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The potential of Google Street View for studying smokefree signage

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In 2004, a revised national law requiring school grounds to become completely smokefree became operational in New Zealand (NZ) – the *Smoke-free Environments Act* (with amendments). This law covers preschools, primary schools and secondary schools for all times of the day and year, and mandates the use of smokefree signage at these facilities (at or immediately inside "every entrance to the premises"). However, there have been no studies of this signage, despite its potential role in both ensuring schools stay smokefree and contributing to wider denormalisation of smoking in a society where the government has a smokefree nation goal for 2025.[1] We aimed to perform a pilot study to explore the utility of Google Street View (GSV) for studying the use of smokefree signage by NZ schools.

GSV is being increasingly used in research to study topics such as the built environment,[2-4] neighbourhood characteristics,[5] cycling routes to school[6] and animals in urban settings.[7] Reported advantages include: efficiency, researcher safety, low cost, unobtrusive data collection and access to historical images of the same streets. Studies of the validity of GSV data compared to field observations are generally favourable,[6,8-10] but problems with differing image dates on intersecting streets have been described.[11]

Methods

We conducted a pilot study of smokefree signage at 50 primary and secondary schools in the lower North Island of NZ in July 2014. This was a convenience sample of schools within two kilometres of the main road when travelling from Wellington City to the Hawkes Bay region, and from the researchers being resident in Wellington City. The schools were in 20 towns/rural districts and four cities of more than 50,000 population (13 suburbs). Data collection included the presence or absence of smokefree/non-smoking signage at the main entrance, and anywhere else on the premises, if visible from the road or footpath. There were two observers (NW and GT) for 35 of the schools, and one (NW) for an additional 15 schools in Wellington. The same schools were then examined using GSV in the subsequent week (by NW).

Results

In the field observations, 32% (16/50) of schools had smokefree signs at the main school entrance, and 66% (33/50) had at least one such visible sign anywhere on the premises (on stand-alone signs, fences or buildings). The average number of signs per school was 1.3 (median: 1, range: 0–6). The comparable figures using GSV were: 16% (8/50) at the main entrance, 32% (16/50) for any signs, and the average number of signs was 0.5 (median: 0, range: 0–4). GSV image date stamps indicated that the images were 1.9 years older on average than the field observations (median: 1.0, range 0.5–6.0). Some signs legible on GSV were no longer legible in the field due to fading. Assuming that all the field observations were correct, the observations using GSV had only modest sensitivity at 44% for main entrance signs (Table 1), albeit with specificity of 97%. Educated guesses around the nature of signs (based on colour and shape but not being able to decipher words) generated some improvements in sensitivity at 52% for any signs (Table 1).

Discussion

This pilot study suggests that GSV has some modest utility for detailing the extent of smokefree sign usage by schools. Sensitivity of GSV might improve over time if Google upgrades the specificity of its automatic blurring algorithms (since some of the smokefree signs had undecipherable words due to automatic blurring that is designed to make vehicle number plates illegible on GSV). Nevertheless, field observations are likely to have superior sensitivity, allowing more angles to be viewed. GSV is efficient – with data collated at the rate of 12 schools per hour in this pilot study. This suggests that further studies using GSV for smokefree signage in streets, parks, campuses and other settings, seem warranted. Ideally, this should include simultaneous samples of field observations by independent observers to further clarify issues around sensitivity, specificity and predictive value of GSV.

From a tobacco control policy perspective it is clearly suboptimal that a considerable proportion of schools do not appear to have any smokefree signage. Tobacco control workers could remind schools of their legal obligations and also their exemplar role in building healthy communities.

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Table 1: Sensitivity, specificity and predictive value of Google Street View relative to field observations of smokefree signage at 50 New Zealand schools.

Performance characteristic of GSV vs field observations	Any signs at main entrance*	Any signs on premises	Any signs on premises including blurred ones**
True positives [A]	7	14	17
True negatives [B]	33	15	14
False positives [C]	1	2	3
False negatives [D]	9	19	16
Total (Number)	50	50	50
Sensitivity [A/(A+D)]	44%	42%	52%
Specificity [B/(B+C)]	97%	88%	82%
Positive predictive value [A/(A+C)]	88%	88%	85%
Negative predictive value [B/(B+D)]	79%	44%	47%

* *That is within two metres either side of the edges of the main entrance (usually a walkway but sometimes a driveway).*

** *That is including signs which were likely to be smokefree ones based on colour and shape but for which the wording was illegible (sometimes due to the automatic blurring function used by GSV for human faces and for vehicle number plates in the New Zealand setting).*

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