Thirsty In Suburbia: An Investigation Into Public Drinking Fountain Provision In The Greater Wellington Region

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Introduction

Obesity and overweight remain a significant public health issue, with adult obesity rates nearly doubling globally between 1980 and 2009(1). For infants and young children in particular there has been a linear increase in the percentage of overweight globally since 1990(1). Childhood obesity is associated with increased morbidity and mortality due to cardiovascular disease and Type 2 Diabetes(2). The increase in child obesity rates is also reflected in the latest New Zealand Ministry of Health data from 2011/12, with 10% of children classified as obese and a further 21% overweight(3). This is an increase from 2006 when only 8% of children were obese(3). Māori and Pacific children are over represented with 17% of Māori and 23% of Pacific children being classified as obese(3). Obesity in children also occurs more in areas of high deprivation(3).

Sugar sweetened beverages (SSBs) are defined as fruit drinks, powdered drinks, cordial (eg, blackcurrant, lemon barley), carbonated or fizzy drinks (eg, lemonade, cola and orange), energy drinks and flavoured waters(4). In New Zealand the recommended intake of SSB's is less than once a week, in small quantities (one glass), and with food or at meal times(4). The reality is that 63.6% of children in New Zealand consume one or more SSB per week(5), and 20% consume SSB's at least three times per week(3). Māori and Pacific children, as well as children living in areas of high deprivation were more likely to consume more than three SSB's per week compared to others(3).

SSB's have been identified as a significant risk factor for obesity(4). A systematic review of 15 prospective cohort studies and meta-analysis of prospective cohort studies and RCTs provides evidence that SSB consumption promotes weight gain in children and adults (6). Beverage consumption can impact on body weight. This occurs via beverages contribution to energy intake and potentially appetite regulation(7). A randomized control trial (RCT) in Germany looking at the effect of reduced SSB consumption on adolescent body weight found that decreasing SSB intake had a beneficial effect on body weight(7). Sugar seems to be less satiating when provided in liquid compared with solid form, thus contributing to incomplete energy compensation(7). Decreasing SSB consumption is associated with decreases in BMI(6), or as a method of preventing progression to overweight or obese states(8,9)

Additionally, the consumption of SSBs has also been identified as a major risk factor for the development of dental caries(10,11). In New Zealand , just over half (52.6%) of children and young people consumed SSB's at least once a week, and 7% consumed SSB's seven or more times per week(12). If left untreated, the progression of caries can lead to pain, reduced ability to chew and eat which may lead to malnutrition, as well as reduction in the quality of life for children(13). In 2012, for instance, 4% of New Zealand children (aged 1-14 years) had one or more teeth removed due to decay, abscess or infection in the past 12 months(3), and over half of the children in New Zealand have a lifetime incidence of tooth decay(3).

Māori and Pacific children were more likely to have had a tooth removed in the past year than other children(3).

Various interventions to address child obesity/overweight by reducing SSB consumption have been undertaken. Taste, availability, TV advertisement and parental consumption are all factors associated with SSB consumption in children(14). Interventions targeting these factors such as delivery of low calorie drinks to the home and behavioral counseling can dramatically reduce sugar sweetened beverage intake(7). Providing campaigns such as "Water is Cool" can also inform children about the benefits of drinking water and alter their attitudes and behaviors(15,16). Interventional data suggests that substitution of SSBs with non-caloric beverages may be the most efficacious modality at changing consumption patterns(6,7), especially when coupled with education opportunities(7,8).

Increasing the availability of water in schools may reduce SSB consumption(8), or produce no change(9). Schools are often seen as controllable environments and are therefore promising settings for overweight prevention. Data from randomized controlled trails in school settings illustrated that environment modification, in the form of drinking fountain installation, can work to increase water consumption and lead to decreases in progression to overweight or obese states(8,9). The mechanism for this is not clear, however we speculate that water may have a satiating effect, and reduce the consumption of other calorie dense foods and drinks.

As mentioned above, one method of increasing the availability of water is to install drinking fountains in schools and public areas where children frequent such as parks, schools, playgrounds, and pools. Such environmental supports have been previously recommended as important enablers in the development of children's ability to promote their dental health(17). In the UK, for example, 11% of parks were found to have drinking fountains installed(18), and 7% of parks in a medium sized city in Ontario, Canada were reported to have drinking fountains(19). Schools seemed to be better at providing drinking fountains with 66.7% of schools in Cardiff UK reporting that their students had access to drinking water(20). Some places such as Massachusetts also had a minimum requirement for the number of drinking fountains in schools per number of pupils(21).

Our study aims to investigate the nature, extent and availability of public drinking water fountains and alternative beverages in the greater Wellington Region of New Zealand. To assess this we will measure the quality and number of drinking fountains that are present, and if there are any alternative drinks available such as from dairies or vending machines. From this data we will be able to assess differences between socioeconomic areas. We investigated two areas within this region; Wellington City and Lower Hutt.

Methods

Ethical Review

Procedures followed in collecting survey data were in accordance with the University of Otago Human Ethics Committee Standards (Category B), this was obtained prior to contacting school personnel or key stakeholders. Consent to enter the schools and record data was obtained verbally prior to collection. An information sheet and consent form was given or emailed to each of the participating schools and key stakeholders.

Site Selection

Data were collected from four Census Area Units (CAUs) located in the Greater Wellington Region (Wellington and Hutt City Councils). CAU's are useful approximations of suburbs in urban settings(22). CAUs were selected based on the following criteria that each selected CAU: 1) had an area size of >1km^2, 2) had either a high or low area-level deprivation (NZDep 2006) ranking (low = 1-2; high = 9-10); 3) had ≥2 schools ; 4) had >10% resident children (15 years and younger) per population; and 5) had >1 public recreational area (defined as a sports stadium/field, swimming pool or park). Deprivation data were obtained from Statistics New Zealand, and created from 2006 census data(23). Likewise resident population data were obtained from the 2006 New Zealand census. Locations of public recreational areas were obtained from Statistics New Zealand, and supplemented by field observation(24). Locations of schools were obtained from Ministry of Education school directory(25). Four CAUs met these criteria. Selected sites were: two in Wellington City, Kilbirnie East (NZDep 9, 2006) and Karori East (NZDep 1, 2006) and two in the Hutt Valley area, Naenae North (NZDep 10, 2006) and Eastbourne (NZDep 1, 2006). Children were defined as ≤18 years of age.

Stakeholder selection

Interviewees and respondents to the online questionnaire were recruited by the following method. An email was sent to all schools in the selected CAU asking for a principle or teacher to participate in the interview. If a positive response was received, an interview was arranged either in person or over the phone. If they would not agree to an interview an online questionnaire was offered. During data collection school staff was also approached directly, if present. Recreational facility staff were also approached directly, and asked to participate. Three local Māori community leaders were contacted, for their opinion.

Data Collection

Field data collection – drinking fountains and SSB access points in each CAU

First, each CAU was systematically, physically searched for the location and characteristics of drinking fountains and the location of SSB access points. We began searching inside schools (both primary and secondary) who consented (n = 2 refused). We continued the search to all-public recreational areas. Last, we searched the entire CAU for all SSB access points. Public drinking fountains were defined as not within school grounds and not located on private property (i.e. residential housing). School drinking fountains were defined as within the school grounds and were funded and maintained by the schools. SSB access points were defined as outlets (e.g. dairies) or vending machines supplying SSBs. Outlets selling SSB's, but primarily focused on food sales and seated services such as cafes, fast-food outlets and restaurants, were excluded from data collection. These outlets were also excluded, as children do not frequent them often. For each drinking fountain or SSB access point, photographs and latitude/longitude coordinates were taken using a smartphone and the 'GPS Essentials' application.

Characteristics of each drinking fountain were also assessed during field observations. These characteristics included aesthetic appeal, functionality (observed running water), usability (ability to use without mouth-to-fountain contact), height in metres (ground to spout), special features (extra tap designed for filling water bottles), freestanding status (not attached to a wall/building), proximity to a bathroom, and vandalisation throughout. These characteristics were recorded using a standardized data collection template. Aesthetic appeal was assessed using a 5-point scale. Points were assigned as follows: 1= Very Poor (poor maintenance and

undesirable for drinking); 2= Poor (either poor maintenance or undesirable for drinking); 3= Average (Properly maintained and desirable for drinking), 4= Good (Properly maintained, desirable for drinking, and visually appealing); 5= Very Good (Properly maintained, highly desirable for drinking, and visually appealing or artistic). Recorded scores from separate observers were then averaged to produce a final score.

Drinking fountain and SSB access point rate creation

All rates were calculated per 100 children. School children rates were calculated using school population data (the number of children enrolled in in each primary/secondary school). This information was obtained from the Ministry of Education(25). Public child rates were calculated using resident CAU child population data, obtained from statistics New Zealand(24).

Creation of geographic access measures

All drinking fountain and SSB access point coordinates (latitude and longitude) were entered and plotted into Google Earth. A buffer zone was created around each school and recreational area. This buffer zone included all areas within a 400m Euclidean distance from any point on the school/recreational area boundary. The distance of 400m was used as it is the distance that most children are able to walk within 5 minutes(26). School and public SSB access points, and drinking fountain distance was determined using a measuring tool (Ground length) featured on Google Earth. Using this information, the number of SSB access points and drinking fountains per 100 school/resident children, within 400m (as the crow flies) of a school/recreational boundary was calculated.

Qualitative data collection

All interview and questionnaire respondents were given a participant information sheet and asked to fill out a consent form to use their responses in this study. The interviews and questionnaires were conducted to gather information about water provision policy and opinions of staff from selected sites (e.g. schools and public recreational areas). Standard questions were used in both the interviews and online questionnaire. We aimed to capture the following themes; drinking fountain access and availability, SSB access point provision, maintenance issues and additional social and cultural perspectives.

Analytical Methods

Quantitative analyses

Data for each drinking fountain and SSB access point were entered into Microsoft Excel 2010 for descriptive statistics and t-test analyses. Specifically, we created proportions of drinking fountains and SSB access points by deprivation of the area. We also conducted independent, two-tailed T-tests with equal variance to test for significant differences in average; 1) rates of school drinking fountains in low versus high deprivation areas; 2) rates of SSB access points within 400m of schools in low versus high deprivation areas; 3) rates of SSB access points versus rates of school drinking fountains; 4) rates of public drinking fountains in low versus high deprivation areas; 5) rates of public SSB access points in low versus high deprivation areas; 6) public SSB access point rates versus public drinking fountain rates; 7) height of drinking fountains in primary versus secondary schools; 8) public drinking fountain rates versus school drinking fountain rates; 9) public drinking fountain rates versus total SSB access point rates; 10) SSB access points rates versus drinking fountain rates. P-values less than or equal to 0.05 were considered significant.

Qualitative analyses

The data obtained from each of the interviews and online questionnaires was read by four researchers and collated. Themes were identified on the basis of ideas expressed and agreed upon by more than one interviewee or respondent. Opinions and ideas that were expressed by only a single interviewee or respondent were not identified as themes, but were still included in our analysis. All researchers met regularly to review the findings and reach a consensus on data analysis.

RESULTS

The four census area units (CAUs) were assessed for total number of drinking fountains and SSB vendors. Sixty drinking fountains and 23 SSB access points were found across these four CAUs (Table 1). All 12 schools within the study areas were approached for permission to participate and two declined, giving a response rate of 83.33%. Fifty-five drinking fountains were found within the school interior and seven within public areas. Two drinking fountains were categorised as being both school drinking fountain and public drinking fountains.

Table 1. Summary of data collected by Census Area Unit and deprivation of the area

	High Deprivation		Low deprivation				
	Kilbirnie	Naenae	Karori East	Eastbourne	Total	High Dep Total	Low Dep Total
School Drinking Fountains	23	8	8	16	55	31	24
Public Drinking Fountains	5	1	1	0	7	6	1
SSB Access	8	9	3	3	20	17	3
Public Areas	3	5	2	6	10	8	2
Schools	4	2	1	3	7	6	1
Total School Children	1922	512	744	843	3178	2434	744
Total Children (census)	381	882	495	597	1758	1263	495
School SSB access (within 400m of school)	12	1	2	3	15	13	2
Public SSB access (within 400m of recreational area)	5	11	2	5	23	16	2

Of the total number of drinking fountains assessed 59 were functional (98%), 57 were usable (95%) and none were vandalised (n=60). Further details regarding functionality, usability and vandalism can be seen below in Fig. 1.

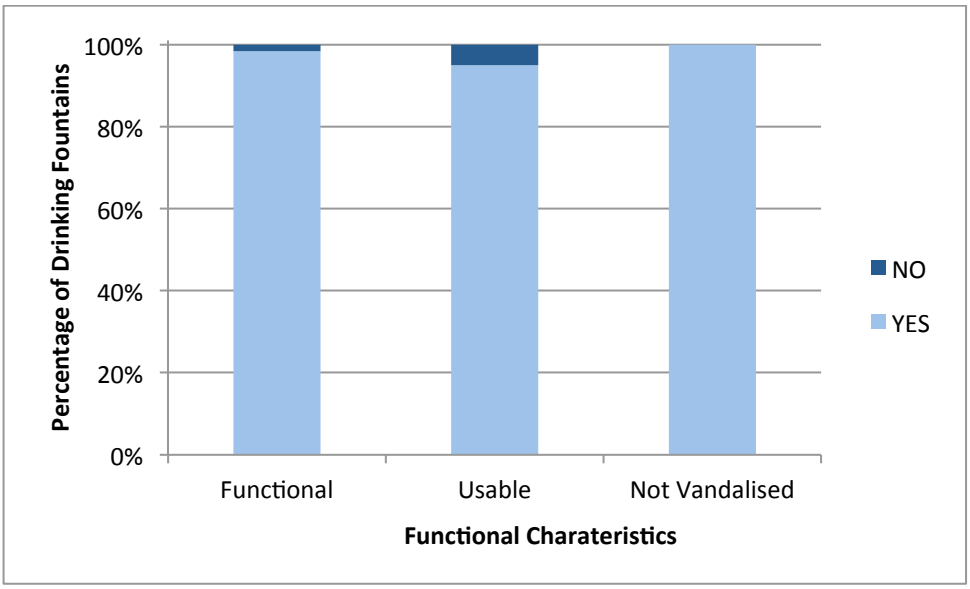

Fig 1. The percentage of drinking fountains which were functional, usable or without vandalism located within the study areas.

Of the total number of drinking fountains assessed 11 had a water bottle feature (18.33%), eight were freestanding (13.33%) and six were within 5m of a toilet (10%). This can be seen in Fig. 2.

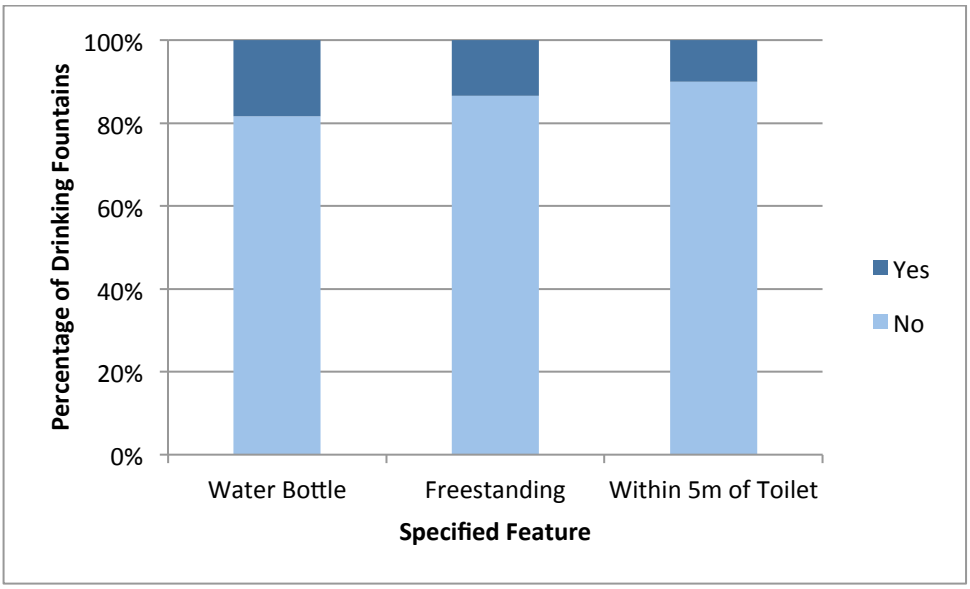

Fig. 2. The percentage of drinking fountains located within the four Census area units which contained a water-bottle feature, were freestanding, and were within 5 meters of a toilet.

The average height for drinking fountains was 0.77m for Primary/Intermediate schools (years 1-9), and 0.92m for Secondary schools (years 9-15). This difference was statistically significant **(p <0.0001) and can be seen in Fig. 3**.

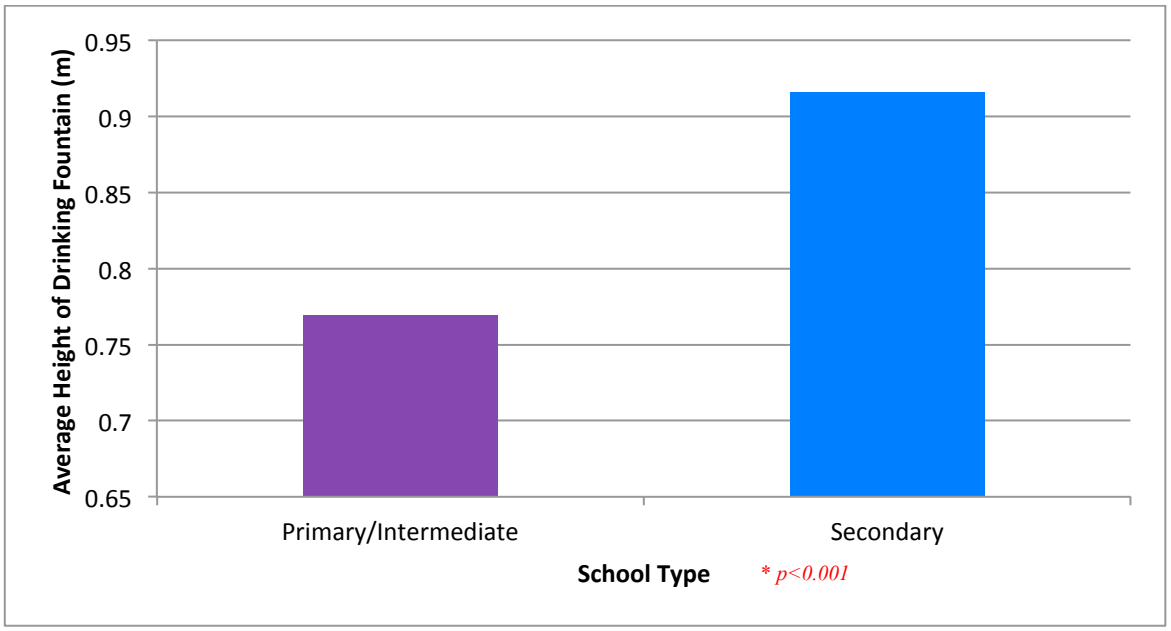

Fig 3. The average height of drinking fountains located in primary/intermediate (years 1-8) and secondary (years 9-15) schools.

Of the total (n=60) drinking fountains, zero (0%) were very poor, eight (13%) were poor, 40 (67%) were average, 11 (18%) were good and one (2%) was very good. Of the 35 drinking fountains found in high deprivation areas: none were very poor, three (9%) were poor, 26 (74%) were average, five (14%) were good, and one (3%) was very good. Of the 25 drinking fountains found in low deprivation areas: 0 were very poor, 5 (20%) were poor, 14 (56%) were average, 6 (24%) were good, and 0 were very good. Details regarding aesthetic appearance of drinking fountains can be seen in Fig. 4.

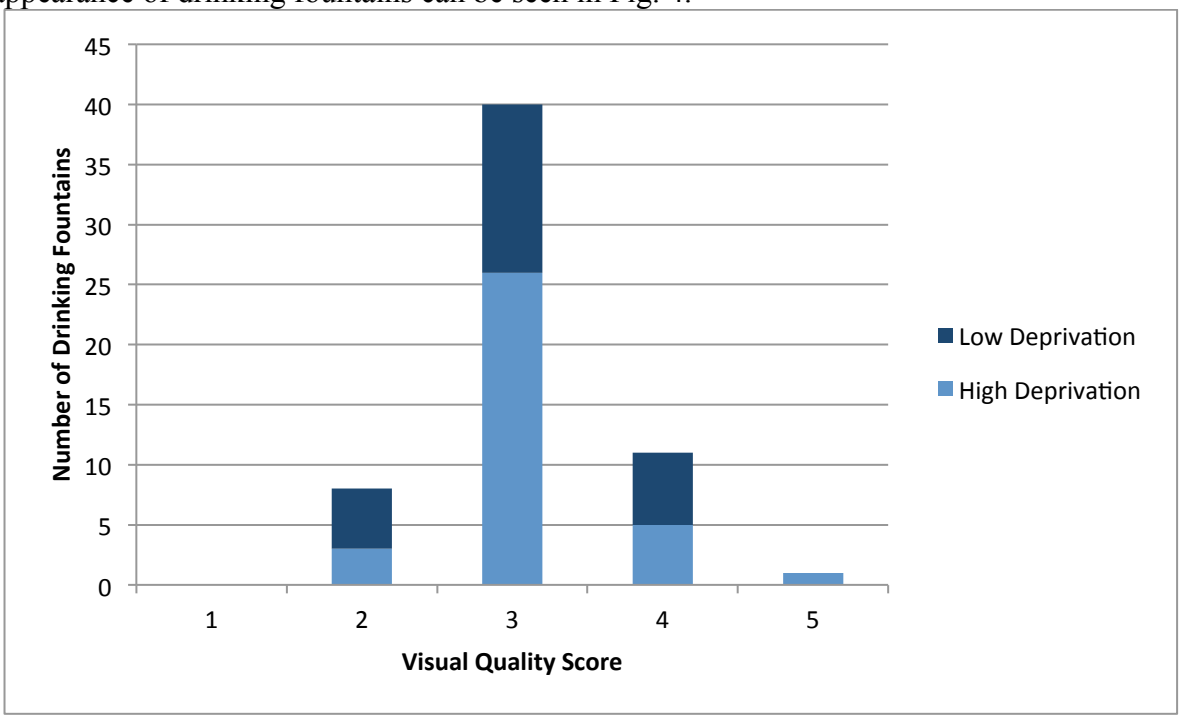

Fig. 4. The number of drinking fountains assigned to each visual quality score (1-5). 1= Very poor, 2= Poor, 3= Average, 4= Good, 5= Very Good by deprivation status.

In high deprivation areas the rate of school drinking fountains per 100 school children was 1.29 and 1.56 for Kilbirnie East and Naenae North, respectively. In low deprivation areas the rate of school drinking fountains per 100 school children was 0.94 and 1.66 for Karori East and Eastborne, respectively. In high deprivation areas the rate of public drinking fountains per 100 resident children was 1.31 and 0.11 for Kilbirnie East and Naenae North, respectively. In low deprivation areas the rate of public drinking fountains per 100 resident children was 0.20 and 0.00 for Karori East and Eastborne respectively. In high deprivation areas the rate of SSB access points per 100 resident children was 2.10 and 1.02 for Kilbirnie East and Naenae North, respectively. In low deprivation areas, the rate of SSB access points per 100 resident children was 0.61 and 0.50 for Karori East and Eastborne respectively.
The overall rates of school drinking fountains was 1.29/100 school children and 0.30/100 resident children for public areas (see Figure 5). However, the rate of SSB was 0.98/100 resident children. The difference between average rates of drinking fountains in schools versus public spaces was statistically significant (**p=0.036**). In contrast, the difference between average rates of public drinking fountains versus rates of SSB access points was not statistically significant, (p=0.22). The rates of school drinking fountains/100 school children compared with SSB access point/100 resident children was not statistically significant, (p=0.51).

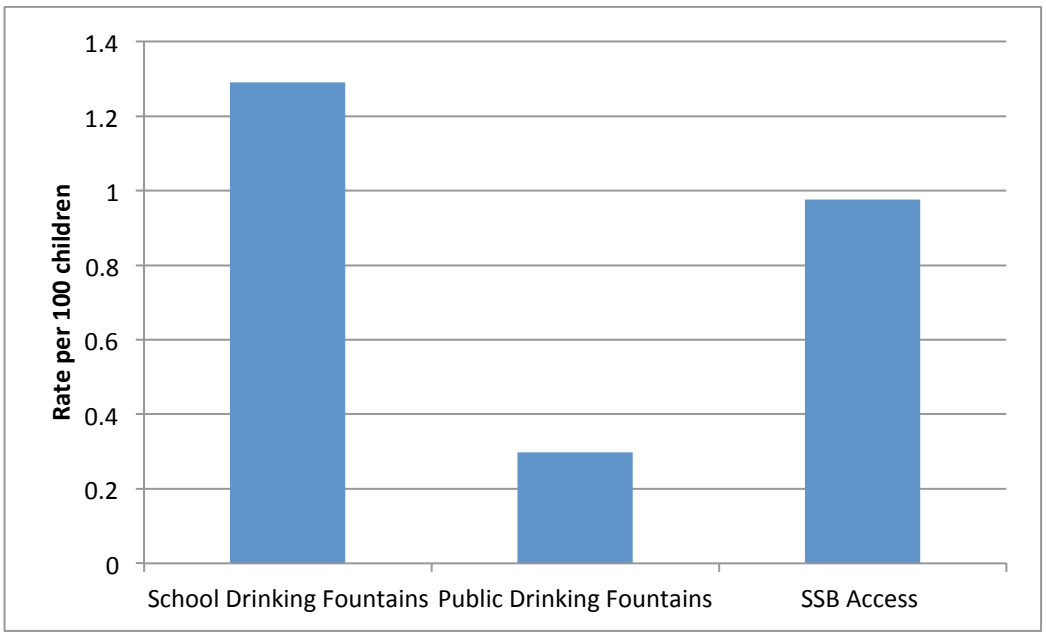

Fig. 5. The rate of school drinking fountains, public drinking fountains and SSB access point/100 children (either resident or school).
The rate of school drinking fountains/100 school children was 1.32 for low deprivation and 1.27 for high deprivation areas. The difference in average rates of school drinking fountains in high versus low deprived areas was not statistically significant (p=0.04).
The rate of public drinking fountains/100 resident children was 0.09 for low deprivation and 0.48 for high deprivation areas. The difference in average rates of public drinking fountains/100 resident children was not statistically significant (p=0.42).
The SSB access points/100 resident children were 0.55 for low deprivation and 1.35 for high deprivation areas. However the difference in average rates of SSB access points for low and high deprivation areas was not statistically significant (p=0.20). Details regarding this can be seen in Fig. 6.

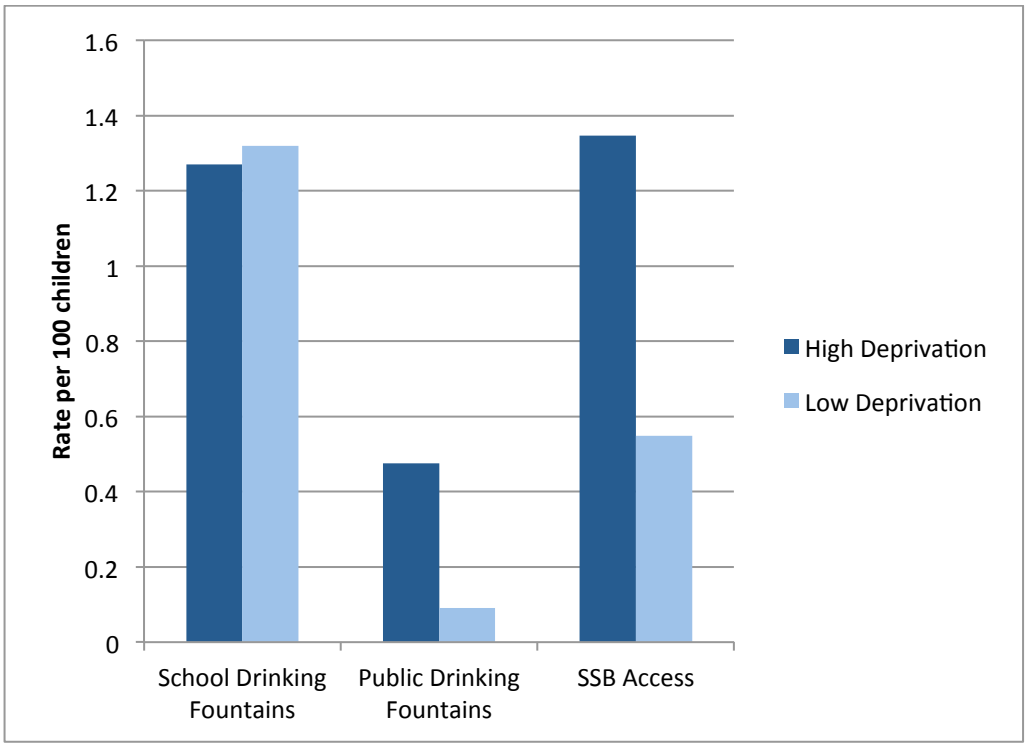

Fig. 6. The rate of school drinking fountains, public drinking fountains and SSB access point per 100 children by deprivation status

As shown in fig. 7, the rate of SSB access points within 400m of schools/100 school children was 0.77 compared with drinking fountains within 400m of schools/100 school children of 1.29. However, the difference in the average rate of SSB access points versus School drinking fountains within 400m of schools was not statistically significant (p=0.29). Rates of SSB access points within 400m of recreational areas/100 resident children was 0.23 compared with the rates of drinking fountains within 400m of recreational areas/100 resident children. The difference between the average rate of SSB access points versus drinking fountains within 400m of recreational areas, for resident children was not statistically significant (p=0.30)

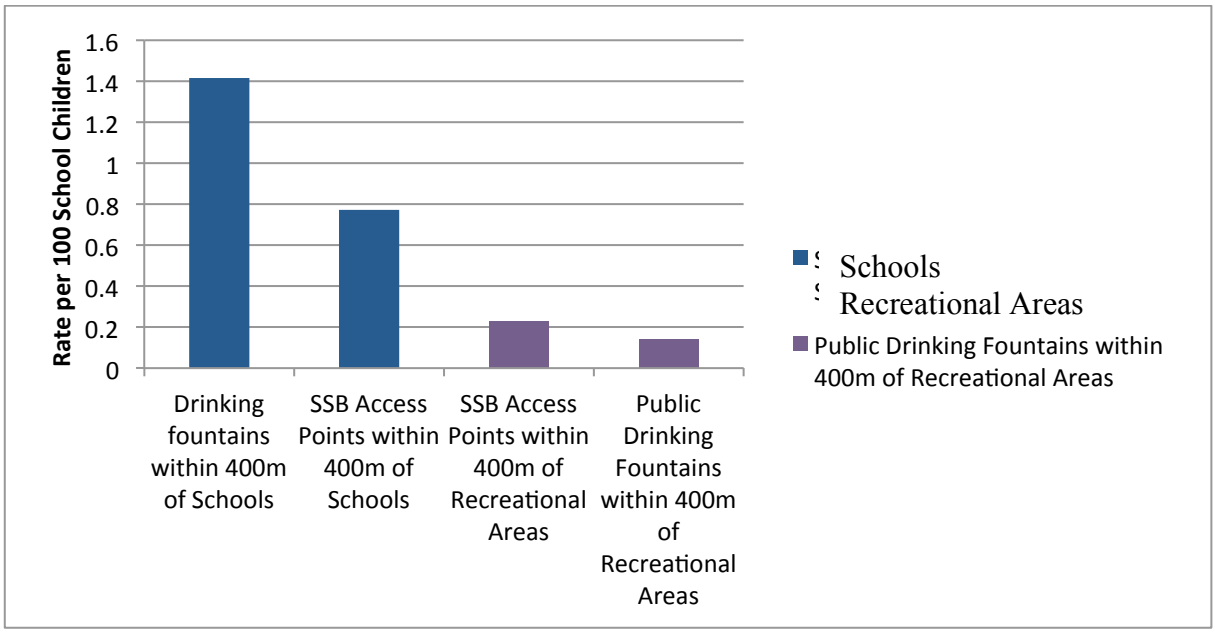

Fig 7. Total rates per 100 children of SSB access points within 400m of schools, school drinking fountains within 400m of schools, SSB access points within 400m of recreational areas and drinking fountains within 400m of recreational areas.

As shown in Fig 8, SSB access points within 400m of schools/100 school children were 1.13 for high deprivation areas and 0.25 for low deprivation areas. However, the difference between average SSB access points within 400m of schools/100 school children in low versus high deprivation areas was not statistically significant (p=0.39).
Drinking fountains within 400m of schools/100 school children were 1.27 for high deprivation areas and 1.32 for low deprivation areas. The difference between average drinking fountains within 400m of schools/100 school children in low versus high deprivation areas was not statistically significant (p=0.14).

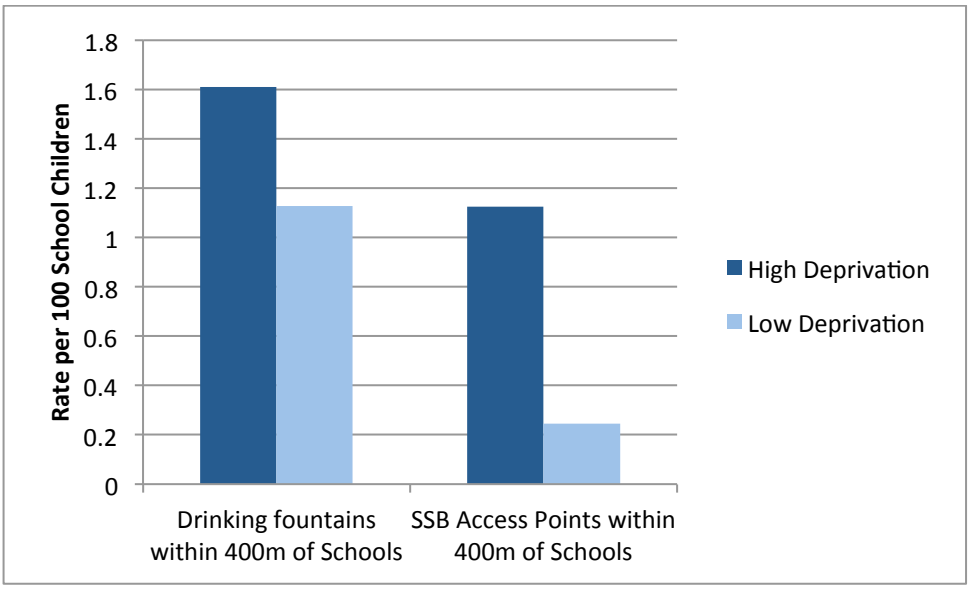

Fig 8. The rate per 100 school children of SSB access points within 400m of schools compared to school drinking fountains by deprivation status

SSB access points within 400m of public areas/100 children was 0.31 for high deprivation areas and 0.16 for low deprivation areas points, this was not statistically significant (p=0.21). Drinking fountains within 400m of recreational areas/100 resident children was 0.26 for high deprivation areas and 0.25 for low deprivation areas. The difference between average rates of drinking fountains within 400m of recreational areas/100 resident children in low versus high deprivation areas was not statistically significant (p=0.06). See Fig. 9 for details.

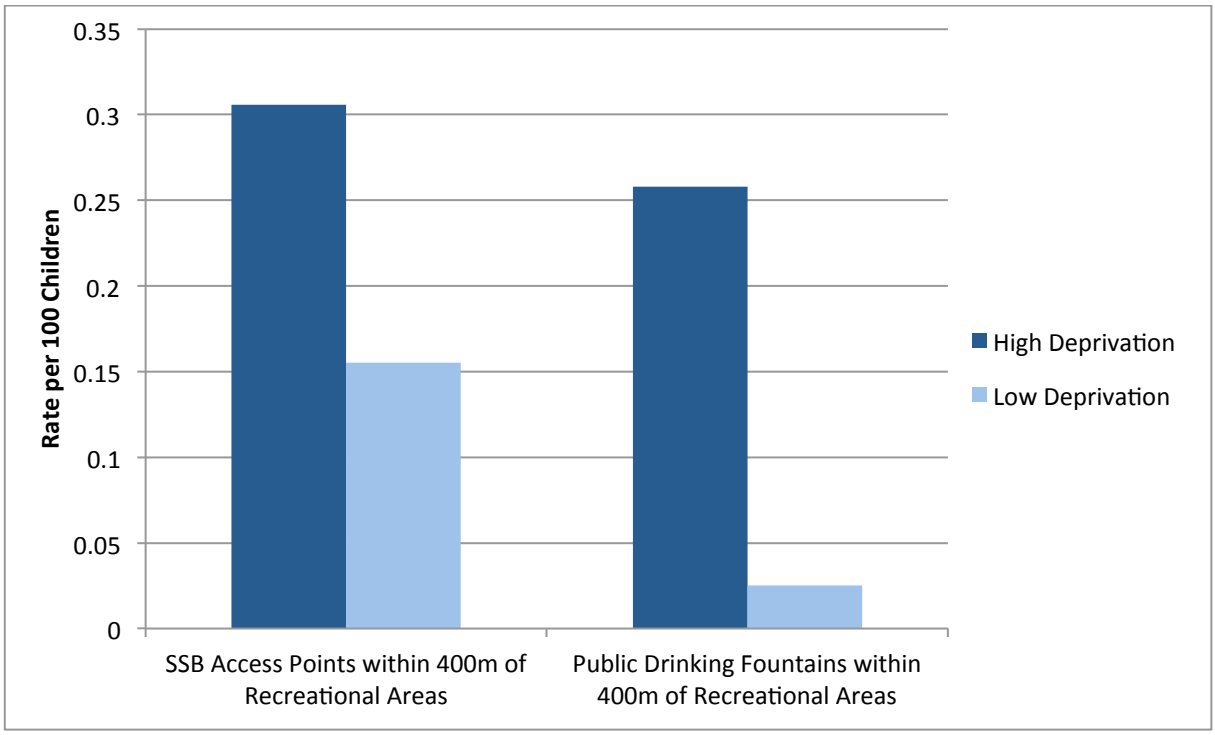

Fig 9. The rate per 100 children of SSB access points within 400m of recreational areas compared to drinking fountains within 400m of recreational areas by deprivation status.

Table 1. The mean rate of drinking fountains and SSB access points within 400m of

	High Deprivation	Low Deprivation	P value
Drinking fountains within 400m of schools/ School children	1.61	1.13	0.28
SSB access points within 400m of schools/ School children	1.13	0.25	0.39
Drinking fountains within 400m of recreational areas/ Resident children	0.26	0.03	0.056
SSB access points within 400m of recreational areas/ Resident Children	0.31	0.16	0.21

school/recreational areas per 100 school/resident children.

Qualitative analysis of key stakeholder interviews and questionnaire responses

We successfully interviewed three primary school principals, a primary school caretaker, a community pool manager and a manager at a local Māori (indigenous) health promotion organisation. A second Māori community leader also responded to a tailored online questionnaire. School principals/teachers responded to the online questionnaire from an additional two primary schools and one secondary school. Anonymity was maintained meaning that online respondents' individual answers were not able to be identified and were therefore analyzed as a whole.

In total 10 participants were questioned.

Access and Availability

All stakeholders interviewed stated that children active within their location (schools, a community pool and two maraes) have access to drinking fountains.

Nine of the ten respondents felt that access to water within their specified location was adequate.
One marae spokesperson stated:

> *"Hutt Valley tap water is great for consumption."* and proceeded to question, in light of this fact, how important drinking fountains were with regards to accessing drinking water.

None of the respondents had specific policy regarding where drinking fountains were required, or how many were needed.

Representatives of both Hutt City and Wellington City Councils were also contacted but did not undergo the standardized interview process. It was established that they have no formal policy regarding the provision and installation of drinking fountains. This occurs on a project by project basis when developing public spaces. Therefore the provision of drinking fountains is based on ideas of appropriateness as opposed to legal obligations and guidelines.

Alternative beverages

A trend amongst those interviewed was the belief that children's choice of beverage was indeed a much larger problem than the access and availability of drinking water. Of note, none of the schools or maraes had a vending machine on site. A Māori community leader noted:

"Everyone knows they are bad. They taste good"

Two primary schools had 'water-only' policies which specified that students were not allowed to consume SSBs on school grounds. These two schools were located in one of the high deprivation index areas we investigated.
A third primary school interviewed had no specific policy regarding SSB consumption on school grounds, and the principle specifically stated that the consumption of SSBs is not a problem, further elaborating:

"We are a decile 10 school with well educated parents. Students don't bring unhealthy beverages. Most students have drink bottles."

Schools that responded to our online questionnaire had no SSBs for sale on site. Neither primary school had written policy regarding SSBs with the high school stating that:

"No high-calorie beverages are sold through the(school) kitchen."

The marae representative we spoke to also outlined a similar policy regarding consumption of unhealthy food and drink on their grounds. This also extended to any events run in the community through a blanket '*healthy kai policy'.* A key component of this policy is promoting water as the *"first choice"* in beverage when children are thirsty.
The marae representative also explained that the removal of on site vending machines was a controversial issue amongst management. Although the machines provided an important source of revenue, it was decided that interests in community health should prevail and therefore a policy be established.

The marae spokesperson that responded online further identified policy requiring the removal of on site vending machines. They also discussed a local kura kaupapa (Māori immersion primary school) that too implemented the '*healthy kai policy'.*
This marae had also adopted a stance against the excessive availability of SSBs insisting that SSBs are not supplied at marae run events.

Two schools in one of the high Nzdep score areas were introducing programmes with school supplied food and milk. One of these schools was about to introduce the 'milk in schools' programme. The other school, a decile one primary school, had already started the 'milk in schools' programme. They also provided breakfast to all students every morning in the form healthy options such as weetbix and milk or toast. Healthy lunch options were supplied to a small group of students who were not able to supply their own. The representative from this school noted that student's performance had notably improved since the implementation of this scheme.

A staff member from a community pool that was interviewed stated that vending machines were on site but their use was minimal. The reason for this was not that pool users were drinking water instead but interestingly that around 50% of the time the vending machines

were broken due to the chlorine in the air. They also stated that there was a large number of shops and dairies in close proximity offering cheaper options.

Stakeholders were also asked about their opinion on the availability of SSBs in the surrounding community. The primary school representatives interviewed had varying opinions as to the extent of the availability of SSBs in the community. Furthermore, it was observed by the researchers that shops and dairies were often in very close proximity to school grounds.

> "(SSBs are) *the first thing you see when they get out of school"*
>
> "(SSBs are) *seen as treat"*
>
> *"people think they are healthy"*
>
> While SSBs are banned on site "*they can drink them on the way to school"*
>
> "(SSBs are) *readily available, with a dairy next door to school"*

Schools that responded through the online questionnaire however, were less convinced that community availability of SSBs was a big problem. One school identified them as being "*readily available"* while the other two stated they were "*scarce"* in the surrounding community or of "*limited availability"*.

When asked about access to SSBs in the community being a problem one marae spokesperson we talked to stated *"Yes. Plain and simple"*.
They then went on to state that *'obesity, especially'* was a problem and that they thought *'access to fizzy drinks'* was a major cause of the problem.

The other marae spokesperson that responded stated "*advertising has a lot to answer for"* when asked about the prevalence of SSB consumption amongst children. With regards to health problems, in this case, obesity, dental caries and type II diabetes, the spokesperson stated that it was part of a wider problem:

> "*It all has to do with poverty, the roll-on effect"*.

Both maraes had community health programmes which organised activities in the community. The *'healthy kai policy'* was enforced at all of these events.

Maintenance and problems

Issues surrounding maintenance were also enquired about. The two maraes and community pool had drinking fountains and water coolers that were supplied and maintained under contract. The contractors have scheduled maintenance inspections once a week. Due to such frequent upkeep these places reported no problems with their drinking fountains and water coolers.

School drinking fountains were maintained by school caretakers, of which only one was interviewed. Principles/teachers also identified some issues with maintenance and upkeep.

Vandalism/graffiti was the most commonly identified maintenance issue.
One school principle explained that 8 years ago they had decided that they could only have drinking fountains indoors due to the problem of constant vandalism. The principle went on to explain that it would be far more ideal to have the drinking fountains outside where children play.
At the school where the caretaker, was interviewed vandalism was identified as being a problem in the past. This particular school was a decile one primary school and the school grounds were used extensively by the community. In the past the caretaker had threatened to remove the drinking fountains and the vandalism problems had ceased.

The height of drinking fountains was identified by two schools as a problem. New entrant primary school students frequently had trouble drinking from taller drinking fountains. Schools with newer drinking fountains had addressed this problem, as shown in F.4.

Additional Cultural Perspectives

The two Māori community leaders interviewed also discussed the cultural significance of water. It was decided at a recent Waikato *hui* (meeting) that water is in fact a *taonga* (treasure) of the Māori people. It is also used to *whakanoa,* or remove *tapu* (sacredness) for example during the *tangihanga* (funeral) process.

In Hutt City, where the two maraes are located, there are two taps that take water directly from an underground aquifer maintained by the council. The local *iwi* (tribe) has also bored their own access to the aquifer but it hasn't yet been tapped. When asked about the importance of these water sources to the community one representative answered:

> *"The source of this water has come from on of the maunga* (mountain). *All things pertaining to papanuku* (earth mother) *is of utmost importance."*

A dilemma was also noted in that this natural ground water is not fluoridated. The representative supported the fluoridation of drinking water due to the associated reduction in dental caries.

Miscellaneous

Researchers observed a conspicuous lack of signposting notifying the presence and location of drinking fountains and water coolers. When searching for these drinking fountains and water coolers their location was not immediately obvious.
It was further noted that there was an abundance of large banners, posters and advertisements promoting SSBs on shop windows as well as product displays in view of the street in high deprivation areas. These displays were promoting only a very small number of large international established brands.

Discussion

Overall our study determined that while drinking fountain provision was consistently adequate in primary and secondary school environments, the same could not be said for other public areas frequented by those same children. Non-school public areas in the greater Wellington region, even large outdoor parks, lack drinking fountains. The only drinking fountains we found were within indoor facilities. Retailers that stock SSB's are also numerous in public areas and within 400m of schools, despite regulated school environments often having policies limiting or eliminating their consumption. Public policy should be modified so that access to drinking fountains in public areas popular with children matches that within school environments.

It is vital that we note the similarities and differences that exist between high and low deprivation areas. Drinking fountains were equally frequent in both schools and public places, regardless of deprivation area. However, there was a higher frequency of SSB access points within 400m of schools in high deprivation areas compared to low deprivation areas. High availability of SSB's encourages their consumption, especially in the absence of free healthy alternatives, as is the case in Greater Wellington public areas(7). Not only was SSB access more frequent, but we also observed that posters and window displays reinforced the availability of SSB's. This was confirmed by our stakeholder interviews, with a representative from a low deprivation area reporting that parents recognised issues with SSBs and their consumption. Schools in high deprivation areas often felt the need to implement specific policies prohibiting SSBs within school boundaries in order to achieve the same result. While schools in high deprivation areas can regulate consumption during school hours, these policies do not extend beyond the school gates and are therefore a poor substitute for parental attitudes. High deprivation area school representatives reported that SSB consumption is still an issue outside school, even in the presence of regulatory policy.

Children in high deprivation areas are more likely to be overweight/obese than children in low deprivation areas(3). The greater access to SSBs in high deprivation areas may be contributing to this inequality. This is a matter of social justice, as higher deprivation populations seem to be targeted by SSB producing companies. Interventions should be targeted to reduce SSB access and consumption in all deprivation areas with a focus on high deprivation areas in order to reduce inequalities. We believe a two way relationship exists where if sweet tasting, eye catching and affordable SSBs are numerous, they are likely to be chosen as an alternative to drinking fountains. In much the same way, numerous drinking fountains are likely to deter the consumption of SSBs due to increased water consumption(9). This will be especially effective if coupled with educational measures to help change children's attitudes to water(8,9)

Our study shows a lack of drinking fountains in public areas. We did not find any outdoor drinking fountains outside of schools, despite our census areas including large parks. In indoor facilities, which have a regular staff presence, drinking fountains were available and well maintained. The lack of this same level of constant vigilance in parks may make council planners reluctant to install drinking fountains in these areas. No respondents in our survey knew of specific policy regarding the provision of drinking fountains. Christchurch City

Council policy dictates that “metropolitan and major” parks will have a minimum of one drinking fountain per park(27). Greater Wellington Region Councils should follow suit and develop and implement similar policies. To ensure the success of such policy specific guidelines, maintenance would be an essential component.

The rate of drinking fountain provision in schools in the Greater Wellington region was comparable to Massachusetts guidelines(21). These guidelines suggest 1.33 drinking fountains per 100 children - we found a value of 1.29 drinking fountains per 100 children. This was consistently true regardless of area deprivation. Also, school representatives consistently felt that water access within schools was adequate. This is probably due to the school environment being largely controllable. Scheduled weekly maintenance inspections were reported as a common practice in most schools and facilities in order to keep drinking fountains functional and useable. A school environment is able to control SSB consumption and availability within school grounds. Future challenges in fountain provision lie in raising rates of drinking fountains in public areas to become comparable with those of schools.

Drinking fountains in the Greater Wellington region were found to be of high quality. Regardless of deprivation area, the vast majority of drinking fountains were functional, usable and non-vandalised. However, vandalism/graffiti was the issue most commonly identified by interviewees as affecting drinking fountain provision within schools. Potential vandals may be reluctant to damage drinking fountains within schools for community loyalty reasons or the fear of cameras and other security measures. Vandalism is therefore likely to be a greater issue outside of schools and may be one of the reasons we found no non-school outdoor drinking fountains. Vandal resistant drinking fountain design would be essential if more drinking fountains in public areas in Greater Wellington.

The aesthetics of drinking fountains were found to be average. Aesthetics may affect a child’s tendency to use a drinking fountain. More creative drinking fountain designs could be used to encourage their use.

Another general observation made by the researchers in the study was that drinking fountains were difficult to locate. This could be improved by installing freestanding drinking fountains in prominent, public areas and having signs or symbols to indicate their presence.

Schools also seem to cater to the physical needs of different children by installing drinking fountains of an appropriate height in primary and secondary schools. There was a statistically significant difference in the height of drinking fountains between primary and secondary schools. Even with this allowance, some school representatives reported that very young children sometimes struggled to reach the spout. This is important to consider when installing drinking fountains in public areas. At least two separate spouts at different heights should be included so that drinking fountains can be used by the majority of children. Adults can easily drink from drinking fountains designed for secondary school children, so this intervention would not reduce adult water access.

Education on its own has been shown to only have a modest effect of SSB consumption(28). However, if provision of drinking fountains is coupled with education this can significantly alter children’s behaviour with regards to SSB and water consumption(8,9).

Several steps were taken to maximize the quality of this study. A standardised data collection template and interview schedule was used, minimising information bias. Doing so also helped

to establish common themes from key stakeholders. We ensured at least 3 observers were involved in data collection for each census area unit, reducing observational bias. All observers used standard data collection templates with an attached key defining each feature to record. This ensured each feature of data was accurately recorded. Information on deprivation and population data was obtained from reputable governmental sources (Ministry of Education and Statistics New Zealand, respectively).

The major limitation of this study was the small sample size of 4 census area units. These were the only ones to meet our inclusion criteria, limiting the generalizability of the study. Furthermore, 2 of the 12 schools in the chosen census area units did not participate in the study. From those that did participate there was a low interview/survey response rate.

Information on area populations was obtained from the 2006 NZ Census(24), which may differ from the current 2013 population. The ethnic composition of each area was not taken into account. In light of New Zealand's multicultural population and the health disparities that exist, ethnic data comparisons should be included as part of future analysis. The school children populations differ from the population of children within the census area unit, limiting our ability to make associations between school populations and area deprivation.

The census area unit boundary may have excluded alternative outlets within 400m of schools or recreational areas and parks resulting in underestimation of SSB providers.
Also, alternative outlets supply multiple SSBs, compared to drinking fountains that only serve one child at a time.

Differences between high and low deprivation areas were not statistically significant with regard to numbers of SSB access points within 400m of schools and total SSB access points with in the census area unit, however an association was noted. Researchers also observed a disparity in these two categories during data collection. We strongly believe that a statistically significant relationship exists and would be found in a larger study with a greater sample size.

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