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Research paper

Clinical practice and variation in care for childhood obesity at seven clinics in California

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ABSTRACT

Background The Healthy Eating Active Living TeleHealth Community of Practice is a virtual quality-improvement learning network of seven rural clinics in California. The goal of this network is to improve childhood obesity prevention and management practices at participating clinics.

Aim Our objective is to describe clinical practices regarding weight assessment and nutrition and physical activity counselling at participating clinics before implementation of the quality improvement intervention.

Methods Participants were 2–11 year old children seen for well-child care in 2010. Telephone surveys of English and Spanish-speaking parents were conducted within three days of their child's well-child visit to determine the content of counselling during the visit regarding nutrition and physical activity. Medical record reviews were conducted to determine clinicians' assessment of weight status.

Findings Twenty-seven clinicians conducted 144 well-child visits included in the study. Body mass index (BMI) was documented in 71% of medical records. Fewer than 10% of medical records had documentation of weight category. Sixty-nine percent of parents received counselling on physical activity and 62% reported receiving counselling on fruit and vegetable intake. Parents were counselled less frequently on breakfast intake, sweetened beverages, television and family meals. Parents of overweight/obese children did not receive more counselling than parents of children with a healthy BMI. Clinician-level effects accounted for moderately large amount of variation in counselling, but accounted for smaller variation in documentation of BMI and weight category. There was high between-clinic variation in documentation practices, with 54% of the total variance for documentation attributable to clinic-level effects.

Conclusions Rural clinicians, like those elsewhere, do not uniformly assess BMI percentile or counsel families on behavioural risk factors for paediatric obesity. There exists considerable clinician-level variation in counselling practices and clinic-site level correlation in documentation practices related to BMI percentile and weight category.

Keywords: child, education, obesity, quality improvement, telemedicine

How this fits in with quality in primary care

What do we know?
Rural residents report lower likelihood of exercising and higher rates of obesity, heart disease and diabetes than their urban counterparts. Evidence-based guidelines from professional organisations recommend that primary care clinicians routinely assess and classify growth in children and offer families evidence-based counselling at all well-child visits.

What does this paper add?
Rural clinicians, like those elsewhere, do not uniformly assess growth or counsel families on behavioural risk factors for paediatric obesity. There exists considerable clinician-level variation in counselling practices and documentation practices related to weight. Clinicians may not routinely target counselling to patients who are at greatest risk, affecting the success of interventions that are based on risk assessment. This finding should be considered in designing and analysing intervention studies to improve clinical practices related to obesity prevention and treatment.

Introduction

Rural populations have poorer access to healthcare and face significant health disparities compared with urban populations.[1–4] Rural residents report less access to paediatric and specialty care, greater travel time to clinicians, lower commercial insurance coverage rates, lower likelihood of exercising and higher rates of obesity, heart disease and diabetes than their urban counterparts.[5–7] Approximately 90% of California's land mass of 175 000 square miles is rural,[8] and 20% of California's five million rural residents are children aged 2–11 years.[9] Unique challenges faced by rural clinicians include professional isolation, reduced access to continuing education and lack of communication with subspecialists and ancillary support services.[10,11]

Over the past three decades, the prevalence of obesity has more than doubled among children aged 2–5 years, and has tripled among children aged 6–11 years.[12] Obesity is now a public health epidemic affecting approximately 16% of children in the USA, with an additional 15% of children considered overweight.[12] American children who reside in rural areas are 25% more likely to be overweight or obese than those residing in urban areas.[13] In California, overweight and obesity are more prevalent in rural than urban areas, with 42% of children in rural California overweight or obese compared with 30% of children in urban areas.[14] Rural children are less likely to engage in vigorous physical activity and spend more time watching television and playing video games compared with their urban counterparts.[14] Childhood obesity is a risk factor for the development of multiple health problems, including diabetes, hypertension and hypercholesterolaemia, as well as psychological consequences such as lower self-esteem, poor body image, anxiety and depression.[17–21] The primary modifiable determinants of obesity include food intake and physical activity. Thus, the cornerstone of obesity prevention in children is behaviour and lifestyle modification.[12,15,16]

Clinicians have multiple opportunities to contribute to paediatric obesity prevention, because approximately 93% of children have a specific source of ongoing healthcare and 78% of children have received a well-child visit in the past year.[5,17] The American Academy of Pediatrics recommends that health supervision visits occur at least annually after the age of 2 years. These visits include a physical examination as well as a developmental, behavioural and learning assessment.[18] The Institute of Medicine in its report, 'Preventing Childhood Obesity,' recommends that clinicians routinely assess and classify growth in children using BMI percentile and offer families evidence-based counselling and guidance at all well-child visits.[12] This advice is consistent with recent evidence-based guidelines from other professional organisations, such as the American Medical Association and the American Academy of Pediatrics.[19–21]

The primary objective of this report is to describe clinical practices regarding weight assessment and nutrition and physical activity counselling in seven rural clinics in California, to inform the design and implementation of a quality improvement intervention for childhood obesity. A secondary objective was to assess the relationship between weight assessment and counselling and selected patient characteristics such as age, race/ethnicity and socioeconomic status, in rural clinics.

Methods

Clinic selection

Forty-five eligible clinics were initially identified that had telehealth capabilities provided by the University

of California (UC) Davis Center for Health and Technology, did not have a specialised weight management programme available to paediatric patients, provided well-child visits to at least 30 children aged 2–11 years during an average month, and had at least two clinicians who provided well-child care. We recruited three clinics in which most well-child care was provided by paediatricians, two in which most well-child care was provided by family physicians, and two in which most well-child care was provided by nurse practitioners or physician assistants. The goal of the seven clinics in the Healthy Eating Active Living TeleHealth Community of Practice was to improve childhood obesity prevention and management practices through the implementation of evidence-based practices and quality improvement strategies.

Study population and design

This was a cross-sectional study to determine how frequently weight was assessed and counselling on nutrition and physical activity was provided at well-child visits. Participants included 2–11 year old children seen for well-child care during April–June 2010 at participating clinics. Clinic staff distributed a flyer to parents of all children who presented for well-child visits that briefly described the study and informed parents that they may be contacted by telephone following the visit. Bilingual research assistants, fluent in English and Spanish, contacted parents by telephone to describe the study utilising a standard script and to assess eligibility to participate. Every attempt was made to contact parents on the evening of the visit, but further attempts were made up to three days later, if needed. Approval to conduct this study was obtained from the UC Davis Institutional Review Board. Informed consent was obtained from parents over the telephone using a standard script. Copies of medical records of children whose parents provided informed consent were mailed to study investigators for review.

Measures

Questions in the parent telephone survey were derived from the Promoting Healthy Development Survey designed by The Child and Adolescent Health Measurement Initiative.[22] These included items in the domains of general counselling with respect to weight, nutrition and physical activity, as well as demographic information. We included additional items on more specific advice topics included in expert recommendations for paediatric obesity prevention, such as sweetened drink intake, fruit and vegetable consumption, consumption of outside food (restaurant, takeout or fast food), television viewing, video game use and physical activity.[23] Five paediatricians in ambulatory practice reviewed the questionnaire to ensure its face validity; one of these was a member of the committee that developed the Expert Committee Recommendations. Our previously published study indicates that parent report, specifically utilising the questionnaire used in this study, is a valid measure of nutrition and physical activity counselling at well-child visits.[24]

Additional questions from the Promoting Healthy Development Survey were included to assess parents' perception of family-centred care delivered by clinicians on a scale of 1 to 4 (never/sometimes/usually/always) in five domains: whether the clinician takes time to understand the individual needs of the child, whether the parent is treated as an expert regarding their child, whether the parent is made to feel that they are a partner in the child's medical care, whether the clinician is easy to understand, and whether the clinician respects the family's values with respect to child rearing.

Medical records were reviewed by the first author, who is a practising paediatrician with experience in auditing medical records to assess the quality of healthcare delivery for paediatric obesity. Using a computerised abstraction form, medical records were reviewed to determine if children's weight, height, body mass index (BMI), BMI percentile and weight category (underweight, healthy weight, overweight or obese) at the visit were documented.

A summary score for counselling was created by counting the number of counselling topics covered in the visit (Cronbach's alpha = 0.88). A family-centred care scale score was created by adding the scores (1–4 scale, 1 = never, 4 = always) for the five family-centred care questions (Cronbach's alpha = 0.76). A BMI documentation score was developed based on a priori definition that assigned the highest possible level from the following options: 5 = correctly documented weight category as defined by the CDC based on BMI percentile, 4 = correctly plotted or documented BMI percentile for age and sex, 3 = correctly documented BMI, 2 = both height and weight documented, 1 = height or weight documented, 0 = neither height nor weight documented.

Data analysis

The multilevel structure of the data, with visits nested within clinicians nested within selected clinics, was accounted for in all analyses of counselling and documentation practices measured at the visit level. Standard error and point estimates for the mean levels of these variables were estimated, with visits to the same physicians specified as clusters (to account for within-clinician correlations) and specifying clinics as strata.[25]

Data from two participating clinics with similar characteristics and the lowest number of participants were combined into a single clinic to increase the stability of these estimates. To describe the net effects of physician- and clinic-level contributions to variability on each of the individual counselling and documentation behaviours, we estimated the variance components associated with visit-, clinician- and clinic-level effects in three-level intercepts-only mixed-effects probit regression models[26] and then expressed each variance component as a percentage of the total of the sum of the variance components for that outcome.[27]

To assess whether selected patient, parent and provider characteristics were associated with differences in overall mean levels of the counselling, family-centred care and BMI documentation scores, we fitted three-level mixed-effects linear regression models. To account for heterogeneity in these outcomes due to unmeasured clinician and clinic effects, we specified random intercepts for clinicians and fixed effects for clinic. Our rationale for specifying clinic effects as fixed was that this more robust specification freed us from making the questionable assumption that residuals were uncorrelated with all unmeasured clinic effects in our small number of clinics.[28,29] Model selection[30] was performed using the Akaike Information Criterion (AIC) on a small set of candidate models for each outcome, with each model including clinician type and one or more of the following covariates: BMI percentile or weight category; age; race/ethnicity; parent's education; whether the child was a first child; and whether the child utilises more medical or educational services than a typical child, as reported by the parent. For the multivariate models, race and ethnicity were combined to create a single variable with the following categories: Hispanic white, non-Hispanic white and other (a designation that combined the small numbers in the remaining categories (Native American/Alaska Native, African American, Asian, and Native Hawaiian/Pacific Islander). Data analyses were carried out using the survey data analysis procedures and mixed-effects regression modelling procedures (PROC GLIMMIX for probit regression and PROC MIXED for linear regression) in Version 9.2 of SAS.[31]

Results

Clinic and clinician characteristics

A total of 27 clinicians conducted the 144 well-child visits included in the study. Paediatric care was delivered by paediatricians (57%), nurse practitioners (16%), family physicians (14%) and physician assistants (13%). Although all participating rural clinics served significantly disadvantaged populations, there was substantial diversity across these populations (Figure 1). For example, Clinic 6 is located in Imperial County, which borders Mexico, is primarily agricultural and has a population of 174 528 individuals, of whom 80% are of Hispanic or Latino origin; 62% of adults are high school graduates.[32] Clinic 2 is located in Humboldt County, which is close to the Oregon border, has an economy based on tourism, lumber and fisheries and has a population of 134 623 individuals, of whom 90% are non-hispanic; 90% of adults are high school graduates.[32]

Child and parent characteristics

Of 144 children in the baseline phase, 53% were male, 53% were Hispanic/Latino and 41% were the oldest

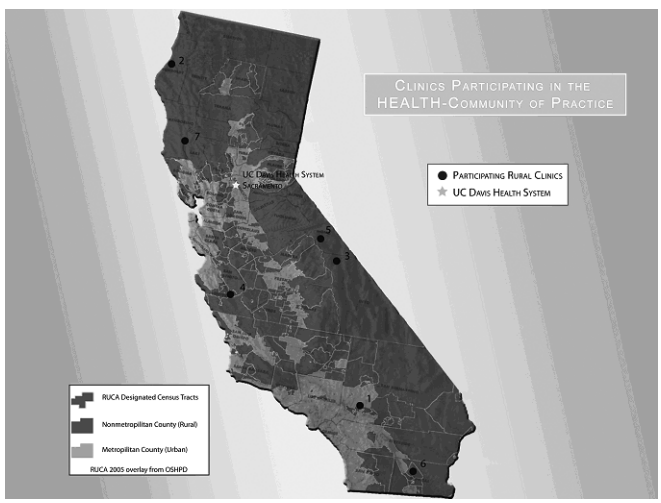

Figure 1 Map of the Healthy Eating Active Living TeleHealth Community of Practice (HEALTH-CoP)

child in the family. We utilised definitions published by the Centers for Disease Control and Prevention and determined that 6% of children were underweight, 58% had healthy weight, 17% were overweight and 19% were obese.[33] Twenty-four percent of parents had not graduated from high school, 28% had completed high school, 26% had received some college education and 23% had completed 4 years of college (Table 1).

Table 1 Parent and child characteristics (%), *N* = 144

Variable	*N* (%)
Age mean (SD)	4.9 (2.4)
Sex	
Male	77 (53)
Ethnicity	
Hispanic	77(53)
No response	1 (0.6)
Race	
White	127 (88)
African American/Black	1 (1)
Asian/Pacific Islander	2 (1)
Native American	12 (8)
No response	2 (1)
Oldest child	
Yes	59 (41)
No	78 (54)
Not applicable	7 (5)
Weight category	
Underweight	8 (6)
Healthy weight	83 (58)
Overweight	25 (17)
Obese	27 (19)
Unavailable	1 (1)
Parental education	
Less than eighth grade	18 (13)
Some high school	16 (11)
High school graduate	40 (28)
Some college	38 (26)
College graduate	24 (17)
Post-graduate	8 (6)
Overall scores	Mean (SD)
Documentation Score	3.5 (0.9)
Counselling Score	3.2 (2.7)
Family-centred Care Score	18.0 (2.6)

Documentation of body mass index and weight category

BMI was documented by clinicians in 71% of medical records (95% confidence inerval [CI] = 57–84%), and 58% of medical records included BMI plotted on age- and sex-specific growth charts (95% CI = 42–73%). However, only approximately 10% of medical records had documentation of BMI percentile (95% CI = 0–20%) or weight category (95% CI = 0.03–19%).

There was a wide range of documentation behaviours between the seven clinics. BMI documentation ranged from 32 to 94% among the clinics and BMI plotting on age- and sex-specific growth charts ranged from 0 to 81%. BMI percentile documentation ranged from 0 to 100% and weight category documentation ranged from 0 to 86%.

Parental report of counselling delivered by clinician on nutrition and physical activity

Figure 2 shows the frequency and variation of counselling for nutrition and physical activity. Sixty-nine percent of parents reported receiving counselling regarding physical activity by clinicians during the visit (95% CI = 55–82%), and 62% reported receiving counselling regarding fruit/vegetable intake (95% CI = 50–74%). Parents reported counselling less frequently regarding breakfast (36%, 95% CI = 24–48%), sweetened beverages (36%, 95% CI = 25–47%), television viewing time (32%, 95% CI = 19–45%), outside food (30%, 95% CI = 21–39%), family meals (28%, 95% CI = 20–36%) and video games (27%, 95% CI = 14–40%).

Parental perception of family-centred care delivered by clinician

Overall parental perception of family-centred care provided by their clinician was high (1= never, 4 = always), with average scores ranging from 3.4 to 3.8 for all five questions.

Multivariate analyses

Clinician-level effects accounted for a moderately large amount of variation in counselling behaviour for individual topics, ranging from 9% for counselling on fruit and vegetable intake to 20% for counselling on physical activity. Clinician-level effects accounted for smaller amounts of variation in documentation of BMI percentile and weight category. There was very high between-clinic variation in documentation practices at participating clinics, such that 54% of the total

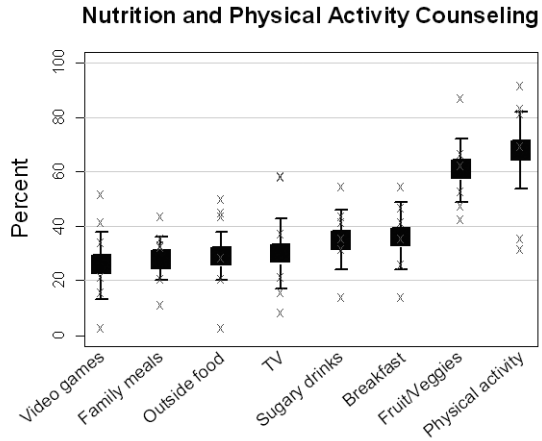

Figure 2 Frequency and variation of counselling for nutrition and physical activity. Squares and bars represent estimates and 95% Wald-based confidence intervals for the overall relative frequency of topic-specific counselling, using survey data analysis procedures to account for within-clinic and within-provider correlations among 144 well-child visits to 27 clinicians in seven rural California clinics. x = clinic specific means

Table 2 Regression coefficients from multivariate mixed-effects linear regression model of the documentation score

Documentation Score (1–5)			
Effect	Levels	Estimate	95% CI
Intercept		3.6	2.8 to 4.4
Provider Type	Family physician	–0.7	–1.4 to -0.03
	Nurse practitioner	–0.7	–1.4 to 0.1
	Physician assistant	–0.1	–0.8 to 0.6
	Paediatrician	(reference)	
Age (centred)		0.11	0.06 to 0.17

variance for documentation of BMI percentile and weight category was attributable to clinic-level effects. The multivariate model for the documentation score contained clinician type and child's age, both of which were significant predictors (Table 2). Compared with paediatricians, family physicians were significantly less likely to fully document BMI measures (0.7 points lower than the paediatrician reference level, 95% CI: -1.4, -0.03). Clinicians were more likely to fully document BMI measures for older children (score increases by 0.11 points for each year increase above the average age of study subjects, 95% CI: 0.06, 0.17).

Although the multivariate model for the counselling summary scale contained clinician type, patient race, parental education, patient weight category, 'more care' and first child, the only predictor that was statistically significant was parent's education (Table 3). Clinicians offered less counselling to parents with education beyond a high school degree, with parents who had attained post-secondary education receiving counselling on 1.7 fewer topics than parents with a high school education (95% CI: -2.8, -0.5). Families of overweight and obese patients did not receive counselling on more topics than families of patients in the healthy BMI range. The multivariate model for the family-centred care summary scale outcome included clinician type, race, education, 'more care', first child, and weight category. None of the predictors was statistically significantly associated with the family-centred care summary score. Transformations were considered, as this summary score was left-skewed, but conclusions for the transformed outcomes did not substantively differ from the original model.

Table 3 Regression coefficients from multivariate mixed-effects linear regression model of the summary counselling score

Counselling Summary Score (0–8)			
Effect	Levels	Estimate	95% CI
Intercept		3.3	–0.1 to 6.7
Provider type	Family physician	–1.1	–3.5 to 1.3
	Nurse practitioner	–0.4	–3.1 to 2.3
	Physician assistant	0.2	–2.2 to 2.7
	Paediatrician	(reference)	
Race/ ethnicity	Hispanic white	0.0	–1.2 to 1.3
	Other	–0.6	–2.3 to 1.1
	Non-Hispanic white	(reference)	
Education	Less than high school	0.4	–0.9 to 1.7
	High school	(reference)	
	Post-secondary education	–1.7	–2.8 to -0.5
Weight category	Underweight	1.4	–0.3 to 3.2
	Healthy weight	(reference)	
	Overweight	–0.8	–2.0 to 0.4
	Obese	0.3	–0.9 to 1.5
First child		–0.3	–1.2 to 0.7
Requires more medical care		0.0	–1.4 to 1.5

Note: Results shown are from linear regression models for multilevel data of 144 well-child visits to 27 clinicians in 7 rural California clinics. Models were estimated using restricted maximum likelihood estimation, with random intercepts specified for clinicians and with fixed effects specified for clinic. There were no significant predictors in the family-centred care summary scale model.

Discussion

Clinicians at most clinics in our study infrequently documented and categorised children's BMI percentile at well-child visits. Parents reported relatively infrequent counselling regarding screen time (television and video game use), sweetened beverage intake and family meals, three strong risk factors for childhood obesity.

Formulating guidelines is necessary, but not sufficient, to change clinical practice.[35] Other studies evaluating the frequency of BMI assessment show considerable variation in clinical practice. A study by Perrin *et al* found that 31% of clinicians reported never using BMI during well-child visits and that many clinicians used general clinical impression as the most common method for assessing excess weight.[36] According to a recent survey of clinical practices related to paediatric obesity prevention and management conducted by Klein *et al*, 52% of clinicians reported assessing BMI percentile in children.[37] Objective evaluations of medical records show an even lower frequency of assessment of BMI percentile. Our analysis of medical records in a paediatric outpatient clinic at an academic medical centre showed that only 17% of medical records had documentation of BMI, 16% had BMI plotted on age- and sex-specific growth charts and 14% had documentation of weight category.[38]

In a national survey conducted by Klein *et al*, most clinicians felt that they had inadequate time to counsel children and families on paediatric obesity and believed that counselling was not effective in managing obesity. They also reported that access to straightforward diet and exercise recommendations for patients would be useful. Clinicians who had received continuing education related to paediatric obesity were more familiar with national guidelines. They were also more likely to use BMI percentile to assess growth, and also reported higher self-efficacy related to childhood and adolescent obesity.[37] Similar to findings of this national survey, in our previously published survey of 126 family physicians, paediatricians and nurse practitioners who treated children at rural clinics in California, most clinicians rated their ability to pre-

vent paediatric obesity as low to moderate. Reported barriers to preventing and treating paediatric obesity included lack of access to weight-management programmes and specialists, poor patient motivation, insufficient parental involvement, limited time during clinical encounters, no access to readily available patient education materials, poor reimbursement and inadequate personal knowledge in the area of paediatric obesity.[39] Therefore, interventions to improve BMI percentile assessment and counselling should address these barriers.

Our study is based on data obtained from seven rural clinics that volunteered to participate in a quality improvement learning network, thereby limiting its generalisability. The leadership at participating clinics may have been unusually sensitive to the burden of paediatric obesity in their practice, may have perceived a need to improve their clinical care with respect to paediatric obesity and may have been motivated to take steps to improve this care. Given the self-selected nature of this group, one might anticipate that non-participating clinics may have even less frequent assessment for BMI in children, as well as less frequent counselling for nutrition and physical activity. Whether or not our results are representative of rural primary care clinics, they clearly indicate the need to engage more rural clinics and providers in quality improvement efforts focused on incorporating weight assessment and obesity prevention counselling during well-child visits. It is possible that clinic-level variability is related to standardisation of work flow and the use of documentation templates at some clinics, which will be important to identify. We will therefore conduct focus group interviews of clinic teams to better understand possible reasons for high clinic-specific correlation in documentation practices and high clinician-level variability in counselling practices that we observed in clinical performance.

We additionally acknowledge the selection bias inherent in our study design. It is possible that parents who were more motivated to engage proactively with the healthcare system elected to participate in the study more frequently than parents who were less engaged. Therefore, if selection bias did indeed occur, we expect that it might have skewed our recruitment toward children with healthier body weights or those whose parents were more knowledgeable of healthier lifestyles.

Our findings demonstrate considerable clinician-level variation in counselling practices and clinic-site level correlation in documentation practices related to BMI percentile and weight category. Hence, publication of clinical guidelines related to childhood obesity need to be accompanied by clinician-level and clinic-level quality improvement interventions to reduce variability in their adoption. Our findings also show that clinicians may not specifically target their counselling to parents of overweight and obese children. Therefore, counselling interventions that focus on high-risk patients may be less effective if risk-based counselling is not emphasised. Our results help inform clinical practice patterns in underserved rural clinics to help tailor clinic-based quality improvement interventions to the needs of participating practices.

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ETHICAL APPROVAL

Approval to conduct this study was obtained from the University of California Davis Institutional Review Board.

PEER REVIEW

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CONFLICTS OF INTEREST

None.

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