

Addressing Children's Oral Health Inequalities in Northern Ireland: A Research-Practice-Community Partnership Initiative

RUTH FREEMAN, BDS, PhD, MSc,
MMedSc, DDPH.RCS^a
MICHELE OLIVER, BDS,
MMedSc^b
GRACE BUNTING, BSc, MPhil^a
JULIA KIRK, BDS, MMedSc^b
WENDY SAUNDERSON, BSc, PhD^c

SYNOPSIS

Objective. Northern Ireland has a high prevalence of childhood dental caries, reflecting heavy consumption of cariogenic snack foods. To develop a policy to promote and facilitate healthier eating, researchers, practitioners, and the school community formed a partnership, together creating the Boost Better Breaks (BBB) school-based policy. The policy was developed with and supported by dietitians, health promotion officers, teachers, school meal advisors, and local suppliers of school milk. Eighty percent of primary schools and preschool groups within the Southern Health and Social Services Board are involved in the program, which permits the consumption of only milk and fruit at break time.

Methods. The authors assessed the effectiveness of the partnership using data from its first two years.

Results. Results of the first two years of evaluation are positive. Initial findings indicate that the program had a positive effect in increasing the mean number of sound teeth in children attending schools in areas in which socioeconomic conditions are poor.

Conclusion. This initiative suggests that collaboration can facilitate improvement in children's dental health and that careful targeting of the policy to schools in poor areas has the potential to narrow disparities.

^aQueen's University, Belfast, Northern Ireland

^bArmagh and Dungannon Health and Social Services Trust, Armagh, Northern Ireland

^cUniversity of Ulster at Coleraine, Londonderry, Northern Ireland

Address correspondence to: Ruth Freeman, PhD, Dental Public Health, Division of Paediatric, Preventive and Public Health Dentistry, School of Dentistry, Queen's University, Belfast, RGH, Grosvenor Road, Belfast BT12 6BP, Northern Ireland; tel. 44 28-9024-0503, ext. 3827; fax 44 28-9043 8861; e-mail <r.freeman@qub.ac.uk>.

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Health for All by the Year 2000, a global health initiative of the World Health Organization (WHO), set as a goal that 50% of 5-year-olds would be caries free and that the average number of decayed teeth for 12-year-olds would be three.¹ This goal was superseded in 1998 by the WHO European health initiative Health 21. Health 21 set a new goal for 2020: 80% of 6-year-olds caries free and an average number of decayed, missing, or filled teeth for 12-year-olds of 1.5.² This target represents recognition of the improvement in oral health worldwide.

Equivalent improvements in Northern Ireland remain elusive, with children and adolescents having the highest prevalence of dental caries in the United Kingdom.³⁻⁷ Poor pediatric oral health reflects Northern Ireland's status as an impoverished and troubled region of the United Kingdom.⁸ As the prevalence of childhood dental caries is related to low socioeconomic status, low-income households, and relative poverty, it is recognized as an indicator of childhood inequality and deprivation.⁹⁻¹²

Associated with socioeconomic status is the heavy consumption of cariogenic snack foods. The "unequivocal axiom" between consumption of sugars and dental caries is well known.¹³ Children in Northern Ireland who come from low-income households and attend disadvantaged schools (as classified by the proportion of children entitled to free school meals) have more dental caries, consume foods higher in sugar and fats, and are more likely to eat candy and sugar-based drinks at break-time than other children.^{12,14-16} Frequent consumption of cariogenic snack foods in childhood in Northern Ireland seems to be associated with greater dental caries experience and lower SES.^{12,14,16}

REDUCING DISPARITIES IN ORAL HEALTH IN NORTHERN IRELAND: THE BOOST BETTER BREAKS PROGRAM

The complexity of issues that link poor health to poverty suggest the need for "strategies aimed at improving health and reducing poverty and inequalities in wealth."¹⁷ With one in three children in the United Kingdom living in poverty, there seemed to be a need to put in place policies to promote oral health where wealth inequalities exist.^{18,19} But oral health promotion policies in Northern Ireland that focused on knowledge had proved ineffective, increasing rather than reducing oral health inequalities.¹⁵ An alternative approach was needed based on the principles of health promotion such as those contained in the WHO's Ottawa Charter.²⁰ Using the WHO approach to health

promotion would capitalize on healthy public policies within a settings approach.²⁰

Partnership among researchers, practitioners, and the school community was necessary to develop a policy to promote and facilitate healthier eating. The Boost Better Breaks (BBB) break-time policy was based on the belief that using community development to negotiate and develop a break-time snacking policy within the school environment would help empower children to make the "healthy choice the easy choice."²¹ The policy was developed using a team of dietitians, school meal advisors, teachers, health promotion officers, and local dairy suppliers of school milk located within the rural community of the Southern Health and Social Services Board (SHSSB).

BBB was launched jointly by the SHSSB and the Southern Education and Library Board in 1994. Since 2001, more than 80% of primary schools and pre-school groups in the SHSSB region have taken part in the BBB break-time scheme.

The BBB initiative specifically addresses the issue of unhealthy break-time snacks and drinks consumed by children in primary and pre-school groups. Community-based practitioners negotiate and develop the break-time strategy with parents, teachers, and governors of the schools and pre-school groups. By raising awareness, the community-based practitioners help parents and teachers appreciate the need for BBB and invite schools, teachers, parents, and children to participate. The participating school or pre-school group must have a written policy, approved by the Board of Governors, which permits the consumption of only milk and/or fruit at break time. Schools must agree not to sell snacks high in fat or sugar in the school environment; teachers must agree not to reward students with candy. Community practitioners and the Community Dental Service monitor school activity, keeping an eye out for difficulties encountered, compliance with the BBB criteria, and adherence to the policy.

After several years of the scheme, children at BBB schools appeared to have fewer carious teeth than children at nonparticipating schools (Personal communication, Michele Oliver, BDS, MMedSc, Armagh and Dungannon Health and Social Services Trust, March 1998). These observations, however, required empirical confirmation. In 1998, the Research and Development Office of the United Kingdom Department of Health financed a three-year evaluation of the BBB program. Links were forged between community-based dental practitioners and research institutions, and a diverse team was brought together to evaluate the BBB. The group included two community-based

practitioners, an expert in social policy, a sociologist, and a clinical academic.

The study, which examined the first two years of a three-year assessment, evaluated the effectiveness of BBB in promoting children's dental health and used a clinical (measurable) outcome to develop schemes targeted at the poorest areas. Childhood dental disease was clinically determined in two ways. The first was the percentage of children who were free of tooth decay and fillings and had no evidence of extracted teeth due to decay. These children were designated as caries free. The second measure was the clinical index known as the DMFT. The DMFT index assigns a score of 1 to any permanent tooth (T) that is decayed (D), missing due to caries (M), or filled (F). The DMFT for a population is represented by the average of individual DMFT indexes in the sample. The measurable clinical outcome (dependent variable) used was the average DMFT of children in their 10th and 11th years of life.

The sample

The SHSSB area is located in very rural part of Northern Ireland. The majority of schools are isolated from one another and are located in small towns, villages, or townlands (rural areas). All primary schools in the region were classified by consistent and current BBB participation, location (urban/rural), coeducational status, and a measure of socioeconomic status (SES).

The Northern Ireland Department of Education uses free school meal entitlement (an aggregate measure of relative poverty, low income, and social disadvantage/deprivation) as an indicator of SES in Northern Ireland.²² This study therefore used the percentage of children in a school who were entitled to free school meals to determine SES. In 2002, 25% of all primary school children in Northern Ireland receive free school meals—a figure that reflects the proportion of children who live at or below the poverty line.^{19,22,23} Schools in which no more than 15% of the children received free school meals were considered higher SES schools; schools in which more than 40% of children received free school meals were considered lower SES schools.

Sixteen schools were randomly selected from those that met the inclusion criteria. These schools were matched for participation in BBB, location of school, coeducational status, and SES. Eight schools were from rural and eight from urban locations. As the experimental and control groups could not be randomly assigned, the experimental design attempted to control for as many contributing factors (SES, coeduca-

tional status, and location) as possible. Block randomization was used to minimize the differences between the two groups and ensure that they were balanced within each stratum.²⁴

To detect a difference in mean DMFT of 0.75 (2.45–1.70) with an alpha of 0.05 and 80% power assuming a standard deviation of 2.45, 16 schools with 169 children participating in the intervention and 169 children in the control schools were used. The parents of all eligible 9-year-old children attending the 16 schools were contacted and consent obtained for their child's participation in the study. Ethical approval was obtained from the Ethical Research Committee, Faculty of Medicine and Health Sciences, Queen's University, Belfast.

Clinical examination

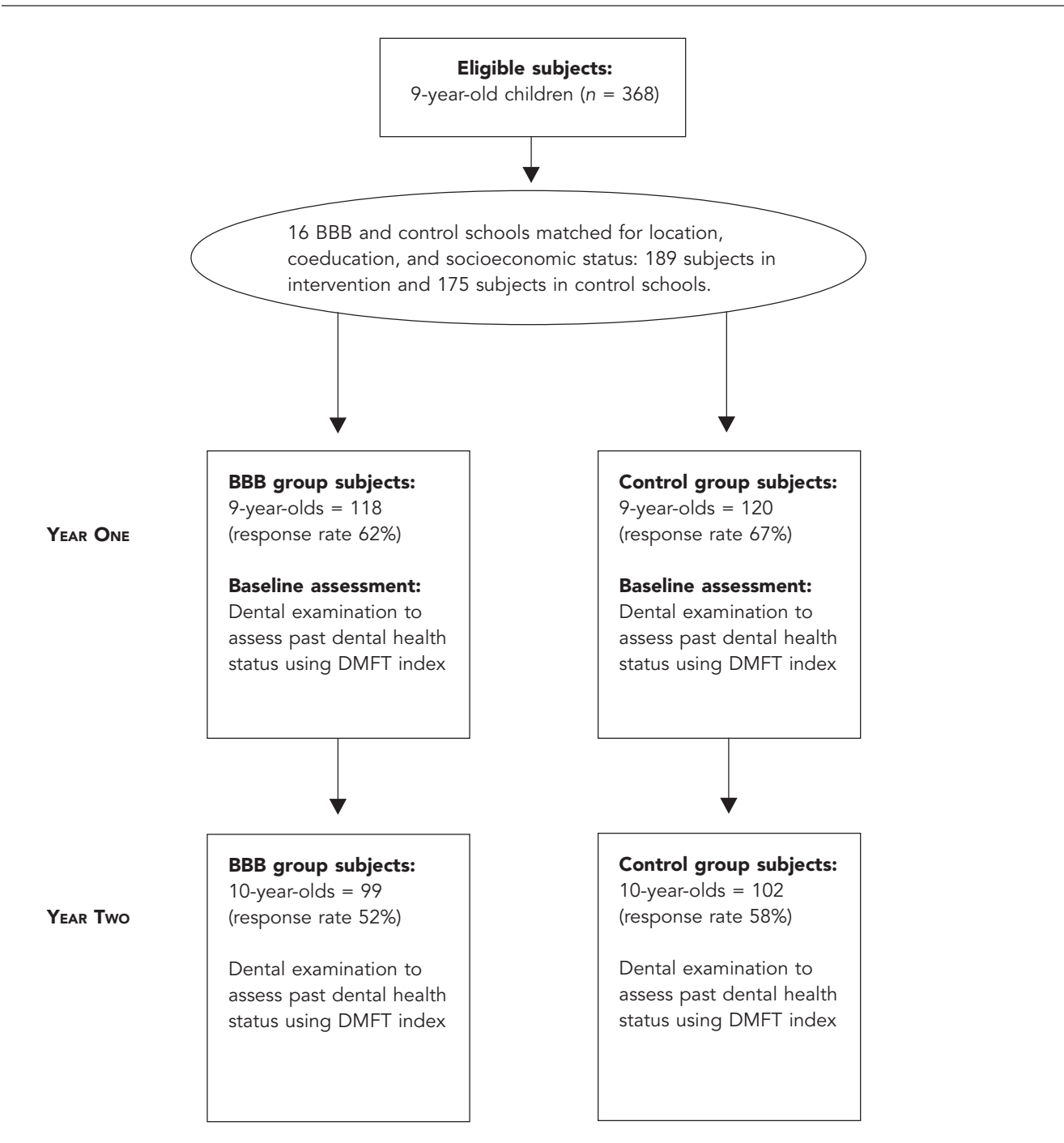
DMFT was assessed using the British Association for the Study of Community Dentistry (BASCD) guidelines standardized for collecting epidemiological data throughout the United Kingdom.²⁵ The BASCD protocol recognizes decay that extends into the dentine on the basis of a clinical examination conducted without the use of probes.^{4,25} The full examination was conducted under standardized conditions observing normal infection control protocols. A single, independent, BASCD-calibrated community dentist examined all children taking part in the study. Neither the dentist nor the dental nurse knew which children were participating in the BBB. Missing deciduous teeth, except incisors, were assumed to have been extracted because of caries. All dental examinations took place at the same time of year.

Intraexaminer reliability was measured by reexamining a 10% random sample of all children. Two dental examinations were conducted for each of the selected children in year one. To assess intraexaminer reliability, an identical format was used in year two. The Kappa statistic was used to assess intraexaminer consistency.²⁶

FINDINGS

Three hundred sixty-four children were invited to participate in the study, 189 children in the BBB participating schools and 175 children in the control schools (see Figure). Two hundred thirty-eight children (65%) took part in the study in year one, and 201 children (55%) participated in year two. Forty-three percent of the children (16) who dropped out of the study ($X^2[1] = 0.34$; $p = 0.56$) attended schools classified as

Figure. Profile of BBB evaluation



having higher SES; 51% (19) attended BBB participating schools ($X^2[1] = 0.06$; $p = 0.82$).]

Our results compare the 201 children who were examined in both years of the study. Intraexaminer reliability was high, with 100% agreement in both years

($k = 1.00$). In year one of the study, 33% of the 201 children were free of caries in their deciduous and permanent dentition; 27% were caries free in year two. In year one, 37% of the DMFT (total decay) consisted of decayed permanent teeth, with 49% consist-

ing of filled permanent teeth. In year two, decayed permanent teeth contributed 24% of total decay experience; 60% of the total decay experience consisted of filled permanent teeth. In year one, 14% of the DMFT consisted of missing permanent teeth compared with 16% in year two (Table 1).

The DMFT of all 201 children who took part in years one and two was compared using a repeated measures analysis of variance (Table 2). There was a significant increase in DMFT over time, and the increase was related to SES. There was no effect by BBB school participation. There was an increase in the number of filled permanent teeth over time. There was also a significant increase in missing permanent teeth with time, and the increase was related to SES. No other significant effects were demonstrated.

Equivalent proportions of children attending lower (20%) and higher SES BBB schools (32%) were decay free in year one ($\chi^2[1] = 2.13$; $p = 0.15$). In year two, equivalent proportions of children attending lower (17%) and higher SES BBB schools (24%) were caries free ($\chi^2[1] = 0.72$; $p = 0.40$). Significantly fewer children attending lower SES control schools were caries free in year one (26%) than were children attending higher SES schools (51%) ($\chi^2[1] = 6.85$; $p < 0.01$). This pattern held in year two, when 19% of children attending lower SES control schools and 42% of children in higher SES control schools were decay free ($\chi^2[1] = 6.05$; $p < 0.01$).

There was a significant increase in DMFT between year one and year two in children in the BBB schools. There was a significant increase in the number of filled permanent teeth over time, particularly among children in low SES schools. There were no significant effects demonstrated for the mean number of missing permanent or decayed permanent teeth (Table 3).

Children attending lower SES schools were compared between year one and year two. There was a moderate increase in the mean number of sound permanent teeth for children attending BBB participat-

ing schools (year one: 12.44 [95% CI 11.46, 13.40]: year two: 14.71 [95% CI 13.49, 15.99]) compared with those attending control schools (year one: 13.75 [95% CI 12.84, 14.65]: year two: 14.65 [95% CI 13.52, 15.80]) ($F[1,85] = 3.66$; $p < 0.05$ [one-tail test]). There were no significant effects of BBB participation demonstrated for total caries experience (DMFT), mean number of missing teeth, or mean number of filled teeth. There were significant increases in mean DMFT ($F[1,85] = 22.01$; $p < 0.001$), mean number of missing teeth ($F[1,85] = 4.17$; $p < 0.05$), and mean number of filled teeth ($F[1,85] = 22.98$; $p < 0.001$) between year one and year two. There were no effects of time or BBB school participation for the mean number of decayed teeth in children attending lower SES schools.

DISCUSSION

This study represents a research-practice-community-partnership initiative at two levels. First, the BBB policy was conceived and developed within a community-practice-industry initiative. Second, a diverse team of community-based practitioners and research-based academics evaluated the program.²¹ The marrying of these two levels of cooperation within a research-practice-community partnership allowed strategy to be converted to policy and policy into action to address oral health inequalities of children in Northern Ireland.

The results initially appeared to suggest that BBB had done little to reduce oral health disparities between control and experimental groups. Between years one and two the dental health of the children declined, with lower proportions being caries free together with increases in the mean number of filled and missing permanent teeth.

When the sample was split into separate BBB participation and control school groups, significant differences in the proportions who were caries free were noted in the control group. These differences were related to SES. However, irrespective of SES, equivalent

Table 1. Dental health status in year one and year two (N = 201 children)

Dental health status	Year one		Year two	
	Mean	95% CI	Mean	95% CI
DMFT index	0.78	0.60, 0.93	1.05	0.83, 1.26
Mean number of decayed teeth	0.29	0.18, 0.41	0.25	0.15, 0.34
Mean number of missing teeth	0.11	0.03, 0.17	0.17	0.06, 0.28
Mean number of filled teeth	0.38	0.26, 0.48	0.63	0.48, 0.78

CI = confidence interval

Table 2. Total caries experience in permanent dentition by year, school BBB participation, and socioeconomic status

<i>Dental health status</i>	<i>Mean</i>	<i>95% CI</i>	<i>F</i>	<i>df</i>
Decayed, missing, and filled teeth				
Year one (<i>n</i> = 201)	0.82	0.64, 1.00	24.91	1,197 ^a
Year two (<i>n</i> = 201)	1.12	0.99, 1.33		
Decayed, missing, and filled teeth				
Higher socioeconomic status, year one (<i>n</i> = 113)	0.51	0.27, 0.75		
Lower socioeconomic status, year one (<i>n</i> = 99)	1.13	0.85, 1.40	6.83	1,197 ^b
Higher socioeconomic status, year two (<i>n</i> = 113)	0.65	0.38, 0.93		
Lower socioeconomic status, year two (<i>n</i> = 99)	1.58	1.28, 1.89		
Filled teeth				
Year one (<i>n</i> = 201)	0.39	0.27, 0.51	5.09	1,197 ^c
Year two (<i>n</i> = 201)	0.67	0.51, 0.81		
Missing teeth				
Year one (<i>n</i> = 201)	0.12	0.04, 0.19	5.56	1,197 ^c
Year two (<i>n</i> = 201)	0.19	0.09, 0.30		
Missing teeth				
Higher socioeconomic status by year one (<i>n</i> = 113)	0.02	−0.08, 0.12		
Lower socioeconomic status by year one (<i>n</i> = 99)	0.22	0.10, 0.33	5.39	1,197 ^c
Higher socioeconomic status by year two (<i>n</i> = 113)	0.02	−0.12, 0.16		
Lower socioeconomic status by year two (<i>n</i> = 99)	0.37	0.22, 0.53		

NOTE: Only significant values are shown. All values for years one and two are estimated mean scores corrected for socioeconomic status, BBB school participation, and gender. All values for socioeconomic status have been adjusted for all other independent factors (BBB, school participation, and gender).

^a*p* < 0.001

^b*p* < 0.01

^c*p* < 0.05

CI = confidence interval

df = degrees of freedom

proportions of children who participated in the BBB program were caries free. Mean DMFT, the mean number of decayed teeth, and the mean number of missing teeth were unaffected by SES, but increases in the mean number of filled teeth were related to SES.

BBB children from lower SES schools attended and received more restorative care than other children. This finding may reflect the type of dental care accessed by low-income families in the United Kingdom, who tend to use community dental practitioners, who readily provide restorative treatments. Children from higher socioeconomic groups are more likely to attend general dental practitioners, who may adopt a less interventionist approach to the treatment of childhood dental caries.^{8,27}

The BBB program did appear to affect the oral

health of the children studied: not only did they have more restored teeth, but children from lower SES schools that participated in the BBB had slightly higher numbers of sound teeth compared with those attending similar schools that did not participate in the program.

The relationship between dental decay and frequent digestion of cariogenic sugars is well known,^{1,3} as is the relationship between SES and adults' and children's dietary habit.^{12,14,16,28} People from lower-income groups tend to consume more foods high in calories, including foods rich in cariogenic sugars.^{12,14,16,28} Was it possible that the BBB program enabled children from lower SES groups to reduce their cariogenic snacking to the level of children from higher socioeconomic groups, that is, to consume cariogenic sugars only four times a day with meals?²¹³ The results of the first two

Table 3. Total caries experience in permanent dentition among children attending BBB participating schools, by socioeconomic status

<i>Dental health status</i>	<i>Mean</i>	<i>95% CI</i>	<i>F</i>	<i>df</i>
Decayed, missing, and filled teeth				
Year one (<i>n</i> = 99)	0.83	0.53, 1.13	8.69	1,96 ^b
Year two (<i>n</i> = 99)	1.12	0.79, 1.47		
Decayed, missing, and filled teeth				
Higher socioeconomic status, year one (<i>n</i> = 58)	0.68	0.30, 1.05	3.56	1,96
Lower socioeconomic status, year one (<i>n</i> = 41)	0.98	0.53, 1.44		
Higher socioeconomic status, year two (<i>n</i> = 58)	0.79	0.36, 1.21		
Lower socioeconomic status, year two (<i>n</i> = 41)	1.45	0.94, 1.97		
Decayed teeth				
Year one (<i>n</i> = 99)	0.31	0.09, 0.53	0.96	1,96
Year two (<i>n</i> = 99)	0.25	0.09, 0.39		
Decayed teeth				
Higher socioeconomic status, year one (<i>n</i> = 58)	0.19	−0.08, 0.47	3.44	1,96
Lower socioeconomic status, year one (<i>n</i> = 41)	0.42	0.08, 0.75		
Higher socioeconomic status, year two (<i>n</i> = 58)	0.25	0.06, 0.44		
Lower socioeconomic status, year two (<i>n</i> = 41)	0.24	0.01, 0.46		
Filled teeth				
Year one (<i>n</i> = 99)	0.44	0.26, 0.63	10.77	1,96 ^a
Year two (<i>n</i> = 99)	0.77	0.54, 1.01		
Filled teeth				
Higher socioeconomic status, year one (<i>n</i> = 58)	0.39	0.16, 0.63	5.11	1,96 ^c
Lower socioeconomic status, year one (<i>n</i> = 41)	0.49	0.20, 0.77		
Higher socioeconomic status, year two (<i>n</i> = 58)	0.50	0.19, 0.80		
Lower socioeconomic status, year two (<i>n</i> = 41)	1.05	0.69, 1.41		
Missing teeth				
Year one (<i>n</i> = 99)	0.06	−0.05, 0.12	2.30	1,96
Year two (<i>n</i> = 99)	0.10	0.02, 0.20		
Missing teeth				
Higher socioeconomic status, year one (<i>n</i> = 58)	0.03	−0.04, 0.11	2.31	1,96
Lower socioeconomic status, year one (<i>n</i> = 41)	0.08	−0.10, 0.17		
Higher socioeconomic status, year two (<i>n</i> = 58)	0.03	−0.09, 0.16		
Lower socioeconomic status, year two (<i>n</i> = 41)	0.17	0.01, 0.33		

NOTE: All values for years one and two are estimated mean scores corrected for socioeconomic status, BBB school participation, and gender. All values for socioeconomic status have been adjusted for all other independent factors (BBB, school participation, and gender).

^a*p* < 0.001

^b*p* < 0.01

^c*p* < 0.05

CI = confidence interval

df = degrees of freedom

years' evaluation are encouraging, as they show a narrowing of oral health discrepancies between children from lower and higher SES groups. The BBB policy appears to have facilitated healthier snacking and af-

ected dental health in children attending lower SES schools in the community of the SHSSB.

This study had a number of limitations. The first was the experimental design, which could not follow a

randomized clinical trial formula, as the children could not be randomly allocated into control and experimental groups.²⁹ The experimental design that was adopted attempted to control for as many contributing factors affecting dental health as possible, and ensured that the study was single-blinded.³⁰

The second potential problem is the assessment of SES. The convention adopted to assess SES was the use of an aggregate-level measure of poverty—disadvantage/deprivation based upon the school and the proportion of children taking free school meals.²² Free school meals has its limitations as an indicator of SES, however. Students can be misclassified, for example. Nevertheless, this measure of SES was sensitive enough to demonstrate a gradient in disease prevalence between higher and lower SES groups. It would seem that using the proportion of children taking free school meals was an adequate indicator of children living on or below the poverty line and reflected the dental health inequalities associated with relative poverty.^{11,17,19}

A third potential problem was the number of children who dropped out between year one and year two. Restrictions imposed by the ethics committee made it impossible to examine children whose parents had not consented to a second dental examination. This had the potential to reduce the power of the study and to affect the sample composition. The balance of the sample was unaffected, as equivalent proportions of children in BBB participating and control schools and from higher and lower SES groups dropped out.

Although the study was underpowered, the findings nevertheless provide some evidence that the BBB policy reduced inequalities by enabling children from lower SES groups to make the “healthy choice the easy choice.”

The BBB initiative also demonstrates the importance of collaboration within a research-practice-community-partnership.³¹ Without this level of cooperation it would have been impossible to develop or evaluate the program. The incorporation of community with practice and practice with research has allowed strategy to be converted to policy and policy into action.

The BBB has the potential to reduce disparities in oral health in communities such as those in Northern Ireland. Future work should involve cooperation among researchers, practitioners, and the community, so that actual improvements in children’s dental health status may be realized through healthy break-time policies such as BBB.

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