graduates.

**Participants**

Participants included 2- to 11-year-old children seen for well-child care from April to June 2010 (preintervention period) and from January to May 2011 (postintervention period). Administrative data were used to identify children who received well-child care during these 2 time periods. The study team recruited children and obtained informed consent from parents using a telephone script. The sample size calculation (n = 144) was based on 2-sided testing (α = 5%) and addressed the need to compare differences in outcome between each phase of the study, with at least 80% power to detect clinically significant differences (0.35 standardized units). The study team assumed a variance inflation factor of 1.20 based on the balancing effects of clustered data and improved precision from regression covariates. A priori, the study team assumed a 20% loss to follow-up between phases 2 and 3.

**Intervention**

Telehealth is defined as the use of electronic information and telecommunications technologies to support
long-distance clinical care, patient and professional education, and public health. An integrated intervention delivered through telehealth was designed to help rural clinics implement strategies to increase assessment of weight and to deliver family-centered counseling. Intervention components are based on the planned care model as applied to pediatric obesity prevention and were informed by the study team’s previously published survey assessing challenges to providing care for pediatric obesity in rural clinics and the utility of distance education in addressing barriers. The team additionally adapted processes utilized in other successful clinic-based QI networks.

Each clinic formed 4-person teams comprising a clinician champion, a nurse or medical assistant, an administrative staff person, and a parent advisor. Teams attended 9 monthly, 90-minute interactive learning sessions delivered by multipoint videoconferencing and had access to a Web-based toolkit of resources. The first 3 sessions focused on participants gaining knowledge and skills in pediatric obesity and basic QI methodology. These were followed by 6 interactive collaborative learning sessions, wherein teams planned and implemented practice-level changes to improve assessment of weight status and counseling.

The clinic teams set specific goals for improving obesity prevention within their clinics; implemented and tested measurable changes; shared information on outcomes with other clinics and with their leadership; shared learning about strategies, successes, and barriers to QI; and identified steps for spreading and sustaining changes locally. Clinics were supported by HEALTH COP faculty and staff through ongoing technical consultation and individualized coaching. Downloadable video recordings of sessions were made available online.

Key components of the intervention were as follows:

1. **Decision support:** Medical assistants and nurses were provided with Web-based calculators and BMI wheels. They were trained to calculate BMI and to notify clinicians of elevated BMI. Clinicians were provided with flip charts and sample visit documentation forms containing decision-support cues for obtaining a medical history, performing an appropriate physical examination, and screening for comorbidities and psychosocial risk factors.

2. **Clinical information systems:** Clinics were provided training on the use of flow sheets, problem lists, and registries to assist with documenting and tracking weight status and counseling.

3. **Community resources:** A community resource database customized to each clinic was developed in conjunction with clinic teams. The database identified linkages to local afterschool activity programs, physical activity resources, and sources of healthy affordable foods.

4. **Family management support:** Clinicians and staff were trained to use nutrition and activity prescriptions and goal setting/tracking worksheets to support families using motivational interviewing and family-centered counseling. Posters containing messages about healthy nutrition and physical activity in English and Spanish were provided to clinics for their waiting and examination rooms.

5. **Delivery system design:** Clinics examined and reorganized their workflow to enhance assessment of weight status and counseling (eg, reassignment of roles of clinic staff and incorporation of standardized forms with cues to improve documentation of weight status and counseling). An online discussion forum was utilized to engage clinics in raising and answering questions, suggesting resources, and sharing experiences.

6. **Health care system support:** This component of the intervention was included to optimize reimbursement for assessment and counseling for obesity prevention by appropriate coding for clinical services. Clinic teams were provided with resources from the American Academy of Pediatrics, which included a guide to coding for obesity-related health care services as well as strategies for clinics to address denial of payment by insurance carriers. It is possible that this coding information may be less relevant in the future because obesity-related counseling, which falls within preventive care, is likely to be covered by insurers under the health reform law. Standardized visit documentation forms included information to support appropriate diagnoses. Clinicians were eligible to receive up to 48 continuing education credits for participating in HEALTH COP.

### Outcome Measures

Clinician assessment of weight status was evaluated by chart review. A BMI documentation score was developed as follows: 5 = correctly documented weight category based on BMI percentile, 4 = correctly plotted or documented BMI percentile for age and sex, 3 = correctly documented BMI, 2 = documented height and weight, 1 = documented height or weight, 0 = neither height nor weight documented. The BMI documentation score was reviewed by 5 pediatricians in ambulatory practice and 2 biostatisticians for face validity; 1 pediatrician was a member of a committee that developed national recommendations for pediatric obesity.

The study team’s previous research demonstrated that parental report via the use of a questionnaire administered shortly after the visit is a better alternative than medical record documentation to evaluate nutrition and activity counseling. This validated questionnaire was
used to survey parents in the present study. The study team contacted parents to administer the questionnaire by telephone on the evening of the visit. If parents were unavailable, attempts to recontact them were made up to 2 days following the visit. The questionnaire assessed whether counseling on the following topics was conducted during the visit: fruits and vegetables, outside food (restaurant, fast food, or take-out food), breakfast, family meals, sugar-sweetened drinks, television viewing, video game/computer use, and physical activity. The total number of prescribed counseling topics covered was enumerated (range = 0-8; Cronbach α = .88 at preintervention). A family-centered care composite was created by adding scores (1 to 4 scale: 1 = never, 4 = always) for the 5 questions on family-centered care (Cronbach α = .76). Parents in the postintervention phase also completed a survey about their children’s nutrition and physical activity behaviors during the telephone call. This survey was administered again to the postintervention group 12 to 15 weeks later to assess changes in behaviors. Difference between responses was scored as 1 = improvement, 0 = no change, or −1 = deterioration for each survey item. Then, 10 items were combined into a summary score that could range from −10 to 10: fruit and vegetable intake, duration of physical activity, consumption of restaurant food, breakfast consumption, family meal, consumption of sugar-sweetened beverages, television viewing, video/computer game use, presence of a television in the child’s bedroom, and presence of a computer in the child’s bedroom. For the purposes of analysis, these scores were treated as continuous variables.

**Statistical Analysis**

All analyses were performed using survey data analysis procedures or mixed-effects linear regression models to account for design effects arising from the multilevel structure of the data (visits nested within clinicians nested within clinics). To control for unmeasured clinic differences and correlation between visits with the same clinician, the study team specified clinics as strata and clinicians as clusters in the survey analysis methods; for the mixed-effects models, the team specified random intercepts for clinicians and fixed effects for clinic. Data from 2 participating clinics with similar characteristics and a small number of participants in the preintervention phase were combined to increase the stability of estimates. Participant and visit characteristics were compared between preintervention and postintervention groups using survey-adjusted χ² statistics and survey-adjusted linear regression models.

Separate multiple linear regression models were fit for each of the 3 primary outcomes. Covariates chosen for regression models were clinician type, clinician champion, BMI percentile or weight category, age, race/ethnicity, parental education, birth order, and whether the child utilized more medical services than other children, as reported by the parent. Variables that changed the estimate of pre-post change by more than 10% were included in models. Demographic variables with statistically significant differences between the preintervention and postintervention groups were also included in models of clinician behavior.

Secondary analyses were performed to evaluate changes in clinicians’ behaviors with regard to individual documentation and counseling measurements using prevalence ratios, which reflect the change in frequency of each behavior. Models of individual behaviors included the same covariates as the corresponding overall model. Although age was not found to be a confounder in the overall counseling score model, it was included in the individual counseling topic models because some topics might be age specific (eg, video games). All analyses were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC).

**Results**

**Demographic Characteristics of Participating Children, Parents, and Clinicians**

Table 1 summarizes child and clinician characteristics. Children were primarily Hispanic and approximately half were female. There were minimal differences in patient and clinician characteristics between the preintervention and postintervention periods, with the exception of parental education and clinician type. Approximately 50% of parents included in the preintervention period had some college education. During the postintervention period, 57% of parents had completed high school. The postintervention period had a larger proportion of children seen by pediatricians compared with the preintervention period. Because of low frequencies, nurse practitioners and physician assistants were combined for multivariable analyses. For the same reason, underweight children were combined with healthy weight children.

**Clinicians’ Documentation of Weight Assessment**

Approximately 16% of children were overweight, and 22% were obese. Figure 2 compares documentation of weight assessment between preintervention and postintervention periods. Following the intervention, the mean raw documentation score increased from 3.5 to 4.6 (1-5 scale). There were significant improvements in all documentation behaviors, with the largest improvements seen in documentation of BMI percentile and weight category.
Figure 2 compares parental report of clinician counseling between the preintervention and postintervention periods. The total counseling score significantly increased by 0.8 points (0-8 scale). Clinicians covered, on average, 0.8 more topics per visit after the intervention than before. Analysis of individual counseling topics demonstrated the largest increase in counseling on television. There was a significant increase in counseling on sugary drinks and video games. Counseling on fruits and vegetables, breakfast, and family meals also increased, although these changes were not statistically significant.

Factors Associated With Weight Assessment and Counseling in Multivariate Analyses

Table 2 summarizes results for the 3 main multivariable regression models. Parents educated beyond high school received counseling on fewer topics related to nutrition and activity than parents with a high school diploma. Parental assessment of family-centered care did not differ significantly between the preintervention and postintervention periods. Nurse practitioners and physician assistants had significantly higher scores for family-centered care compared with pediatricians, although the small number of visits for these clinicians suggests that these results should be interpreted with caution.

Because the 2 data collection phases did not occur in the same calendar months, the study team performed sensitivity analyses focusing on temporal patterns. Two models restricted to only the preintervention or postintervention phases found no such trends for the primary outcomes. Estimates also were very similar between the reported models and models restricted to the calendar months common to both study phases. Also, 5 children were enrolled in both the preintervention and postintervention phases, and sensitivity analyses confirmed that including these children did not substantively affect results.
Change in Nutrition and Physical Activity Behaviors

A total of 92 participants from the postintervention phase were followed up by telephone 3 months later. The unadjusted nutrition and physical activity change score was 0.3 (95% CI = [−0.2, 0.8]). During secondary analyses, heterogeneity was assessed by examining bivariate relationships between the change score and the set of candidate covariates used in previous analyses. Higher parental education and provision of care by clinician champions were both significantly associated with improvement in nutrition and physical activity behaviors and were combined in a single multivariate model (overall model $F$ test $P$ value = .01). Individual change scores for all 6 combinations of these variables are reported in Table 3.

Discussion

Participation in HEALTH COP, a virtual QI learning network, significantly increased rural clinicians’ adherence to guidelines for childhood obesity prevention. There were significant improvements in documentation practices related to weight assessment. Counseling on television, sugary drinks, and video games significantly increased, along with an overall increase in the number of counseling topics. Less-educated parents received more counseling. Increased discussions on weight, nutrition, and physical activity did not negatively affect parental perception of care. In fact, trends suggest that parental perception of family-centered care improved following the intervention.

This study demonstrates that QI learning networks are an effective strategy to improve preventive care for childhood obesity. Moreover, it is feasible to use virtual learning networks in delivering such QI interventions to clinicians in underserved rural clinics. This intervention enhanced rural clinicians’ access to continuing education in childhood obesity and QI methodology and enabled peer support. An example of peer support that was facilitated by the online discussion forum was in the area of parent education materials. Clinics shared and provided feedback to each other on parent education handouts that they had adapted and implemented at their sites. Clinic participation, in turn, improved access to recommended care for rural and underserved children at high risk for obesity.

Formulating guidelines is necessary but not sufficient to change clinical practice. Reducing variation in care and increasing adherence to recommended practices is an important aspect of QI. The most feasible and effective
strategies utilize a multifaceted systems approach. Components of effective interventions may include clinician-level interventions (eg, clinician education, educational outreach, counseling algorithms) and system-level interventions (eg, office staff assistance, work flow modifications, tools to enhance data collection and counseling, reminder systems). Systematic and routine screening for risk factors may increase behavioral counseling, as demonstrated by trials of tobacco cessation interventions, which found that establishing a system to document tobacco use tripled the odds of clinician intervention.
The present study adds to the recent literature on the effectiveness of QI learning networks in enhancing health care delivery at the practice level and adds new information on the effectiveness of virtual QI learning networks. Young et al. described clinics in Utah that improved their delivery of pediatric preventive services, including documentation of BMI, after participating in a learning network. Margolis et al. reported that continuing medical education and training in QI methods in primary care clinics in North Carolina resulted in significant improvement in the delivery of preventive services compared with clinics that received only continuing medical education. However, this intervention did not affect self-reported parent knowledge or behavior. Schonlau et al. reported that QI education and coaching significantly improved process measures of asthma care. However, patients did not show an increase in asthma-related knowledge, and the intervention did not improve patient-level outcome measures. Cloutier et al. found that an asthma management program increased adherence to national guidelines at urban primary care clinics and resulted in significant reductions in hospitalizations and acute visits for children with asthma.

In the present study, the study team noted that parents of children seen during the preintervention period had significantly higher educational levels compared with those seen during the postintervention period. One possible explanation is the lower volume of patients seen for well-child care in the postintervention phase (which coincided with winter months) in clinics located in more northern and mountainous regions of California, possibly because of inclement weather and a higher volume of acute visits. Parental education in these particular clinics was higher than parental education in the other clinics, which may increase the likelihood of unmeasured confounders.

The present study was conducted at 7 rural clinics that volunteered to participate in HEALTH COP, thereby limiting generalizability. It is possible that leadership at these clinics was especially concerned about the burden of obesity, perceived a need to change their clinical practice, and was motivated to improve care. The scale utilized to evaluate BMI documentation may be considered another limitation because it was only assessed for face validity.

Although the sample size did not permit a complete analysis of the difference in change between clinician champions and nonchampions, the study team noted that in clinics with multiple clinicians, clinic champions showed greater improvements in care delivery. The fact that all clinics volunteered to participate suggests that most clinicians had some level of interest in the intervention. Future studies may need greater emphasis on specific strategies for dissemination of innovations to other clinicians at the same clinic.

The results of this study demonstrate that there are opportunities to substantially improve clinical care delivery related to weight assessment, and nutrition and activity counseling using QI learning networks such as HEALTH COP. Use of telehealth technology to facilitate virtual QI learning networks in geographically dispersed clinics demonstrates results comparable with more resource-intensive face-to-face learning networks.

Declaration of Conflicting Interests
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The authors received the following financial support for the research, authorship, and/or publication of this article: This research was supported by a career development award to Dr Shaikh from the Agency for Healthcare Research and Quality (Grant Number K08HS18567).

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