Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 00 (2022) 000–000

Transportation Research Procedia

www.elsevier.com/locate/procedia

Transport Research Arena (TRA) Conference

Effectiveness of real-time and post-trip interventions from the H2020 i-DREAMS naturalistic driving project: A Sneak Preview

Kris Brijs[a]*, Muhammad Adnan[a], Veerle Ross[a], Ariane Cuenen[a], Yves Vanrompay[a], Muhammad Wisal Khattak[a], Christos Katrakazas[b], Eva Michelaraki[b], Ashleigh Filtness[c], Rachel Talbot[c], Graham Hancox[c], Laurie Brown[c], Evita Papazikou[c], Chiara Gruden[d], Geert Wets[a], George Yannis[b], Tom Brijs[a]

[a]*UHasselt, Transportation Research Institute (IMOB), Science Park – Building 5, 3590 - Diepenbeek, Belgium*
[b]*National Technical University of Athens, Dept of Transp Planning and Engineering, 5 Heroon Polytechniou str, 15773 Athens, Greecec*
[c]*Transport Safety Research Centre, School of Design & Creative Arts, Loughborough University, Loughborough, UK*
[d]*University of Maribor, Fac. of Civil Engineering, Transportation Engineering and Architecture, Smetanova ulica 17, 2000 Maribor, Slovenija*

Abstract

This paper addresses the effectiveness of real-time and post-trip interventions from the H2020 i-DREAMS naturalistic driving project. The project aims to setup a framework for the definition, development and validation of a context-aware 'safety tolerance zone (STZ)' for driving. A range of sensors are used to collect a large variety of data, which enables assessment of the STZ, and help designing interventions. Effectiveness evaluation is based on the outcome and process evaluation using the COM-B and RE-AIM frameworks, respectively. Preliminary results for a sample of 27 car drivers from Belgium and 26 car drivers from UK are presented. Overall, the interventions were found effective in improving driving behaviour. UK drivers have performed significantly better, while Belgian car drivers showed mixed results, mainly due to the changing mobility patterns during COVID19 pandemic.

Peer-review under responsibility of the scientific committee of the Transport Research Arena (TRA) Conference
Keywords: i-DREAMS, safety interventions, effectiveness, naturalistic driving

* Corresponding author. Tel.:+32-011-269129
E-mail address: Kris.Brijs@uhasselt.be

2352-1465
Peer-review under responsibility of the scientific committee of the Transport Research Arena (TRA) Conference

1. Background

In the era of digitization, rapid steps in transport automation bring new challenging conditions, transforming the framework of operator/vehicle/environment interactions, and the need for increased understanding of the human factors affecting the behaviour of operators/drivers. At the same time, technology developments make massive and detailed operator performance data easily available (e.g. new in-vehicle sensors that capture detailed driving style and contextual data, increase in the penetration and use of information technologies by drivers, Internet of Things). This creates new opportunities for the detection and design of customized interventions to mitigate the risks, increase awareness and upgrade performance, constantly and dynamically (Toledo et al., 2008; Horrey et al., 2012). The optimal exploitation of these opportunities allows authorities to address the new challenges and to manage timely the new developments in order to achieve goals on road safety. Horrey et al (2015) provided two perspectives for safety management (i.e. local and general). The local or 'in real-time' perspective implies the closed-loop process of sampling, judging and acting upon the real-world situations. The 'general' perspective is based on the holistic idea that the response of the drivers during real-world situation is dependent on factors that are more stable across time (such as personality, driving experience, safety attitudes etc.). Typically, advanced driving assistance systems (ADAS) do not really consider such stable factors. Research shows that in order to have impact on the influence of those more stable characteristics, other interventional approaches are required, often running over a longer time episode and targeting for a gradual and stepwise change process in the vehicle operator (Karlsson et al 2017).

In relation to the above, the objective of the European funded Horizon2020 project i-DREAMS (2019-2023) (details of the project: https://idreamsproject.eu) is to setup a framework for the definition, development and validation of a context-aware 'safety tolerance zone (STZ)' for driving (Brijs et al., 2020). The formal working definition of STZ adopted within i-DREAMS is as follows:

"the time/distance available [for vehicle operators] to implement corrective actions safely [in the potential course towards a crash]".

The monitoring module of the i-DREAMS framework is accounting for a diversity of risk indicators related to the road environment, the driver and the vehicle, which enables a continuous assessment of driving to determine if a driver is within acceptable boundaries of safe operation. Within the intervention module, interventions are developed and tested, which are operational in the vehicle during the trip, as well as after the trip to prevent drivers from getting too close to the boundaries of unsafe operation.

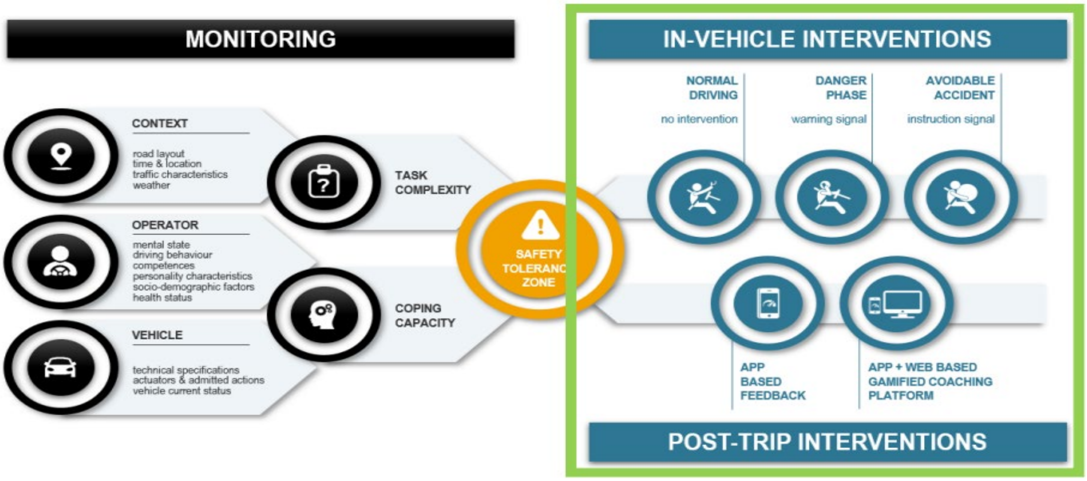

Fig. 1. Conceptual framework of the i-DREAMS platform.

Fig. 1 illustrate the conceptual framework of i-DREAMS, where the STZ is a central component. The measured information about context, operator and vehicle allow to calculate task complexity and coping capacity. Such calculations are made in real-time (during driving) as well as after the completion of the journey, which helps generating information on driving status in terms of STZ. In turn, the status of STZ determines the type of real-time interventions required to be provided. Post-trip interventions use the collected data during a trip and provide information and advice to the driver with the aim of influencing behaviour for future trips. The green frame in Fig. 1 indicates the thematic scope of this paper. The developed technologies are tested and evaluated in 600 drivers across 5 different countries (Belgium, UK, Greece, Portugal and Germany) and in multiple modes (car, truck, bus, rail). In this paper, we discuss first results about the effectiveness of these interventions based on data collected in the project for a selection of car drivers for Belgium and UK.

2. Methodological Details

2.1. Data and its types

The naturalistic driving data collected in i-DREAMS concerns a variety of data about safety promoting goals (SPG) and performance objectives (PO). Table 1 defines these SPGs and POs and their inter-relationship.

Table 1. SPG and PO and their inter-relationship.

Safety Promoting Goals (SPG)	Performance Objectives (PO)
Vehicle Control	Acceleration, Deceleration, Steering control
Speed Management	Speed
Road Sharing	Headway, Illegal Overtaking, Lane Discipline, Forward Collision Warning, and Pedestrian Collision Warning
Driver Fitness	Fatigue and handheld mobile phone use (during driving)

Participants for field trials are recruited based on several inclusion criteria e.g. appropriate driving experience and road exposure, age (minimum 18 years), balanced representation of gender, vehicle type (so that i-Dreams technology can appropriately be installed), use of smartphone, multi-driver access (i.e. one vehicle many drivers, to increase sample size) etc. The recruitment process followed various steps such as general advertising, initial screening of interested candidates based on the inclusion criteria, targeted advertisement for specific sub-groups, and provision of detailed enrolment information followed by contract finalization. Selected participant also receives a reward of 250euros in total in terms of instalments at various stages of the data collection period. During this data collection period, all drivers pass through 4 different stages of observation and interventions allowing to compare their driving behaviour with and without safety interventions. Intelligent real-time audio-visual interventions in the vehicle aim at keeping the driver within safe boundaries of operation, whereas additional information and feedback is given after the trip on the driver's smartphone to coach and motivate drivers to further improve their safety performance (Brijs et al., 2020). Naturalistic driving data and app usage are supplemented with a series of qualitative driver surveys on socio-demographics, use of driver assistance systems, safety attitudes and opinions and acceptance of i-DREAMS technology.

2.2. In-Vehicle Interventions

The purpose of the *i*-DREAMS interventions is to effectively increase driver safety by supporting the driver in his/her driving task. The intervention mechanism needs to be based on the Safety Tolerance Zone (STZ) concept. According to the STZ, a driver can be in three different phases:

(1) Normal Driving phase,

(2) Danger phase,

(3) Avoidable Accident phase.

In case a driver is within the first phase (i.e. normal driving), no real-time interventions are necessary. On the contrary, in case a driver is within the phase of danger, an alert is offered, while in the case of the avoidable accident phase, an intrusive warning signal (either or not accompanied by an instruction) is offered. An intervention device (a hardware) is developed that aims to inform and warn the driver, in real-time, about the context-aware safety envelope for driving.

This device provides visual and sound alerts, information on the state of the STZ (Lourenço et al., 2020). With real-time interventions, drivers have almost no time to think about their actions, hence, a nudging approach is utilized for these kinds of interventions. Within this approach, heuristics (i.e. mental shortcuts) and manipulations of cues within a social or physical environment are being used in order to activate non-conscious thought processes involved in human decision making. The device issues warnings on the following risk indicators, i.e. Headway, Speed, Fatigue, illegal overtaking, Lane departure and Pedestrian collision.

2.3. Post-Trip Interventions

Within post-trip interventions, signals are given to the driver after driving, with the help of a smartphone application. This smartphone application has two versions: one version with only scores based on driving performance, and a second version including gamification elements (e.g. points and goals). Key-stakeholders (i.e. company management, i.e. CEO or fleet safety manager, outdoor service providers, and indoor coaches, i.e. planner or buddy) that are actively involved in the process of coaching professional drivers (related to Truck/Bus and Rail modes) to improve their driving style have access to a web platform. With post-trip interventions, drivers have time to think about their future actions, hence, a coaching approach is used. Within this approach, there is a focus on helping/guiding the driver in order to drive more safely by boosting their competences. As a result, conscious thought processes involved in human decision making can be activated. The i-DREAMS app contains the following main functionalities (Vanrompay et al 2020):

- *Scores*: an overview of the scores for each SPG and PO that is activated for a driver. The scores are developed as trip-based indicator to provide a measure of their performance to the driver in a common scale. The value ranges from 0-100 (calculated based on number of events corresponding to a particular STZ level for a particular type of PO), and higher the score means better performance for a particular PO. Scores for each SPG are calculated as an average of scores for all PO corresponding to a particular SPG.
- *Trips*: a list of trips performed by the driver along with trip scores for each SPG and PO. Also, the driver can see a GPS trace representation of a selected trip on a map, together with the events corresponding to performance objectives that happened on that trip.
- *Pros-cons*: a list of advantages and disadvantages of certain driving behaviour related to specific POs.
- *Tips*: a list of coping tips to improve driving behaviour related to specific POs.
- *Goals and badges*: that contains information on completed goals (a list of goals for specific POs that were successfully reached by the driver), open goals (a list of goals for specific POs that were taken up by the driver and on which the driver is currently working) and new goals (a list of goals for specific POs that are new and which the driver can take up)
- *Leaderboard*: a score-based ranking of drivers in a group.

2.4. Intervention Effectiveness Evaluation

The safety intervention assessment methodology is based on the COM-B logic model of change for outcome evaluation, which describes safety outcomes (i.e. crash occurrence), safety performance goals (i.e. Vehicle control, Speed Management, Road Sharing, Driver Fitness), performance objectives (as mentioned in Table 1 under various SPGs) and change objectives (underlying behavioural determinants that need to change for the performance objectives to become realizable) that are causally linked with each other, as well as elements from the RE-AIM framework for process evaluation, including “reach, adoption and implementation fidelity” (Glasgow et al., 1999; Gaglio et al., 2013). Literature search indicated that the majority of the studies focusing on the assessment and the effectivity of the interventions, mostly used a before-after analysis (Toledo et al 2008, Arumugam and Bhargavi, 2019), presenting the overall statistics of events’ occurrences, as well as safety outcomes, safety promoting goals, performance objectives and change objectives. Questionnaires (based on before-after analysis) were also used to assess the interventions. A few studies also used meta-analysis (i.e. statistically combining the results of studies in a systematic review to conclude about effect of intervention) (Katrakazas et al 2020).

Both an outcome and a process evaluation have recently been initiated on the data collected in the project until now. Preliminary results presented in this paper are mainly in the form of descriptive statistics. Outcome evaluation is performed to determine changes/impact for the variables listed as SPGs and POs in the form of changes in scores and number of events/100km monitored across 4 phases (Table 2 defines of these phases). Although it would be ideal to detect statistically significant impact on safety outcomes (e.g. crash occurrence), this is not very likely, since crashes are rare events, and the total duration of the field trials covers only a few months. In relation to process evaluation, preliminary results presented in this paper mainly indicate driver engagement behaviour with the developed smartphone app in different phases with a viewpoint that higher and consistent engagement with the app (in terms of its overall quality of material design and implementation) may help improving the driving behaviour.

Table 2. Phases and their definition.

Phase	Definition
1	Phase 1 corresponds to an initial reference monitoring period after installation of i-DREAMS technology when interventions were not yet active) – Duration: 4 weeks
2	Phase 2 corresponds to the monitoring period when only real-time interventions were active within a vehicle- Duration: 4 weeks
3	Phase 3 corresponds to the monitoring period when in-vehicle real-time interventions were active and drivers also received feedback (scores and events per trip) on their driving performance through the app, Duration: 4 weeks
4	Phase 4 corresponds to the monitoring period when in-vehicle real-time interventions were active along with feedback but at the same time gamification elements were also active. Duration: 6 weeks

3. Results and Discussion

3.1. Belgium and UK Car Drivers: Overall Statistics

Data of 27 drivers from Belgian car field trails were used in the analysis because of its completeness in all respect. Data was collected for this trial in the period between April 2021- November 2021, however commencing dates for the individual drivers were different and therefore start/end date of phases for each driver were different. The majority of the drivers started their phase 3 in the months of July, August and September, when COVID19 restrictions were gradually starting to be relaxed. Therefore, a higher number of trips was recorded for phase 3 and phase 4 compared to first two phases (see Table 3). 16 drivers were male and 11 were female, with four in the 18-25 age group, eleven in the 26-45 and 3 in the 46-64 age group and nine were 65+. A total number of 8,916 trips were recorded travelling a total of 123,233.95 Km with an average of 330.22 trips per driver. The average trip length was 13.82 Km and duration was 16.21 minutes. Based on Flemish travel behaviour data (Onderzoek Verplaatsingsgedrag Vlaanderen (OVG 5.1)), car trips length and duration recorded were 14.16 Km and 18.97 minutes which are similar to the observed figures.

26 drivers of 25 cars took part in the UK car field trials. All live in the Midlands region of England, UK. Trials took place in the period October 2021 – February 2022 with phase 1 commencing October 4th, phase 2 November 1st, phase 3 November 29th and phase 4 December 27th. Similarly, to Belgium field trials, individual driver's start dates and therefore phase changes varied but all were completed within this period). Some COVID19 restrictions were still in place during this period, specifically a 'work at home where possible' order for December and January. All drivers recruited stated they were still using their vehicles for commuting at least 2/3 times a week. Sixteen drivers were male and ten were female with four in the 18-25 age group, nine in the 26-45 and 46-64 age groups and four were 65+. A total number of 10,598 trips were recorded travelling a total of 127,229.19 Km with an average of 407.6 trips per driver for the 18-week trial period. The average trip length was 12 Km and duration was 16.97 minutes, representing consistent numbers with the UK travel statistics data. For England, an average of 580 car trips covering a distance of 5,009 miles (8,061 Km) per driver occurred in 2019 (DfT, 2019). On average, each car trip had a duration of 22 minutes and distance of 8.4 miles (13.5 Km) (DfT,2019).

3.2. Belgium and UK Car Drivers: Outcome evaluation

Table 3 provides the general idea of effectiveness of the interventions as total events/100km occurred (obtained by adding events/100km for all POs) in danger and avoidable accident phases are indicated along with the average scores (obtained by averaging the score for all POs). It is clear that for both countries there is decrease in the events/100km frequency (similarly increase in the avg. scores) from the first phase to other phases. For the UK cars the trend is more consistent (and seems significant) than for the Belgian Cars as there is reduction of *67.7* events/km from phase 1 to phase 4 for the UK cars. For the Belgian cars, the reduction is higher in phase 2 (almost 7 events/100km are reduced) but for phase 3 and phase 4 the events/100Km are again increasing. Relaxation of COVID19 restrictions (during phase 3 and phase 4) could possibly explain this as traffic volumes on the roads increased, which probably also implied an increase in the exposure to interactions between vehicles, resulting in the raise in events/100km frequency.

Table 3. Trip information, Total events/100km and Avg. scores in each phase of data collection.

Phase	Belgium Cars				UK Cars			
	Trips	Distance Travelled (Km)	Avg. Trip Scores	*Events/ 100km	Trips	Distance Travelled (Km)	Avg. Trip Scores	*Events/ 100km
1	1,842	24,272.64	85.16	253.06	2196	28,747.90	83.78	273.46
2	1,761	24,213.92	85.45	245.79	2559	28,284.17	84.36	255.45
3	2,560	35,293.04	85.46	247.16	2534	28,155.41	85.09	221.41
4	2,573	39,454.35	85.21	252.95	3309	42,041.71	85.11	206.39

*Events/100km are mentioned as total events occurred for all risk indicators (POs) in danger and avoidable accidents phases of the STZ

Table 4. Events/100km for each SPG, PO for all phase of data collection.

SPG	PO	Country	Events/100km – Dangerous STZ				Events/100km- Avoidable Accident STZ			
			Phase 1	Phase 2	Phase 3	Phase 4	Phase 1	Phase 2	Phase 3	Phase 4
Vehicle Control		BEL	57	58	60	67	12	13	13	14
		UK	**153**	**128**	**124**	**135**	**34**	**21**	**20**	**20**
	Acceleration	BEL	28	31	32	35	9	11	11	11
		UK	80	56	52	57	26	13	12	13
	Deceleration	BEL	4	5	6	6	0.25	0.34	0.31	0.25
		UK	9	8	8	9	0.90	0.80	0.90	0.90
	Steering	BEL	25	22	23	26	2.42	2.41	1.87	2.99
		UK	64	64	63	69	7.77	6.63	6.95	6.08
Speed Management	Speeding	BEL	**66**	**66**	**62**	**64**	**39**	**35**	**33**	**34**
		UK	**53**	**54**	**33**	**34**	**32**	**31**	**27**	**28**
Road Sharing		BEL	**64.14**	**59.2**	**64.12**	**62.14**	**13**	**11**	**13**	**10**
		UK	**119**	**118**	**104**	**108**	**15**	**15**	**13**	**11**
	Headway	BEL	54	51	55	53	13	11	13	10
		UK	95	96	85	91	15	14	13	11
	Illegal overtaking	BEL	0.04	0.07	0.03	0.02	0.004	0.00	0.00	0.00
		UK	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00
	Lane Discipline	BEL	7	6	6	7	0.00	0.00	0.00	0.00
		UK	7	6	6	5	0.00	0.00	0.00	0.00
	Forward Collison Avoidance	BEL	3	2	3	2	0.00	0.00	0.00	0.00
		UK	16	15	13	12	0.00	0.00	0.00	0.00
	Pedestrian Collision Avoidance	BEL	0.10	0.13	0.09	0.12	0.00	0.00	0.00	0.00
		UK	0.58	0.52	0.40	0.52	0.00	0.00	0.00	0.00

Driver Fitness		BEL	0.35	0.99	1.34	1.01	**0.01**	**0.01**	**0.00**	**0.00**
		UK	**0.92**	**0.001**	**0.003**	**0.02**	0.00	0.00	0.00	0.00
	Fatigue	BEL	0.01	0.01	0.02	0.02	0.01	0.01	0.00	0.00
		UK	0.01	0.001	0.003	0.02	0.00	0.00	0.00	0.00
	Distraction	BEL	0.34	0.98	1.32	0.99	0.00	0.00	0.00	0.00
		UK	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00

For SPGs such as Speed Management and Road sharing, car drivers for both countries have responded well in the intervention phase. The effect is larger for events/100km in avoidable accident STZ for Belgium car drivers compared to events recorded in dangerous STZ. However, UK car drivers responded to the interventions better in both STZ-phases. Additionally, UK car drivers responded better for vehicle control (for all performance objectives within it) and driver fitness (see shaded lines in Table 4). Headway, illegal overtaking, lane discipline, forward collision avoidance, pedestrian collision avoidance, fatigue and distraction improved to some extent (i.e. not consistently) for drivers from both countries. Overall, UK drivers responded well compared to Belgian drivers. An individual level analysis was also performed for both countries' drivers to ascertain what percentage of drivers responded well in the different intervention phases. In the case of Belgian car drivers, 13 drivers (out of 27) i.e. 48% showed response to the intervention strategies in a consistent manner. Furthermore, no effect of gender is noted. Different from that, however, low age and low-income category drivers performed relatively better. In the case of UK car drivers, 16 drivers (out of 26) i.e. 62% showed consistent response to the intervention strategies.

3.3. Belgium and UK Car Drivers: Process evaluation

In relation to process evaluation, the results presented in this study are only based on user engagement with the i-DREAMS smartphone app. Given the intervention framework, drivers were mainly engaged with the app during phase 3 and phase 4. In phase 3, drivers were provided with general feedback about their trips, scores and events for indicators related to performance objectives. In phase 4, the gamification elements were introduced in the app, e.g. drivers were provided challenges with several goals, such as increase 1 or two points in the score of a certain performance objective in the next 100 km. Badges were given to the drivers on completion of a particular challenge. Drivers could also monitor their progress on the leader board to see their position within the group of drivers. To implement this process and to ascertain transferring the effect of this post-trip intervention in improving the driving behaviour, serious interaction of a driver with the app is required. Drivers were also notified periodically through push notifications whenever new and relevant information was available. Fig. 2 provides the trends for the number of daily app visits of the drivers from both countries. There are a number of other features for which the data is recorded e.g. visiting each feature (such as goals progress), likes/dislikes for tips and pros/cons for each PO and the amount of time spent on each feature etc., but these will be reported later elsewhere.

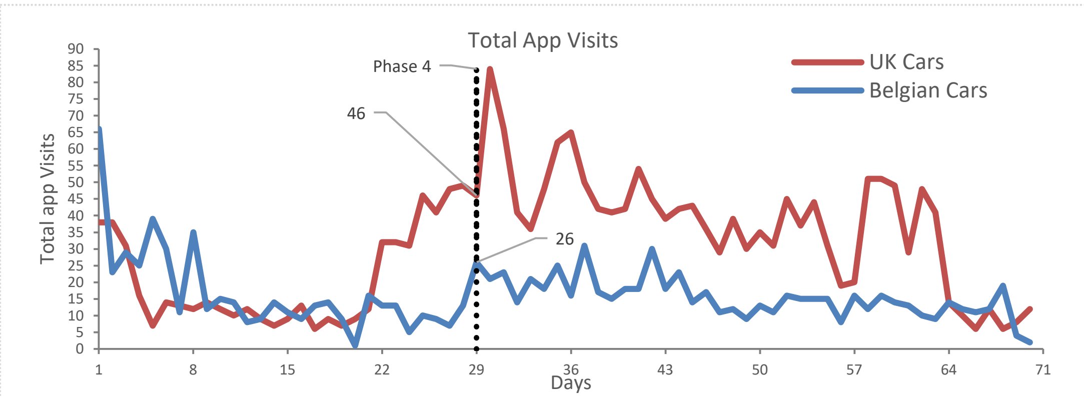

Fig. 2. i-DREAMS smartphone app visits for Belgian and UK car drivers

It can be seen from Fig. 2 that following the first day of phase 3, engagement with the app by drivers steadily declines. Yet, as soon as phase 4 starts, higher engagement is noted with the app, and interaction also becomes more consistent across several days. Overall, UK drivers were engaged more compared to Belgian drivers. This could be correlated with the performance of UK drivers, as overall the extent of their improvement is better for SPG and POs based on the results shown in section 3.2.

4. Conclusions

The current paper presents a preliminary assessment of safety interventions provided within the i-DREAMS large naturalistic driving experiment. The assessment comprises outcome and process evaluation using the COM-B and RE-AIM framework. Initial results from a sample of 27 Belgian car drivers show mixed results, likely biased by changing mobility patterns during different waves of the COVID-19 pandemic. A sample of 26 UK drivers, showed better performance in terms of response to the designed in-vehicle real-time and post-trip interventions. It is encouraging to see that the UK car drivers have responded better than their Belgian counterparts, which clearly indicates that both real-time and post-trip interventions are effective. Also, engagement with the app is higher among the UK car drivers. Overall, it can be concluded that the interventions show effectiveness potential. The results presented in this paper further confirmed that a two-tier intervention framework (real-time and post-trip) as conceptualized by Horrey et al (2015) in terms of 'local and general' perspectives is producing more profound effects and can improve the driving behaviour which is important to achieve the goals of road safety. Future work will focus on a more detailed analysis of data including inferential statistics and comparison with more modes of transport and countries.

Acknowledgements

This paper is based on the project that has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 814761

References

Arumugam, S., & Bhargavi, R. (2019). A survey on driving behavior analysis in usage based insurance using big data. Journal of Big Data, 6(1), 86.

Clark, T., Woodley, R., De Halas, D., 1962. Gas-Graphite Systems, in "Nuclear Graphite". In: Nightingale, R. (Ed.). Academic Press, New York, pp. 387.

Brijs, K., et al. (2020). Toolbox of recommended interventions to assist drivers in maintaining a safety tolerance zone. Deliverable 3.3 of the EC H2020 project i-DREAMS.

Brijs T., Brijs K., Kaiser S., Talbot R., Lourenço A., Antoniou C., Yannis G., Avenoso A., and Wets G. (2020). IDREAMS: an intelligent driver and road environment assessment and monitoring system. In Proceedings of the 8th Transport Research Arena TRA 2020, April 27-30, Helsinki, Finland.

DfT (2019) National Travel Survey: Fact Sheets for England 2019. Department for Transport. Accessed 7/4/22 at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906847/nts-2019-factsheets.pdf

Gaglio, B., Shoup, J. A., & Glasgow, R. E. (2013). The RE-AIM framework: a systematic review of use over time. American journal of public health, 103(6), e38-e46.

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. American journal of public health, 89(9), 1322-1327.

Horrey W.J., Lesch M.F., Dainoff M.J., Robertson M.M. & Noy Y.I. (2012). On-board safety monitoring systems for driving: Review, knowledge gaps, and framework. Journal of Safety Research 43;49-58.

Horrey W.J., Lesch M.F., Mitsopoulos-Rubens E., Lee, J.D. (2015). Calibration of skill and judgement in driving: Development of a conceptual framework and the implications for road safety. Accident Analysis and Prevention 76; 25-33.

Karlsson M.A., et al. (2017). MeBeSafe: Measures for behaving safely in traffic (Deliverable 1.1), to be consulted at www.mebesafe.eu.

Katrakazas, C. Michelarki E., Yannis G., Cuenen A., Brijs K., Brijs T., Fitness A., Talbot R., Hancox G., Gruden C., (2020 Methodology for the evaluation of interventions. Deliverable 7.1 of the EC H2020 project i-DREAMS;

Lourenco, A., Carreiras, C., Gasper, C., Velez D., Abrunhosa L., De Vos, B., Duarte G., Brijs T., (2020) A set of flexible modules for sensor data collection, integration and real-time processing. Deliverable 4.1 of the EC H2020 project i-DREAMS;

Toledo, T., Musicant, O., & Lotan, T. (2008). In-vehicle data recorders for monitoring and feedback on drivers' behavior. Transportation Research Part C: Emerging Technologies, 16(3), 320-331.

Vanrompay, Y., Donders, E., Fortsakis, P., Brijs, T., Brijs K. & Wets, G. (2020). A smartphone app (Android) for personalized driving behavioural feedback. Deliverable 4.5 of the EC H2020 project i-DREAMS