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SAFETY EVALUATION OF A BLACK SPOT TREATMENT PROGRAMME IN FLANDERS

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The treatment of black spots is an important part of the traffic safety policy of many countries. Although a lot of resources are invested, often the effects of these investments are unknown. This study evaluated the traffic safety effect of the black spot program in Flanders, which was measured through a before- and after evaluation of the accident numbers.

METHOD

In 2002, the Flemish Government decided to select the high risk locations in Flanders (Belgium) and adapt their infrastructure. Every location that counted at least three injury accidents during the period 1997-1999 was selected, and subsequently a priority score was calculated based on the number and severity of casualties. The size of these spots varied and was dependent on the extent of the occurrence of the accidents

Priority score = $1 * X + 3 * Y + 5 * Z$

With

X= number of slightly injured persons

Y= number of severely injured persons (any person who was involved in a traffic accident and needed a hospitalization for more than 24 hours)

Z= number of injured persons who died at the location of the accident or within 30 days of the accident

A location was identified as a black spot when its priority score is 15 or more. In total 809 black spots were selected, from which most were intersections. The Flemish Minister of Mobility and Public Works commissioned a first evaluation of the treatment of black spots concerning the effect on traffic safety.

This effect was evaluated through a before- and after analysis of the number of traffic accidents. It is however important to control for other confounding factors that could have had an influence on the occurrence of accidents from the before to the after period, such as other traffic safety measures, the chance effects of the occurrence of accidents and weather circumstances. For this reason, the Empirical Bayes method was used. This method compares the number of accidents after the implementation of a measure, with the expected number had there been no treatment. This 'expected' number is based on the accident frequencies before the treatment with correction for extraneous factors, such as effects of chance in the occurrence of accidents. In order to control for general trend effects, a comparison group was used. It is important that this comparison group is comparable to the research locations for different characteristics (such as lay-out of the intersection, traffic volumes), but differs in that the treatment under evaluation has not been implemented.

DATA

In order to make an evaluation of the traffic safety effect possible, accidents that occurred at and around the black spots were selected. At the time of the study, geo-coded accident data was available from 1996 up until 2008 (Ministry of Mobility and Public Works, Agency of Roads and Traffic). The first black spots were treated in 2004. As the selection of the black spots was based on the accident numbers of 1996-1999, these were excluded from the study, and only accidents starting from 2000 were included. The before period subsequently included at least four years. As accidents were available up until 2008, and at least one year of accidents during the after period is needed, only locations that were treated up until 2007 could be included. This led to a final research group of 134 black spots, which were all intersections. The injury accidents that occurred in a radius of 100 meters around this black spot were included.

The different treatments applied can be categorized in six groups,;

- Traffic lights → conflict-free traffic lights: For 53 locations traffic lights regulated intersections were converted to conflict free lights which lead to a protection of the left turn.
- Traffic lights → traffic lights + changes in lay-out: Fifteen intersections that were traffic light regulated during the before period, mainly got changes in the lay-out. Examples of treatments are: separate turning lanes, the installation of speed cameras, better construction of cycle paths (broader or higher paths, introduction of crossings).
- Traffic lights → roundabout: Five locations were converted from a traffic lights regulated intersection to a roundabout.
- Priority controlled → priority controlled + changes lay-out: 26 locations that were priority controlled during the before period, remained priority controlled, but got a change in the lay-out. Examples are better construction of cycle paths, construction of traffic islands and installation of medians.
- Priority controlled → traffic lights: Nine locations that were previously priority controlled received traffic lights, from which six were conflict free traffic lights.
- Priority controlled → roundabout: Eight priority controlled locations were converted to a roundabout.

Furthermore, there were some treatments that were only applied on a limited number of intersections: 4 intersections from which a road was closed, 3 where a speed ramp was installed, 2 roundabouts that got some changes in the layout. The other 9 locations each got a different treatment, such as changes in one of the turning lanes and the installation of an underpass.

The comparison group included locations that remained unchanged during the period 2000-2008. These locations were comparable to the research locations with respect to road design and traffic characteristics. This group comprised 211 locations, all of them intersections. As a double check, a second comparison group was used. This second comparison group included all injury accidents from 2000-2008 in Flanders.

Furthermore accidents, both in the research as the comparison groups, were subdivided according to their severity. At first all injury accidents were selected Secondly a sub selection of the first group was handled, and only accidents with seriously and fatally injured were included.

RESULTS

To begin with, the overall effect of treatment of the 134 black spots was calculated. This meta-analysis showed a decrease in the number of injury accidents of 24% to 27%, dependent on the comparison group that was used. Previous research also showed favorable effects on traffic accidents, however results were more limited. Elvik & Vaa (2004) carried out a meta-analysis of studies that analyzed the effect of black spot treatment, and only included studies that controlled for confounding variables. They generally found a decrease in the number of accidents of 17%. A more recent study that analyzed the effect of treatment of 150 black spots in Australia, found a decrease of 15% in the number of accidents (Meuleners et al., 2008).

The analyses that used comparison group 1 and 2 as a control for trend, showed a decrease in the number of severely and fatally injured of respectively 40% and 52%.

Additional to the overall effect, it was also examined whether differences could be determined according to the characteristics of the location. Seven variables were analyzed: localization inside/outside the urban area, priority

score, type of treatment, and number of lanes, maximum speed limit and traffic volume at the main road. The road with the highest road category and/or the highest traffic volume was selected as the main road.

A first variable that showed a significant influence on the effect was the priority score of the black spot. It was found that locations that had a higher priority score showed a higher decrease in the number of injury accidents compared to locations with a lower score. Consequently the black spot program had a favorable effect on the most dangerous locations in particular.

Secondly, locations with a speed limit of 70km/h on the main road performed better than locations with a speed limit of 90 km/h.

Thirdly, the best results were found for locations that were previously priority controlled and only got some changes in the lay-out of intersection. These locations performed better compared to priority controlled intersections that were converted into a roundabout. But on the other hand these did not differ significantly from priority controlled locations that received traffic lights.

No significant differences were found according to the type of conversion at locations that were previously traffic light regulated.

Next to analyses on the accident level, it was also examined whether there was a difference in the number of injured road users. The number of injured persons before were compared with the number of casualties after. Trend was controlled through the analysis of the casualty numbers in comparison group 1, which included the locations that were treated after 2008. For every road user, that is car driver and passengers, moped rider, cyclist, motorcyclist, pedestrian and truck driver, a higher decrease was found in the research group compared to the comparison group.

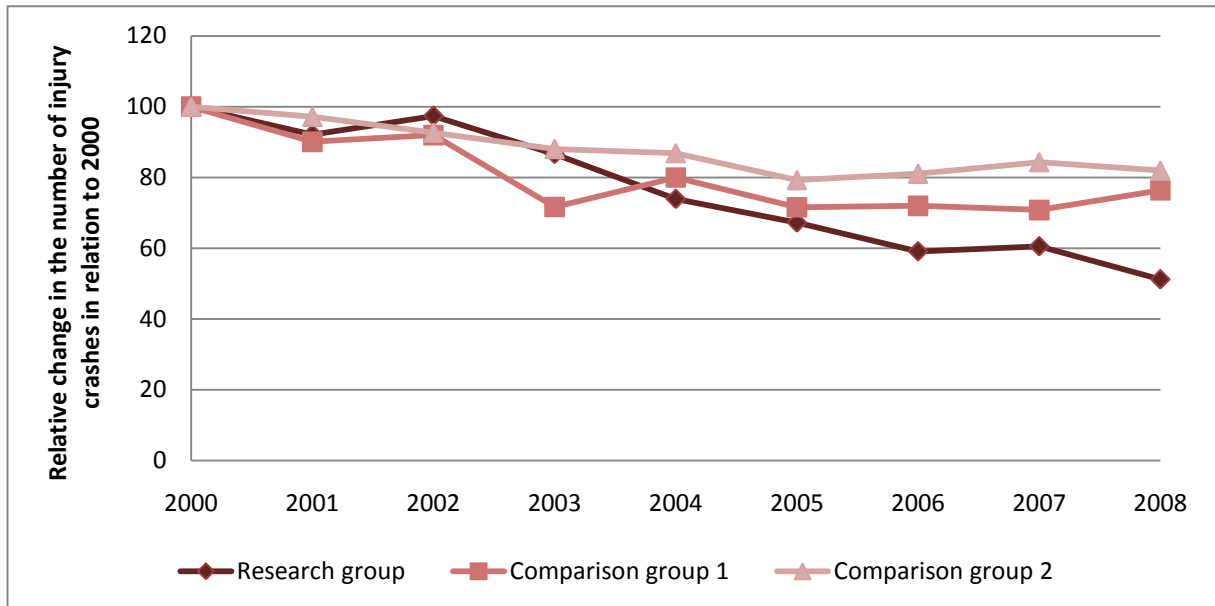
CONCLUSION

It can be concluded that the treatment of black spots has a favorable effect on traffic safety. The number of injury accidents decreased with more than one fourth from before to after, as a result of this measure. The number of severe accidents even decreased to half of the number from the before period. However one should not have blind faith in this measure. It is conceivable that on a certain moment the most dangerous spots will have been handled, and further investment in black spots will not lead to additional benefit in traffic safety. In the case of Flanders it is for example not certain whether the same results will be found when a new selection of black spots based on a new time period would be used. Furthermore a selection of the black spots and the decision of the treatment type should be carried out carefully. For example, priority controlled intersections can have different treatments in order to control traffic flows, such as the installation of traffic lights or the conversion to a roundabout. It can be expected that these measures have a strong effect on traffic safety. On the contrary, intersections with traffic lights are already highly controlled, and possible changes are limited, which will subsequently be less effective.

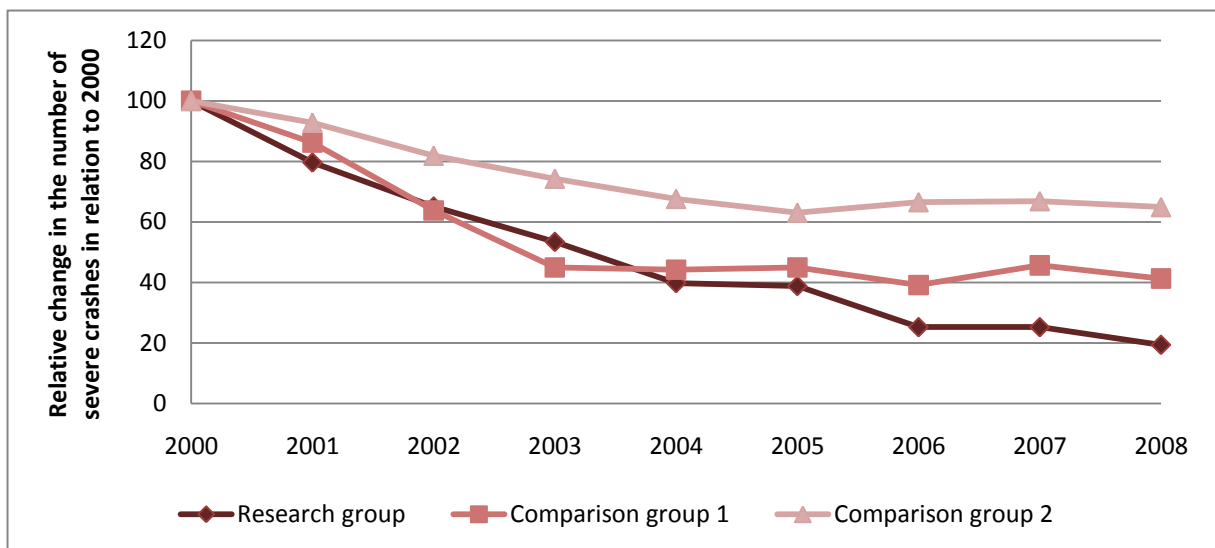
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Meuleners, L. B., Hendrie, D., Lee, A. H., & Legge, M. (2008). Effectiveness of the black spot programs in Western Australia. *Accident Analysis & Prevention*, 40(3), 1211–1216.



Graph 1: Evolution in number of injury accidents throughout 2000-2008



Graph 2: Evolution in number of the severe accidents throughout 2000-2008