Effectiveness of Road Safety Campaigns

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Please note: The studies included in this synopses were selected from those identified by a systematic literature search of specific databases (see supporting document). The main criterion for inclusion of studies in this synopsis and the DSS was that each study provides a *quantitative effect estimate*, preferably on the number or severity of crashes or otherwise on road user behaviour that is known to be related to the occurrence or severity of a crash. Therefore, key studies providing qualitative information might not be included in this synopsis.

1 Summary

Kaiser, S. & Aigner-Breuss, E., June 2017

1.1 COLOUR CODE: LIGHT GREEN

There is some indication that campaigns are beneficial for road safety on various levels. Meta-analyses show an association with accident reduction, increased safe behaviours and risk awareness. However, for other outcome variables such as drink-driving or safety relevant attitudes, no such effect was found. Furthermore, meta-analysed studies vary strongly, mainly regarding the design of the evaluated campaigns.

1.2 KEYWORDS

Road safety campaign, awareness raising, campaign effectiveness, campaign evaluation

1.3 ABSTRACT

Road safety communication campaigns aim at informing, persuading and motivating people to change attitudes and behaviour, and ultimately at improving road safety. Two meta-analyses on campaigns with various road safety themes showed an association with a reduction of accident occurrence (9%) as well as a favourable change in (observed and self-reported) seat belt use (+25%), yielding behaviour (+37%), speeding behaviour (-16%) and risk comprehension (+16%). Although drink-driving behaviour was found to be reduced by 17%, this result was not significant. Also, no significant changes were found for favourable road safety attitudes and knowledge. Often, when road safety campaigns are implemented, they are accompanied by increased enforcement. Accounting for this factor, a decrease in accidents can still be found in a meta-analysis due to campaigns solely, however, the effect was smaller (10% vs. 13% for campaigns combined with enforcement).

1.4 BACKGROUND

From 2006 to 2009, the EU Project CAST "Campaigns and Awareness-Raising Strategies in Traffic Safety" was carried out by 19 partners from 15 European countries. This project identified essential parameters of campaigns and was aimed at enhancing the effectiveness of communication strategies in road safety (Delhomme et al., 2009).

How is 'campaign' as a road safety measure defined?

The EU project CAST provides the following definition of campaigns in the field of road safety: "Road safety communication campaigns can be defined as purposeful attempts to inform, persuade, or motivate people in view of changing their beliefs and/or behaviour in order to improve road safety as a whole or in a specific, well-defined large audience, typically within a given time period by means of organised communication activities involving specific media channels often combined with interpersonal support and/or supportive actions such as enforcement, education, legislation, enhancing personal commitment, rewards, etc." (Elliott, 1993, Rice & Atkin, 1994, Vaa et al., 2008, as cited in Delhomme et al., 2009). While this is an accepted definition, it has to be noted that the combination of campaigns with e.g. enforcement makes it difficult to assess the effectiveness of the campaign as a single measure.

Effectiveness of Road Safety Campaigns

When designing a campaign it is crucial to follow these main steps:

- Define specific road safety problem
- Define target audience
- Define message and communication strategy

The media to transport the message are manifold and have to be tailored to the target group. Commonly used channels are broadcastings on TV, radio, newspaper, posters, leaflets, billboards, internet advertisement and social media.

How do campaigns affect road safety?

Campaigns target the following aims, as Delhomme et al. (2009, p. 17) point out:
"(1) to provide information about new or modified laws.
(2) to improve knowledge and/or awareness of new in-vehicle systems, risks, etc., and the appropriate preventive behaviours.
(3) to change underlying factors known to influence road-user behaviour.
(4) to modify problem behaviours or maintain safety-conscious behaviours.
(5) to decrease the frequency and severity of accidents."

So the effect of a campaign can be increased information, knowledge, raised awareness, changed attitude, and changed behaviour to the extent that eventually the frequency of accidents is reduced. However, since accident occurrence is multicausal and highly influenced by chance there is rarely a direct link from a campaign to accident reduction. Campaigns influence the "mediators" in cognition of humans, which are knowledge, awareness, and attitudes. Many campaigns are combined with enforcement and new legislation. It is difficult to attribute the effect to a single element of this combination. Campaigns can also be used to establish favourable preconditions in the public for new legislation.

Which factors influence the effect of a campaign on road safety and which are the modifying conditions?

Important factors for an effective campaign are clearly defined road safety problems and target groups, as well as a corresponding tailored message. Furthermore, it is necessary to use theoretical psychological models that explain the risk behaviour or safety problem (Delhomme et al., 2009). These models help to define the campaign's aim, the campaign strategy and message. It is important to note that communication has to be based on the cultural codes used in the target community (national, regional, sub-groups etc.). That means that a promising campaign might not be as effective in another cultural setting if it is not adapted to its audience. A controversial issue when designing a campaign message is whether or not fear-based information is effective. While this kind of approach was used widely in the past, more recent research indicates that information campaigns that focus on positive consequences are more effective, especially among males and young groups, than confronting campaigns (SWOV, 2015). Other influencing factors are the duration and intensity of a campaign. Also, other situational factors such as simultaneous competing events (e.g. tragic accident reported in media) can have an impact on the campaign effects.

How is the effect of a campaign on road safety measured?

The following measures are used to assess the effectiveness of campaigns:

- Accident occurrence
- Observed behaviour such as seat belt usage, mean speed, headway distance etc.
- Behaviour and intended behaviour reported in questionnaires and interviews

- Attitudes, opinions, norms, knowledge, behavioural beliefs, risk perception reported in questionnaires and interviews
- Observations of other road users reported in questionnaires and interviews

The vast majority of studies in this field apply a before-after design to measure the campaign effect. In a few cases, the effects are put into the context of accident statistics since crashes are multicausal events.

1.5 OVERVIEW OF RESULTS

Two meta-analyses (Phillips et al., 2009 and 2011) calculated the effect of road safety campaigns in general and for various additional campaign themes such as drink-driving or speeding.
Phillips et al. (2011) reported an overall decrease of crashes of 9% as well as 8% for injury crashes and 11% (non-significant) for fatal crashes. Differentiating by theme, especially drink-driving campaigns seem associated with accident reduction (see also synopsis 'Awareness raising and campaigns – Driving under the influence') while speeding campaigns did not lead to a significant change. Regarding (observed and self-reported) behavioural changes Phillips et al. (2009) report a significant increase in seat belt usage (25%) and yielding behaviour (37%) as well as a 16% significant reduction in speeding. Drink-driving behaviour was found to be reduced by 17%, not significantly, however. Also risk comprehension was found to be positively influenced (16% increase), while no impact was observed for favourable road safety attitudes and knowledge.
Only Phillips et al. (2011) made a further differentiation between campaigns which were accompanied by increased enforcement activities and campaigns solely. Both groups resulted in a significant reduction of accidents. However, the decrease is higher for campaigns combined with enforcement (13% vs. 10%).

It should to be noted, that the individual studies which were considered in the two meta-analyses vary tremendously in terms of campaign specifics (exact activities, media, length, target group, underlying theoretical model as foundation for design etc.) and the provided figures serve as an approximation (Phillips et al., 2009).

2 Scientific overview

2.1 THEORETICAL BACKGROUND

Aim and methods of awareness raising measures and campaigns

The main purpose of awareness raising measures and communication campaigns is to encourage road users to engage in safe behaviour in traffic. The underlying concept of campaigns in road safety is social marketing.

Social marketing is defined as "the use of marketing principles and techniques to influence a target audience to voluntarily accept, modify or quit behaviour for the benefit of individuals, groups or society as a whole, and marketing strategy factors which includes marketing mix" (Kotler et al, 2002, as cited in Delhomme et al., 2009, p. 87). Social marketing aims at influencing and changing social behaviours, which are in the interest of a target audience or of the society as a whole. That is the case if e.g. a campaign promotes the idea that drink-driving is against the social norm of the peer group.

Social marketing can also be targeted at raising knowledge and changing attitudes respectively in order to influence the behaviour (Delhomme et al., 2009). As an example, campaigns can inform a target group about the correct behaviour like the correct use of child restraints.

When developing a campaign, it is crucial to conduct a detailed analysis of the **road safety problem** that is targeted and to clearly identify the **target group** of the campaign. It is less effective to spread information all over the public. Segmentation of the audience means focusing on those who show the problematic behaviour. This can be done by means of statistics, databases, observations and surveys.

For developing the **campaign's message**, it is also necessary to know as much as possible about the target group. What are the deficits in knowledge? Is there a lack of awareness of the problem? Are the people not able to resist the problem behaviour? Why? Is it a planned behaviour or is it a habit? What could motivate the target group to adapt their behaviour? In this respect, theoretical models are very helpful: their use for the development of the campaign message has been found to increase the effectiveness of campaigns (Delany et al., 2004). There are several psycho-social theories, which are applied to explain road user behaviour. For evidenced-based campaigns the following models are most often used (Robertson & Pashley, 2015):

- Theory of planned behaviour (TPB)
- Health belief model
- Protective motivation theory
- Transtheoretical model of chance
- Social norms theory
- Elaboration likelihood model

A description of these models can be found in SafetyCube's Deliverable 4.2 (Theofilatos et al., 2017).

Besides developing the message, the **campaign strategy** has to be defined. Campaigns may use an information approach or use emotions, especially fear to draw the target audience's attention to the message. There are still controversial discussions on this topic (see e.g. Castillo-Manzano et al., 2012). Phillips et al. (2011) analysed road safety campaigns in 12 countries from the years 1975 to 2007. The authors found weak methodologies and therefore could not draw conclusions on whether fear appeals should be used or not. More studies with robust methodologies are needed.

To evaluate whether or not the message of the campaign can influence the behaviour of the target group as intended, a **pre-test of message** and slogan should be conducted before the campaign is finalised and released (Delhomme et al., 2009, Hoekstra & Wegman, 2011).

The following **types of media** are generally used for road safety campaigns: television, radio, newspaper/magazines, cinema, web/online, social media, billboards, flyers/leaflets/posters, message signs and events involving face to face communications. An overview of the advantages and disadvantages of different types of media for road safety campaigns can be found in Delhomme et al. (2009).

Campaign effects and influencing factors

Awareness raising activities and campaigns can positively influence a number of road safety relevant constructs such as favourable attitudes, knowledge and perceptions as well as safe behaviour and therefore, also accident rates. However, there are various factors to be considered to maximise impact.

Phillips et al. (2011) carried out a meta-regression (model of predictor variables) based on 119 individual campaign effects to identify the relative importance of factors influencing the effectiveness of road safety campaigns. They identified the following factors of campaigns to be associated with accident reduction:

- Personal communication
- Road side delivery (billboards, message signs)
- Drink-driving theme
- Combination with enforcement
- Short campaign duration (0-29 days)

Vaa et al. (2004) conducted a meta-regression considering various outcome variables, not only accident reduction (e.g. self-reported behaviour or attitudes) and found the same factors to be beneficially influencing campaign outcomes.

Snyder & Hamilton (2004) discuss the impact of the factor 'behavioural baseline' on health campaign outcomes. If a favourable behaviour such as seat belt wearing is already widespread, the impact of a campaign will obviously be diminished. But having very few people engaging in a certain behaviour can also be disadvantageous as a starting point for a campaign, since there are not enough role models in the target group yet. Thus, in general a moderate baseline rate leads to the highest impact.

Limitations of campaigns and challenges of evaluation

In the past, evaluations of campaigns were rarely carried out for various reasons. For one, sometimes there is a lack of awareness regarding the benefit of evaluating, or there may be budget and time constraints. Uncertainties in terms of methodological application are also a barrier ("How can I clearly see and measure if this effect was created by the campaign?"). However, by understanding the mechanisms of certain attitudes and behaviours and describing them by psychological theories (see above), it is feasible to define measurable dimensions.

As previously described, the effectiveness of road safety campaigns can be measured by various means. The ultimate outcome measure is a reduction in crashes. It is difficult though to link an accident reduction to a campaign, while controlling for all other possible contributing factors. The defined outcome measures to account for campaign effects are therefore often 'indirect' like intended behaviour or attitudes etc. Even though there is evidence concerning the influence of these constructs on actual behaviour, there are also always other determining factors (e.g. situational factors) that cannot be accounted for.

A before-after-design ideally includes a meaningful reference group to control for confounding factors (e.g. a similar geographical region where there is no exposure to the contents of the campaign), which is however rarely the case.

Next to a lack of (systematical and valid) evaluation of effects, often, campaigns are combined or conducted simultaneously with enforcement measures and implementation of new legislation respectively. If an effect (improvement) is measured then, it remains unclear to which of the single

components it is attributable, and to what extent. Furthermore, even though research indicates a generally positive effect of an additional enforcement strategy on road safety, this might not be the case for specific topics such as speeding (Hoekstra & Wegmann, 2012).

2.2 CODED STUDIES

The literature search was carried out in three databases (Scopus, TRID and a KFV-internal literature database) with separate search strategies (for a detailed description see the section "Supporting documents"). Additionally, a free web-based search was conducted via Google.
Below, first information on the characteristics of coded studies is given and subsequently the main research methods used for evaluating campaigns and awareness raising measures is provided.

Description of studies

There is only a very small number of meta-analyses on the effectiveness of road safety campaigns. The most recent meta-analysis using accidents as outcome variable was published in 2011. Phillips et al. (2011) investigated 67 studies on road safety campaigns from 12 different countries over the time period 1975 to 2007 and extracted 119 estimates. They allowed for publication bias and heterogeneity of effects and then found a weighted average effect of road safety campaigns of 9% in accident reduction (with 95% confidence that the weighted average is between –12 and –6%)". In order to better understand the variability of results the authors collected information on campaign characteristics and evaluation design associated with each effect. A model of seven campaign factors was developed and tested by a meta-regression (e.g. theme of the campaign, nature of campaign message and how message was delivered, if there was a pre-test with a sample of the target group and if a psychological/social marketing model was used). After having identified this list of possible contributors, the factors were inspected by statistical analyses.
Phillips et al. (2011) state that the meta-analysis of "119 individual estimates of the effect of campaigns on accidents using a fixed-effect model gave a combined estimate" (p. 1210). To characterise the campaigns, subgroups were analysed.
The authors reported that it was difficult to find studies dated after 2000 and a "thorough search failed to find any campaign evaluations based on accident effects that were published between 2008 and 2010". Furthermore, "according to a fixed effects (regression) model, a drink–drive theme, shorter campaign duration (<30 d), use of personal communication, roadside delivery, and enforcement are each uniquely associated with greater accident reductions" (p.1213).

Phillips et al. (2009) focused the meta-analysis on various outcome measures and road safety themes (e.g. seat belt use, speeding, drink-driving, yielding to pedestrians, attitudes, risk comprehension and knowledge) including 437 individual campaign effects from the last 30 years in 14 countries. Weighted average effects were calculated after accounting for publication bias. 202 campaign effects were taken from campaigns accompanied by increased enforcement. More than half of the studies did not employ a control group.

Table 1: Information on sample and design of coded meta-analyses, sorted by authors

Author(s), year, country	Measure description	Evaluation design	Research conditions
Phillips et.al, 2009, international	Road safety campaigns in 14 countries in the last 30 years; campaign media: TV, radio, newspaper, leaflet, posters, cinema, billboard, personal communication, website, variable and fixed message signs	Meta-analysis of 180 studies	A weighted average was calculated from 437 individual campaign effects.

Author(s), year, country	Measure description	Evaluation design	Research conditions
Phillips et.al, 2011, international	Road safety campaigns in 12 countries (1975-2007), campaign media: TV, radio, newspaper, leaflet, cinema, billboard, personal communication	Meta-analysis of 67 studies	A weighted average was calculated from 119 individual campaign effects.

Description of the main research methods

The two coded meta-analyses mainly comprised studies with a before-after design with various outcome variables. While Phillips et al. (2011) focused on crashes (all, fatal and injury), Phillips et al. (2009) also considered observed and self-reported road safety behaviour. Most of the evaluation studies included a control group. Both meta-analyses were adjusted for publication bias and used weighted average effects.

2.3 OVERVIEW OF RESULTS

The following table presents information on the main outcomes of the coded studies (Table 2). A description of coded studies on the topics fatigue, visibility and protective clothing as well as helmets can be found in the section "Supporting Documents" together with the corresponding main results.

Table 2: Summary of meta-analyses results

Author(s), year, country	Exposure variable	Dependant / outcome type	Effects on road safety		Main outcome – description
Phillips et.al, 2009, inter-national	Road safety campaigns on seat belt use	Seat belt use (observed, 119 effects and self-reported, 14 effects)	↗	Percent change = 0.25 CL: 95%, CI: 0.18 - 0.31	Road safety campaigns on seat belt use are linked to a significant 25% increase of seat belt usage.
	Road safety campaigns on speeding	Speeding (observed, 21 effects and self-reported, 7 effects)	↗	Percent change = -0.16 CL: 95%, CI: -0.25 - -0.06	Road safety campaigns on speeding are linked to a significant 16% decrease in speeding behaviour.
	Road safety campaigns on drink-driving	Drink-driving (observed, 4 effects and self-reported, 19 effects)	–	Percent change = -0.17 CL: 95%, CI: -0.46 - 0.28	Road safety campaigns on drink-driving are linked to a non-significant 17% decrease of drink driving behaviour.
	Road safety campaigns on considerate behaviour	Yielding to pedestrians (observed, 11 effects and self-reported, 2 effects)	↗	Percent change = 0.37 CL: 95%, CI: 0.14 - 0.65	Road safety campaigns on considerate behaviour are linked to a significant 37% increase of yielding to pedestrians.
	Road safety campaigns	Favourable road safety attitudes (self-reported, 39	–	Percent change = 0.05 CL: 95%, CI: 0.00 - 0.11	Road safety campaigns are linked to a non-significant 5% increase of favourable road safety attitudes.

		effects)			
		Risk comprehension (self-reported, 24 effects)	↗	Percent change = 0.16 CL: 95%, CI: 0.04 - 0.30	Road safety campaigns are linked to a significant 16% increase of risk comprehension.
		Knowledge (self-reported, 17 effects)	–	Percent change = 0.44 CL: 95%, CI: -0.10 - 1.32	Road safety campaigns are linked to a non-significant 44% increase of road safety knowledge.
Phillips et al., 2011, inter-national	Road safety campaigns	Crashes	↗	Percent accident reduction=0.09 CL: 95%, CI: 0.12 - 0.06	Road safety campaigns are linked to a significant 9% accident reduction.
		Injury Crashes	↗	Percent accident reduction = 0.08 CL: 95%, CI: 0.13-0.02	Road safety campaigns are linked to a significant 8% injury accident reduction.
		Fatal Crashes	–	Percent accident reduction = 0.11 CL: 95%, CI: 0.22 - -0.01	Road safety campaigns are linked to a non-significant 11% fatal accident reduction.
	General road safety campaigns on mixed topics	Crashes	↗	Percent accident reduction = 0.14 CL: 95%, CI: 0.25 - 0.01	General road safety campaigns on mixed topics are linked to a significant 14% accident reduction.
	Road safety campaigns on speeding	Crashes	–	Percent accident reduction = 0.04 CL: 95%, CI: 0.10 - -0.01	Road safety campaigns on speeding are linked to a non-significant 4% accident reduction.
	Road safety campaigns on drink driving	Crashes	↗	Percent accident reduction = 0.18 CL: 95%, CI: 0.23 - 0.12	Road safety campaigns on drink driving are linked to a significant 18% accident reduction.
	Road safety campaigns on other topics	Crashes	↗	Percent accident reduction = 0.07 CL: 95%, CI: 0.12 - 0.01	Road safety campaigns on other topics are linked to a significant 7% accident reduction.
	Road safety campaigns with enforcement	Crashes	↗	Percent accident reduction = 0.13 CL: 95%, CI: 0.16 - 0.09	Road safety campaigns with enforcement are linked to a significant 13% accident reduction.
	Road safety campaigns without	Crashes	↗	Percent accident reduction = 0.10	Road safety campaigns without enforcement are linked to a significant 10% accident reduction.

	enforcement			CL: 95%, CI: 0.16 - 0.03	
	Road safety campaigns with law changes	Crashes	–	Percent accident reduction = 0.09 CL: 95%, CI: 0.17 - 0.00	Road safety campaigns with law changes are linked to a non-significant 9% accident reduction.
	Road safety campaigns without law changes	Crashes	↗	Percent accident reduction = 0.12 CL: 95%, CI: 0.16 - 0.07	Road safety campaigns without law changes are linked to a significant 12% accident reduction.

*Effects on road safety are coded as significant positive (↗), significant negative (↘) or non-significant (–).

Phillips et al. (2009, 2011) analysed the overall effect of road safety campaigns – with additional effect calculations for various campaign themes e.g. drink-driving, speeding. They thereby considered the results of previous meta-analyses.
Phillips et al. (2011) reported an overall decrease of crashes of 9% as well as 8% for injury crashes and 11% for fatal crashes. The latter however was not significant. Considering different campaign themes it proved that especially drink-driving campaigns are yielding effects. Whereas, campaigns with a drink-driving theme resulted in a significant accident reduction (18%) anti-speeding campaigns led to no significant change.

Regarding behavioural changes, Phillips et al. (2009) reported a significant increase in seat belt usage (25%) and yielding behaviour (37%) as well as a 16% significant reduction in speeding. However, no significant change in drink-driving behaviour was found. It should be noted that behavioural outcomes refer to observed and self-reported behaviour.
Road safety campaigns also positively influence risk comprehension (16% increase), while no impact was found for favourable road safety attitudes and knowledge.

It is important to consider that both meta-analyses calculated effects of campaigns with and without enforcement components. Phillips et al. (2011) reported results adjusted for accompanied enforcement measures. The reduction for campaigns accompanied by enforcement is higher (13%) than campaigns only (10%). Both effects are significant, though.

Modifying Conditions

Phillips et al. (2011) carried out a meta-regression (model of predictor variables) based on 119 individual campaign effects to identify the relative importance of factors influencing the effectiveness of road safety campaigns. They identified the following factors of campaigns to uniquely be associated with accident reduction:

- Personal communication
- Road side delivery (billboards, message signs)
- Combination with enforcement
- Short campaign duration (0-29 days)

Phillips et al. (2009) outlined conclusions on a meta-regression by Vaa et al. (2004). They considered various outcome variables, not only accident reduction (e.g. self-reported behaviour or attitudes) and found the same factors as listed above to be beneficially influencing campaign outcomes.

2.4 CONCLUSION

There is some indication that campaigns are beneficial for road safety on various levels. Meta-analyses show an association with accident reduction, increased safe behaviours and risk awareness. However, for other outcome measures such as drink-driving behaviour or safety relevant attitudes, no such effect was found. Furthermore, meta-analysed studies vary strongly. Accounting for the factor that campaigns are often combined with enforcement activities, there is still a decrease in accidents, however, a smaller one.

Biases and transferability

Most campaign evaluations included in the meta-analyses were carried out soon after the campaign ended. Hardly any long-term effects are available. Therefore, sustainable changes in behaviour due to campaigns remain unclear. Meta-analysed studies were quite different regarding exposure variables (different aims and means of campaigns).

Studies reporting on campaigns supported by enforcement activities were included in the meta-analyses. Only for the overall crash reduction was a differentiation between combined measures and campaign only made. For most other reported outcomes, only the combined effects of campaigns and enforcement are known.

The authors themselves urge that the results are interpreted with caution, since the set of individual effects vary considerably. Furthermore, it was not possible to control for quality in terms of measurement accuracy, specificity of effect, regression to the mean or accident migration of single studies (Phillips et al., 2011).

3 Supporting documents

3.1 LITERATURE SEARCH STRATEGY

This synopsis deals with the effectiveness of road safety campaigns in general. Campaigns for specific topics such as speeding are documented in separate synopses. However, for the topics of fatigue, distraction, visibility, protective clothing and helmets the number of codable studies was not sufficient for a stand-alone synopsis. Therefore, the identified studies are included and documented at this point – subsequent to the section 'general'.

3.1.1 Campaigns in general

The literature search was conducted in December 2016 and carried out in the following three databases:

- Scopus: a large abstract and citation database of peer-reviewed literature
- TRID: a large online bibliographic database of transportation research
- DOK-DAT: KFV-internal literature database

Database: Scopus **Date:** 16th of December 2016

No.	search terms, logical operators, combined queries	Hits
#1	"Campaign" OR "safety Campaign" OR "awareness" OR "public information"	248,963
#2	"road safety" OR "traffic safety"	12,033
#3	#1 AND #2	697
#4	Limited to Europe, Russia, USA, Canada, Australia and New Zealand	**436**

Table 3: Used search terms, logical operators, and combined queries of literature search (Scopus).

Detailed search terms, as well as their linkage with logical operators and combined queries are shown in table above. Using search fields title, abstract and keywords (TITLE-ABS-KEY), and a general limitation to studies which were published from 2006 to current, led to 697 studies.
In a further reduction step results were limited to European countries, as well as Russia, USA, Canada, Australia and New Zealand. This led to a final sample of 436 studies of literature search in database Scopus (Table 3).

Database: DOK-DAT **Date:** 7th of December 2016

Search no.	Search terms, operators, combined queries	Hits
#1	"Werbung" (advertisement) AND "Sicherheit" (safety)	467
#2 (within #1)	"Wirksamkeit*" (effectiveness) OR "Evalu*" (evaluation) OR "Bewertung*" (assessment)	278

Table 4: Used search terms, logical operators, and combined queries of literature search (DOK-DAT).

German search fields 'Titel', 'ITRD Schlagworte' and 'freie Schlagworte' were used. Hits were only limited to the years 1990 to 2016 and got 278 more potential studies (Table 4).

Database: TRID **Date:** 20th of December 2016

Search no.	Search terms, operators, combined queries	Hits
#1	"safety" AND "campaign" AND "evaluation"	240

Table 5: Used search terms, logical operators, and combined queries of literature search (TRID).

Search terms were "safety", "campaigns" and "evaluation". Hits were limited to the years 2000 to 2016 and got 240 potential studies with various campaign themes.

Results Literature Search

Database	Hits
Scopus (remaining papers after several limitations/exclusions)	436
DOK-DAT	278
TRID database	240
Total number of studies to screen title/ abstract	**954**

Table 6: Results of databases and free search after limitations

In all, the literature search lead to 954 potential studies for screening.

Screening

Total number of studies to screen title/ abstract	**954**
Exclusion criteria: no campaign/evaluation or topic not or not sufficiently covered or duplicates	925
Studies to obtain full-texts	**29**

Table 7: Screening of abstracts

After screening the titles and abstracts 29 studies remained for screening the full-text.

Total number of studies to screen full-text	**29**
Full-text could be obtained	29
Reference list examined Y/N	Partly
Eligible papers	**29**

Table 8: Papers obtained for full-text screening

Screening of the full texts

Total number of studies to screen full paper	29
Studies covered by another topic	3
Studies excluded because no evaluation or quantitative effects reported	9
Studies covered by meta-analysis	7
Not relevant	8
Remaining studies	**2**

Table 9: Screening of full-texts

Studies are presented by author's name; meta-analyses are mentioned first.

No.	Publication	Coded Yes/No	Reason
1.	Delaney, A., Lough, B., Whelan, M. & Cameron, M. (2004). A Review of Mass Media Campaigns in Road Safety. Victoria: Monash University, Accident Research Centre.	N	Study covered in a meta-analysis
2.	Elliott, B. (1993). Road Safety Mass Media Campaigns: A Meta Analysis. Federal Office of Road Safety, Canberra (CR 118).	N	Study covered in a more recent meta-analysis
3.	Phillips, R.O., Ulleberg, P. & Vaa, T. (2009). Do road safety campaigns work? A meta-analysis of road safety campaign effects. In: Forward, S. & Kazemi, A., 2009. A theoretical approach to assess road safety campaigns. Evidence from seven European countries. 25-45.	Y	
4.	Phillips, R.O., Ulleberg, P. & Vaa, T. (2011). Meta-analysis of the effect of road safety campaigns on accidents. Accident Analysis and Prevention 43, 1204-1218.	Y	
5.	Adamos, G., Nathanail, E., & Kapetanopoulou, P. (2012). Does the theme of a road safety communication campaign affect its success? Transport and Telecommunication 13(4), 294–302.	N	Study coded within another synopsis
6.	Backer, T., Rogers, E. & Sopory, P. (1992). Designing Health Communication Campaigns: What Works. Sage: Newbury Park.	N	No evaluation or quantitative effects reported
7.	Carey, R.N. & Sarma, K.M. (2016). Threat appeals in health communication: Messages that elicit fear and enhance perceived efficacy positively impact on young male drivers. BMC Public Health 16(1).	N	Thematically not relevant
8.	Castillo-Manzano, J.I., Castro-Nuno, M. & Pedregal, D.J. (2012). How many lives can bloody and shocking road safety advertising save? The case of Spain. Transportation Research Part F 15(2), 174-187.	N	Thematically not relevant
9.	Delhomme, P. (2002). Some Criteria for Running Successful Campaigns. PRI Road Safety Forum 2002. PRI. Lisbon. A summary of the findings from the GADGET project.	N	No evaluation or quantitative effects reported
10.	Delhomme, P., Vaa, T., Meyer, T., Goldenbeld, C., Jaermark, S., Christie, N. & Rehnova, V. (1999). Deliverable 4: Evaluation of road safety media campaigns:	N	Study covered in a meta-analysis

No.	Publication	Coded Yes/No	Reason
	An overview of 265 evaluated campaigns and some meta-analysis on accident. GADGET project contract no. RO-97-SC. 2235.		
11.	Elvik, R., Hoye, A., Vaa, T. & Sorensen, M. (2009). The handbook of road safety measures. 2nd Ed. Bingley: Emerald Group Publishing.	N	Relevant effects covered in a meta-analysis
12.	Fry, T.R.L. (1996). Advertising wearout in the Transport Accident Commission road safety campaigns. Accident Analysis & Prevention 28(1), 123-129.	N	Thematically not relevant
13.	Haid, K. (2002). Opportunities and limitations in road safety information. A literature study. On behalf of the Swedish Road Administration. Vienna: Austrian Road Safety Board.	N	No evaluation or quantitative effects reported
14.	Hoekstra, T. Wegman, F. (2011). Improving the effectiveness of road safety campaigns: Current and new practices, IATSS Research, 34 (2), 80–86.	N	No evaluation or quantitative effects reported
15.	Hutchinson, T.P. & Wundersitz, L.N. (2011). Road safety media campaigns: Why are the results inconclusive and what can be done? International Journal of Injury Control and Safety Promotion 18(3), 235-241.	N	No evaluation or quantitative effects reported
16.	Johnston, R. & Brady, H.E. (2006). Capturing campaign effects. The University of Michigan Press.	N	Thematically not relevant
17.	Kuratorium für Verkehrssicherheit (1992). 5 Jahre Aktion 'Minus 10%' in Österreich. Wien: Kuratorium für Verkehrssicherheit	N	Thematically not relevant
18.	Robertson, R.D. & Pashley, C.R. (2015). Road Safety Campaigns. What the research tells us. TIRF. http://tirf.ca/wp-content/uploads/2017/01/2015_RoadSafetyCampaigns_Report_2.pdf	N	No evaluation or quantitative effects reported
19.	Rohrmann, B. (1992). The evaluation of risk communication effectiveness. Acta Psychologica 81(2), 169-192.	N	Thematically not relevant
20.	Sävenhed, H., Brüde, U., Nygaard, B., Petterson, H.-E. & Thulin, H. (1996). Heja Halland. Utvärdering av en trafiksäkerhetskampanj. (Heja Halland. An evaluation of a traffic safety campaign). VTI Meddelande 779, Linköping.	N	Study covered in a meta-analysis
21.	Segui-Gomez, M., Lopez-Valdes, F.J., Tsirigoti, A. & Ntinapogias, A. (2008). Message 1: "Be a safe driver" - Message 2: "Be a safe road user." Archives of Hellenic Medicine 25(1), 11–18.	N	Thematically not relevant
22.	Snyder, L.B. & Hamilton, M.A. (2004). A meta-analysis of the effect of mediated health communication campaigns on behavior change in the United States. Journal of Health Communication 9(1), 71-96.	N	Study coded within another synopsis
23.	Vaa, T., Assum, T., Ulleberg, P. & Veisten, K. (2004). Effects of information on behaviour and road accidents: Conditions, evaluation and cost-effectiveness (TØI-report 727/2004). Oslo: Institute of Transport Economics.	N	Study covered in a meta-analysis
24.	Wakefield, M.A., Loken, B. & Hornik, R.C. (2010). Use of mass media campaigns to change health behaviour. The Lancet 376, 1261–1271.	N	No evaluation or quantitative effects reported
25.	Whittam, K.P., Dwyer, W.O., Simpson, P.W. & Leeming, F.C. (2006). Effectiveness of a Media Campaign to Reduce Traffic Crashes Involving Young	N	Study covered in a meta-analysis

No.	Publication	Coded Yes/No	Reason
	Drivers. Journal of Applied Social Psychology 36(3), 614-628.		
26.	Wiik, J., Kopjar, B. & Bulajic-Kopjar, M. (1995). Trends in bicycle-related injuries in Norway, 1990-1993. Does prevention yield effects? In: Van Weperen, W. (Ed.). 3rd International Conference on Product Safety Research. Amsterdam, March 1995	N	Not relevant (too many measures combined)
27.	Wundersitz, L.N., Hutchinson, T.P. & Woolley, J.E. (2010). Best practice in road safety mass media campaigns: A literature review. Centre for Automotive Safety Research. Adelaide, Australia.	N	No evaluation or quantitative effects reported
28.	Wundersitz, L. & Hutchinson, T.P. (2011). What can we learn from recent evaluations of road safety mass media campaigns? Journal of the Australasian College of Road Safety 22(4), 40-50.	N	No evaluation or quantitative effects reported
29.	Zampetti, R., Messina, G., Quercioli, C., Vencia, F., Genco, L., Di Bartolomeo, L. & Nante, N. (2013). Nonfatal road traffic injuries: Can road safety campaigns prevent hazardous behaviour? An Italian experience. Traffic Injury Prevention 14, 261-266.	N	Study coded within another synopsis

3.1.2 Fatigue, distraction, visibility, protective clothing and helmets

The literature search for the topics fatigue, distraction, visibility, protective clothing and helmets was conducted in December 2016. It was carried out in the following three databases:

- Scopus: a large abstract and citation database of peer-reviewed literature
- TRID: a large online bibliographic database of transportation research
- DOK-DAT: a KFV-internal literature database

Database: Scopus **Date:** 16th of December 2016

No.	Search terms, logical operators, combined queries	Fatigue	Distraction	Visibility, protective clothing	Helmets
#1	"Campaign" OR "safety Campaign" OR "awareness" OR "public information"	248,963	248,963	248,963	248,963
#2	"fatigue*" OR "sleep*" OR "tired*" OR "drowsy" OR "drowsiness" OR "alert*" OR "monoton*" OR "mental* fatigue*" OR "mental* tired*", "Sleep disorde*" OR "narcolepsy" OR "apneoa" OR "'apnea" OR "rest" OR "break"	67,572			
	"Distract*" OR "cell phone" OR "mobile phone" OR "smart phone" OR "phone use" OR "text*" OR "navigation" OR "IVIS" OR "handheld" OR "hands-free"		616,048		
	"Protective clothing" OR "cycling" OR "motorcycling" OR "pedestrian" OR "visibility"			144,207	
	"Helmet"				7,188
#3	"road safety" OR "traffic safety"	12,033	12,033	12,033	12,033
#4	#1 AND #2 AND #3	**18**	65	96	**37**

#5	Limit to Europe, Russia, USA, Canada, Australia and New Zealand	-	**52**	**62**	**-**

Table 10: Used search terms, logical operators, and combined queries of literature search (Scopus).

Detailed search terms, as well as their linkage with logical operators and combined queries are shown in the table above. Search fields title, abstract and keywords (TITLE-ABS-KEY) and a general limitation to studies which were published from 2006 to current were used.
In a further reduction step, results were partly limited to European countries, as well as Russia, USA, Canada, Australia and New Zealand. This led to a final sample of 18, 52, 62 and 37 studies, respectively, for the literature search in database Scopus (Table 10).

Database: DOK-DAT **Date:** 7th of December 2016

Search no.	Search terms, operators, combined queries	Hits
#1	"Werbung" (advertisement) AND "Sicherheit" (safety)	467
#2 (within #1)	"Wirksamkeit*" (effectiveness) OR "Evalu*" (evaluation) OR "Bewertung*" (assessment)	278

Table 11: Used search terms, logical operators, and combined queries of literature search (DOK-DAT).

German search fields 'Titel', 'ITRD Schlagworte' and 'freie Schlagworte' were used. Hits were only limited to the years 1990 to 2016 and got 278 more potential studies (Table 11).

Database: TRID **Date:** 20th of December 2016

Search no.	Search terms, operators, combined queries	Hits
#1	"safety" AND "campaign" AND "evaluation"	240

Table 12: Used search terms, logical operators, and combined queries of literature search (TRID).

Search terms were "safety", "campaigns" and "evaluation". Hits were limited to the years 2000 to 2016 and got 240 potential studies with various campaign themes.

Results literature search

Database	Fatigue	Distraction	Visibility, protective clothing	Helmets
Scopus (remaining papers after several limitations/exclusions)	18	52	62	37
DOK-DAT	278	278	278	278
TRID database	240	240	240	240
Total number of studies to screen title/ abstract	**536**	**570**	**580**	**555**

Table 13: Results of databases and free search after limitations

In all, the literature search lead to 536, 570, 580 and 555 potential studies for screening, respectively.

Screening

Total number of studies to screen title/ abstract	Fatigue	Distraction	Visibility, protective clothing	Helmets
	536	**570**	**580**	**555**
Exclusion criteria: no campaign/evaluation or topic not or not sufficiently covered or duplicates	531	566	576	549
Studies to obtain full-texts	**5**	**4**	**4**	**6**

Table 14: Screening of abstracts

After screening the titles and abstracts 31 studies remained for screening the full-text.

Total number of studies to screen full-text	Fatigue	Distraction	Visibility, protective clothing	Helmets
	5	4	4	6
Full-text could be obtained	5	4	4	6
Reference list examined Y/N	1	Partly	Partly	Partly
Eligible papers	**6**	**4**	**4**	**6**

Table 15: Papers obtained for full-text screening

Screening of the full texts

Total number of studies to screen full paper	Fatigue	Distraction	Visibility, protective clothing	Helmets
	6	4	4	6
Studies covered by another topic or measure category		2	1	3
Studies excluded because no evaluation or quantitative effects reported		1	1	2
Effects covered by meta-analysis or other included study	3			
Not relevant	2	1		
Remaining studies	**1**	**0**	**2**	**1**

Table 16: Screening of full texts

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Studies are sorted by authors' names.

No.	Publication	Coded Y/N	Reason
Fatigue			
1.	Adamos, G. & Nathanail, E. (2016). Predicting the effectiveness of road safety campaigns through alternative research designs. *Journal of Safety Research, 59*, 83-95.	N	Included in other study
2.	Adamos, G., Nathanail, E. & Kapetanopoulou, P. (2013). Do road safety communication campaigns work? Transportation Research Record, 2364, 62-70.	Y	
3.	Adamos, G., Nathanail, E. & Kapetanopoulou, P. (2014). Cluster modeling of driving behavior under fatigue Transportation Research Record, 2465, 24-32.	N	Included in other study
4.	Fletcher, A., McCulloch, K., Bault, S.D. & Dawson, D. (2005). Countermeasures to driver fatigue: a review of public awareness campaigns and legal approaches. Australian and New Zealand. *Journal of Public Health, 29(5)*, 471-476.	N	Not relevant, no campaign
5.	Nathanail, E. & Adamos, G. (2010). Impact assessment of a mass media campaign on fatigue. 24th ARRB Conference, Australia, 2010.	N	Included in other study
6.	Popp, R. & Geisler, P. (2015). Daytime sleepiness and road safety: Prevention and countermeasures to sleepiness in sleep medicine. *Somnologie, 19*(3), 171-177.	N	Not relevant, no campaign
Distraction			
1.	Chaudhary, N.K., Casanova-Powell, T.D., Cosgrove, L., Reagan, I., & Williams, A. (2012). Evaluation of NHTSA distracted driving demonstration projects in Connecticut and New York. Report No. DOT HS 811 635. Washington, DC: National Highway Traffic Safety Administration.	N	Focus on enforcement
2.	Cosgrove, L., Chaudhary, N. & Roberts, S. (2010). High Visibility Enforcement Demonstration Programs in Connecticut and New York Reduce Hand-Held Phone Use. Research Note DOT HS 811 376. Washington, DC: National Highway Traffic Safety Administration.	N	Focus on enforcement
3.	Florida Department of Highway Safety and Motor Vehicles (2016). Distracted Driving Campaign Evaluation Report. Retrieved from: https://www.flhsmv.gov/pdf/distracted/distracteddrivingreport_2016.pdf	N	No measures of effectiveness reported
4.	Wandtner, B. (2016). Die Wirkung von Verkehrssicherheitsbotschaften im Fahrsimulator – eine Machbarkeitsstudie. Bericht der Bundesanstalt für Straßenwesen, *Mensch und Sicherheit, M 266*.	N	Other topic, not relevant
Visibility, protective clothing			
1.	Roge, J., El Zufari, V., Vienne, F. & Ndiayne, D. (2015). Safety messages and visibility of vulnerable road users for drivers. *Safety Science, 79*, 29-38.	Y	No measure of effectiveness
2.	Tales of the Road campaign (2011) http://webarchive.nationalarchives.gov.uk/20120606112243/http:/assets.dft.gov.uk/publications/think-research/talesoftheroad-evaluation-2011.pdf	N	No measure of effectiveness
3.	TNS (2014). THINK! Cycling 'Safety Tips' campaign evaluation. Retrieved from http://think.direct.gov.uk/cycling.html	N	Considered within other topic

No.	Publication	Coded Y/N	Reason
4.	UK Department of Transport (2014). THINK! Motorcycle safety campaign 2014 evaluation presentation. Retrieved from https://www.gov.uk/government/publications/think-motorcycle-safety-campaign-2014-evaluation	Y	
Helmets			
1.	Kazemi, A. & Forward, S. (2008). Evaluation of the Swedish Bicycle Helmet Wearing Campaign 2008. In S. Forward & A. Kazemi (Eds.): A theoretical approach to assess road safety campaigns. Evidence from seven European countries, p. 47-72.	N	Focus on education
2.	Farley, C., Laflamme, L. & Vaez, M. (2003). Bicycle helmet campaigns and head injuries among children. Does poverty matter? *Journal of Epidemiol Community Health, 57*, 668-672.	N	Focus on education
3.	Furian, G. & Gruber, M. (1999). Die österreichische Radhelminitiative 1992-1998. Institut SICHER LEBEN, Kuratorium für Schutz und Sicherheit, Wien 1999.	Y	
4.	Hunt, S. (2006). Development of a bike helmet safety program. *Air Medical Journal, 25(5)*, 194-195.	N	No measures of effectiveness
5.	Parkin, P.C., Spence, L.J., Hu, X., Kranz, K.E., Shortt, L.G. & Wesson, D.E. (1993). Evaluation of a Promotional Strategy to Increase Bicycle Helmet Use by Children. *Pediatrics, 91(4)*, 772-777.	N	Focus on education
6.	Wiik, J., Kopjar, B. & Bulajic-Kopjar, M. (1995). Trends in bicycle-related injuries in Norway, 1990-1993. Does prevention yield effects? *International Journal of Consumer Safety, 3*, 67-77.	N	No measures of effectiveness for single measure

3.1.3 Studies on fatigue, visibility and protective clothing and helmets

For some of the topics the number of identified codable studies was not sufficient to draw conclusions and create a separate synopsis. Thus, it was decided to incorporate the study results at this point.

Author(s), year, country	Measure description	Evaluation design	Research conditions
Adamos et al., 2013, Greece	Road safety campaign on fatigue of professional and non-professional drivers (2008, 2009): television spot, a radio spot, leaflets, posters, and insertions in national newspapers	Before-after questionnaire: Before=November 2008 After=June 2009	n before=2,000 n after=996
Department of transport, 2015, UK	Think! Motorcycle campaign to increase visibility of PTW (2014): TV, outdoor posters, radio, online, petrol station, cinema	Before-after questionnaire: Before=September 2014 After=October 2014	n=500 riders

Author(s), year, country	Measure description	Evaluation design	Research conditions
Roge et al., 2015, France	Safety messages concerning the vulnerability of PTW and pedestrians: film	Before-after simulator study, detection task	Randomised sample including control group, n test group=17 n control group=17
Furian & Gruber, 1999, Austria	Cycle helmet campaign (1995-1997): posters, pamphlets, festivals/activities, school programmes, company programmes, retailer actions	Before-after observations of helmet wearing of children, adolescents and adults: Before=1994 After=1998	n before=36,000 n after=22,500

Table 17: Summary of coded study results regarding fatigue, visibility and protective clothing as well as helmet use

Author(s), Year, Country	Exposure variable	Dependant / outcome type	Effects on Road Safety		Main outcome - Description
Adamos et al., 2013, Greece	Fatigue driving campaign	Self-reported behaviour, stop and rest	↗	Kruskal-Wallis test, p=0.003	Significant increase of reported behaviour to stop and rest when tired among non-professional drivers
		Self-reported behaviour, not driving at all	–	Kruskal-Wallis test, p=0.055	No difference between before and after campaign for reported behaviour to not driving at all when tired among non-professional drivers
		Self-reported behaviour, stop and rest	↗	Kruskal-Wallis test, p=0.001	Significant increase in self reported behaviour to stop and rest among professional drivers
		Self-reported behaviour, not driving at all	↙	Kruskal-Wallis test, p<0.001	Significant decrease in self reported behaviour in not driving at all when tired among professional drivers
Department of Transport, 2015, UK	Think! Motorcycle campaign	Self-reported, wearing protective gear	/	Percent change = 0.01	Increase of wearing protective gear of 1% (no test for significance reported)
		Self-reported, wearing bright reflective clothing	/	Percent change = -0.03	Decrease of wearing bright reflective clothing of 3% (no test for significance reported)
Roge et al. 2015, France	Safety message concerning VRU presented via film	Detection of VRU in simulator (visibility distance in meters)	↗	Fischer LSD test, p=0.0002	Significant increased visibility distance of VRU in the test group after watching the film. There is no difference between test and control group after the safety message.
Furian & Gruber, 1999, Austria	Cycle helmet campaign	Helmet wearing rate	↗	Percent change = 0.057	Significant increase of overall helmet wearing rate between 1994 and 1998 by 5.7%
		Helmet wearing rate, children	/	Percent change = 0.236	Increase of children's helmet wearing quote between 1994 and 1998 by 23.6%

Author(s), Year, Country	Exposure variable	Dependant / outcome type	Effects on Road Safety		Main outcome - Description
		Helmet wearing rate, adolescents	/	Percent change = 0.073	Increase of adolescents' helmet wearing quote between 1994 and 1998 by 7.3%
		Helmet wearing rate, adults	/	Percent change = 0.037	Increase of adults' helmet wearing quote between 1994 and 1998 by 3.7%

* Effects on road safety are coded as: significant positive (↗), significant negative (↙), non-significant (–) or no test for significance reported (/)

3.2 REFERENCES

Meta-analyses

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List of additional coded studies (campaigns on fatigue, protective clothing, helmet use)

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