Field testing anti-speeding messages

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Abstract

On a 60mph section of road that included a 40kph school zone, speed detection devices were installed prior to, immediately after, and further away from variable message signage (VMS) displaying anti-speeding messages. Speed data (>250,000 vehicle movements) were collected continuously prior to VMS installation (week1), during message display (week2), and post-display (week3). Speed reductions associated with VMS deployment from week1 to week2 were partially sustained at week3.

Background

Using VMS for road safety requires effective messages to influence driver behaviour (Wu & Liang, 2017), and only display messages allowing drivers to change their immediate behavior (e.g., speed choice). Drivers may change their speed selection to a modest extent on encountering VMS messages (Schramm et al., 2012; Song et al., 2016; Soole et al., 2010), and changes may be sustained over time (Winnett & Wheeler, 2002). This study sought to determine whether drivers' speeds through a straight level section of road including a school zone could be influenced by anti-speeding messages.

Method

Week1: data gathering prior to VMS installation provided baseline measures. Week2: three messages displayed. Week3: after VMS removal, data would identify residual effects. The selected site had a speed-related fatal or serious (requiring hospitalization) crash within the previous 6 years. The 60kph speed limit throughout included a school zone with a 40kph school hours speed limit.

The messages (see Table 1), developed according to principles described by Lewis et al. (2016), used a protection motivation theory theoretical framework (Cathcart & Glendon, 2016; Glendon et al., 2018; Glendon & Walker, 2013). Figure 1 shows a sample displayed message.

Results

Results reported here relate only to data from the speed detection device recording vehicle movements into the school zone. So that only vehicles whose drivers were free to select their speed were included in the analyses, vehicles at <4s distance from a lead vehicle were excluded (19%).

All vehicles detected exceeding speed limit: week1 16.41% (mean 46.94kph), week2 13.82% (45.75kph) – week1:week2 effect[1] 0.151, week3 14.58% (46.10kph) – week1:week3 effect[1] 0.106.

Mean speed changes in *week2 compared with week1*: night-time -1.65% (effect[2] 0.003), daytime excluding school hours -1.98% (0.004), school hours -4.01% (0.013). Mean speed changes in *week3 compared with week1*: night-time -1.84% (effect[2] 0.003), daytime excluding school hours -1.32% (0.002), school hours -2.43% (0.005).

[1] Cohen's *d* (both effects $p<.001$).
[2] Partial η^2 (all effects $p<.001$).

Percentages of drivers entering the school zone at >40kph over the 10 week1 school hours periods: 45.03-68.56% (mean range 40.03-43.88kph); week2: 30.56-52.12% (range 38.57-41.00kph); week3: 35.73-59.24% (range 38.28-42.44kph).

Conclusion

Modest mean speed reductions from week2 compared with week1 were detected for all time periods. School hours' vehicle movements showed the largest mean speed decrease and the largest reduction in percentages of drivers exceeding the 40kph school zone speed limit. Week2:week1 reductions were partially sustained in week3 for all time periods.

Main lessons: 1) strategically deploy speed detection devices and analyse resultant speed data before deploying VMS; 2) avoid displaying VMS messages at times when few drivers are speeding. Recommend displaying targeted messages at this location during school hours only and vary messages (perhaps daily) for maximum effect. Study replications are required for longer time periods in varied road environments.

Table 1. Anti-speeding messages and their protection motivation theory (PMT) derivations

Screen 1 display	Screen 2 display	PMT appraisal category	PMT element represented	Field study presentation
SPEEDING?	PENALTIES APPLY!!	Threat appraisal	Counter-rewards	Days 1, 2 & 3 (~72 hours)
KEEP OUR STREETS SAFE	STAY WITHIN THE LIMIT	Coping appraisal	Self-efficacy	Days 4 & 5 (~ 48 hours)
REDUCE YOUR SPEED	KEEP YOUR FAMILY SAFE	Threat appraisal	Perceived severity	Days 6 & 7 (~ 48 hours)

Figure 1. VMS prior to school zone showing one of the messages

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