

Trend on the Usage of Technology and Road Accident: An Examination Study

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Abstract

Road accident has been indeed a global major concern. The statistics keep rising every year and a new trend along with the advancement of technology has become one of the road accident contributors. The application of technology, specifically through the use of mobile phone while driving has been reported to cause road accidents. Therefore, this review paper aimed to study on the trend of the usage of mobile phone while driving and road accident by specifically discussed on five main trends, namely type of journal publication, years of research publication, research setting, research sample (participant) and research design. This review has been undertaken through five academic databases such as Scopus, Wiley Online Library, Emerald, Web of Science and ScienceDirect which accumulated a total of 2462 findings. After going through several reviewing processes, 34 studies have been selected to be included in this review. Findings on the trend show that this topic mostly been published in the journal of Accident Analysis and Prevention with most of the studies been published within the years of 2011 and afterward. Moreover, most included studies were undertaken in the Western and European setting and applied the research design of case series with actual accident victims as the research sample (participant). Based on this trend analysis, a proper recommendation has been made for any future researchers who interested on pursuing the similar research area.

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I. INTRODUCTION

One of the global problems that faced by most of countries in the world is road accident which has been reported to contribute around 1.35 million deaths yearly (1). It has also been reported that nearly 50 million people suffer from disabilities in result of the accident involvement (1). This issue has significantly impacted most of the countries' economy since the government need to bear the properties and facilities damages, medical cost and even the loss of the human productivity.

World Health Organization (WHO) reported that the implication of road accident cost most countries worldwide 3% of their overall gross domestic product (1). Apart from that, it is also been reported that around 60% of the world vehicle density are in the low and middle income countries like India, Thailand and China which further contribute approximately 93% of the world road fatalities (1). Such statistics indeed triggered the alarm for an urgent countermeasure plan. In order to outline the appropriate contingency and prevention

plan, various studies have been conducted around the globe in order to understand the reason behind the occurrence of road accident. It has been reported that human factors cause most of the accident occurrences and there is also an emerging trend in the usage of technology through the illegal use of mobile phone while driving which becomes one of the accident contributors. Therefore, this paper aims to systematically review the trend on the usage of technology through the application of mobile phone while driving and the occurrence of road accident.

II. LITERATURE REVIEW

Review over literatures reveals that human factors lead the occurrences of road accident with approximately 90% of the overall statistics, whereas the remaining 10% is due to the environmental factors and technical factors such as the vehicle and road faulty (2, 3). Thus, human factors are the predominant cause of road accident that required greater attention. One of the most recent human factors that significantly been reported to cause road accident is through the application of technology, specifically the use of mobile phone while driving (4, 5). This behaviour is a part of the traffic violation behaviour which categorized as an illegal intentional behaviour. This is because drivers indeed have the knowledge where such behaviour could jeopardize their driving attention and subsequently increase the accident risk (6).

Mobile phone is one of the electronic gadgets that been through a rapid revolution. The advancement of technology has made mobile phone a smart gadget that could provide various functions to the users such as navigation system, voice call, web surfing, sending and received text messages, playing music and many more. As a result, mobile phone has been considered as one of the

necessity gadgets to most of people in the world nowadays. Although mobile phone provides a great aid in our life but, there is a limitation that everyone are bonded to follow. The usage of mobile phone while driving is strictly being prohibited under the traffic law and regulation in all countries around the world. This is because the use of mobile phone while driving causes the drivers to divert their attention from driving. For example, even though an action like reading a text only requires a few seconds, but the truth is anything can happen on the road in just within that seconds. Drivers' attention is diverted when doing a multitasking task (i.e. driving and reading text) which sometime beyond our brain capacity and efficiency.

United States Department of Transportation reported that distracted driving has claimed approximately 3166 lives yearly (7). There are various factors that can cause drivers being distracted for example, eating and drinking while driving, checking the navigation system, talking to the passenger, and fiddling with the stereo, but, it has been reported that the illegal use of mobile phone while driving contribute the most of the accident occurrences (7). Drivers who unable to control themselves tend to answer a phone call or read text a moment it has been received although they are still driving. The main problem here is when their mobile phone is in the most difficult place to be reached for example in the bag or pocket. The action of reaching the mobile phone itself has already caused a great distraction to the drivers. In addition to that, reading the text or answering the phone call also sometime involved emotional feeling which could significantly jeopardize the drivers' state of mind which might subsequently increase the accident risk. As a result, the usage of technology through the illegal uses of mobile

phone indeed a significant contributor that could cause road accidents.

III. METHODOLOGY

A review over five academic databases namely, Emerald, ScienceDirect, Scopus, Wiley Online Library and Web of Science has been conducted within the year of 1951 until December 2018 (varies based on databases). Several keywords and Boolean Operators have been outlined in order to undertake the search process. Some of the keywords and Boolean Operators used are “determinant” OR “factor” OR “cause” AND “road accident” OR traffic crash”. The search process is up to December 2018, limited to the English language articles and published in peer-reviewed journals. Apart from that, several inclusion and exclusion criteria also have been outlined in order to assist the reviewing process. Only findings that match with the requirement criteria are included in this review study, which further been exported into the reference management software, EndNote X7. The inclusion and exclusion criteria for this review are as below:-

Inclusion criteria:

1. Type of study: Cross-sectional study (survey; interview; observation), case series, and case control study.
 2. Participant: All types of respondents either already involved in a road accident or not and accident data.
 3. Outcomes: Any studies that investigate on the use of mobile phone while driving and road accident. The outcome of this review explained in the trend of included studies in term of the year, journal, country (research setting), participant (research sample) and study design.
- Exclusion criteria:-

1. Type of study: Review study, meta-analysis study, governmental report, dissertation and thesis.

2. Research focus: Any studies that investigate on the factors that cause road accident such as other human factors, environmental factors and technical factors.

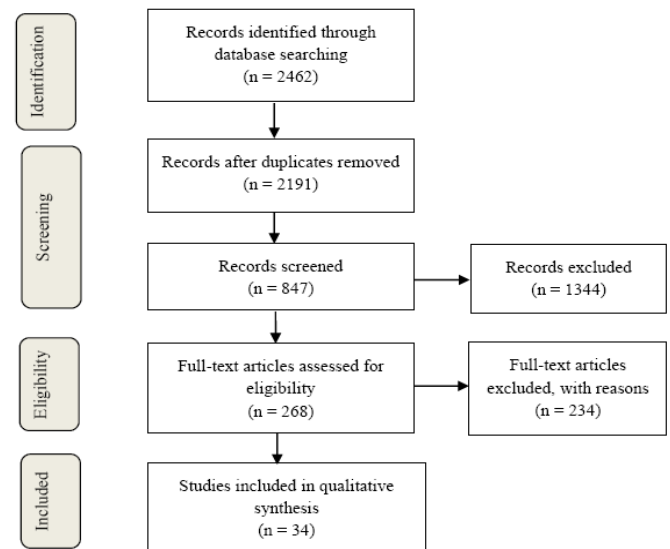


Figure 1: PRISMA flow diagram of the review process

IV. RESULT

The search process from five databases yielded 2462 articles (Emerald: 128, Wiley Online Library: 141, ScienceDirect: 855, Web of Science: 549 and Scopus 789). After the search process, the researchers then have undertaken the screening and reviewing process. Firstly, the researchers delete any duplication findings through the “detect duplication” function that is available in EndNote. During this process, a total of 271 duplicates findings have been removed. Secondly, the researchers screened the remaining 2191 titles and delete a total of 1344 irrelevant titles. Next, the researchers read each of the 847 abstracts and eliminate another 579 abstracts. Subsequently, the researchers retrieved the full texts of the remaining 268 abstracts through the “find full text” function under the EndNote and manually search 58 full texts that unable to be retrieved through EndNote by personally emailed the each of the author and request the full text. During this

process, only 37 full texts has successfully been retrieved whereas, the remaining 21 full texts are being excluded from the study. Finally, only 34 related studies that fulfil the requirement criteria are being included in this review study. Figure 1 shows the PRISMA flow diagram of the overall review process.

a) Type of Journals and Years of Publication

All included studies were published in 20 journals. Majority of the studies (n = 8) were published in Accident Analysis and Prevention, followed by four studies were published in PLoS ONE, three studies were published in Journal of Safety Research and two studies were published in ITE Journal (Institute of Transportation Engineers) and American Journal of Public Health respectively. Whereas, the remaining 15 studies were published in International Journal of Epidemiology, Safety Science, Journal of Traffic and Transportation Engineering-English Edition, SpringerPlus, British Medical

Journal, New England Journal of Medicine, Tzu Chi Medical Journal, Psychiatry Research, Chinese Journal of Traumatology (English Edition), Procedia Engineering, Journal of Adolescent Health, Canadian Journal of Civil Engineering, Journal of Transport & Health, Planning Malaysia and ActaPolytechnicaHungarica. Meanwhile, regarding on the years of publication, majority of the studies (n = 5) were published in the years of 2011, 2013 and 2017 respectively, followed by four studies were published in the years of 2014 and 2016 respectively. Next, three studies were published in the year of 2007 and two studies were published in the years of 2015 and 2018 respectively. Finally, one study was published in the years of 2003, 2006, 2010 and 2012 respectively. Detail information on the type of journals and years of publication can be found in Table 1 and Table 2.

Table 1
Detail on the type of journals and years of publication

Journal	Years												Total
	2003	2006	2007	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Accident Analysis & Prevention	1		2				3	1			1		8
International Journal of Epidemiology							1						1
Plos One								1	1	1	1		4
Safety Science					1								1
Journal of Traffic and Transportation Engineering-English Edition											1		1
Journal of Safety Research										1	1	1	3
ITE Journal (Institute of Transportation Engineers)					2								2
SpringerPlus										1			1
British Medical Journal						1							1
New England Journal of Medicine								1					1
Tzu Chi Medical Journal			1										1
American Journal of Public		1		1									2

Health													
Psychiatry Research												1	1
Chinese Journal of Traumatology (English Edition)					1								1
Procedia Engineering								1					1
Journal of Adolescent Health							1						1
Canadian Journal of Civil Engineering									1				1
Journal of Transport & Health										1			1
Planning Malaysia										1			1
ActaPolytechnicaHungarica					1								1
Total	1	1	3	1	5	1	5	4	2	4	5	2	34

b) Research Setting (Countries)

All included studies were undertaken in 14 countries around the world. Majority of the studies (n = 9) were undertaken in US, followed by five studies in French, four studies in China, three studies in Australia and two studies in Turkey and Taiwan respectively. Finally, the remaining eight studies were

conducted in eight countries such as Oman, Ethiopia, Norway, Abu Dhabi, Malaysia, Canada, Mid-Europe (author does not specify the information) and the combination of Australia, New Zealand and Columbia. Detail information on the research setting can be found in Diagram 1 and Table 2.

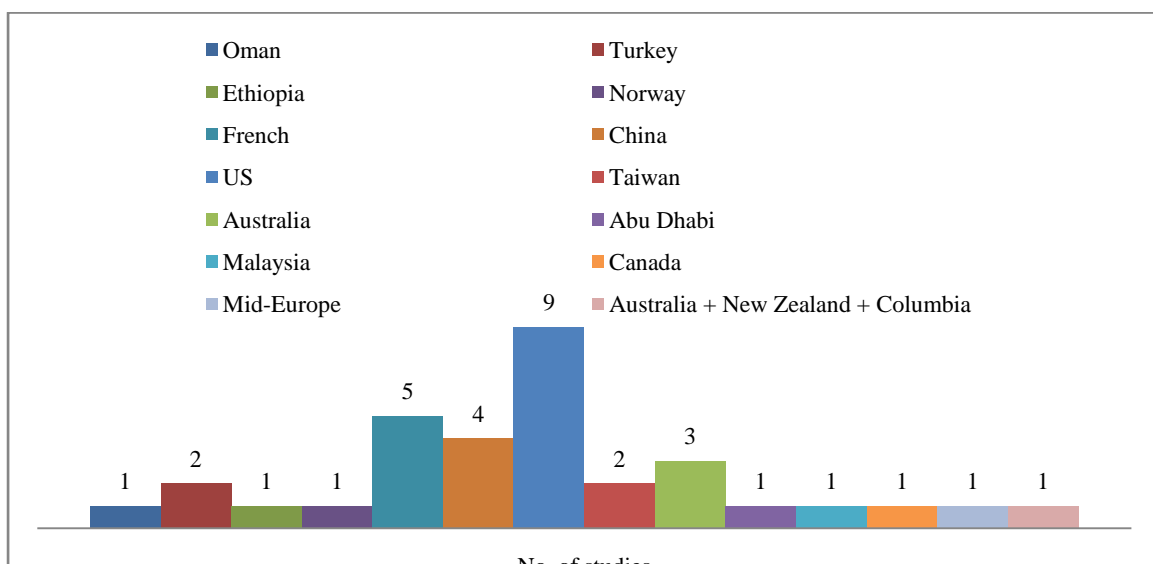


Diagram 1: Detail on research setting

c) Research Sample (Participant)

From the overall 34 included studies, most of the studies (n = 15) use the sample of accident victims followed by eight studies use the sample of accident case data. Next, three

studies use the sample of video data and students respectively, followed by two studies use the sample of young drivers and driver in general (detail not provided by the author) respectively. Finally, only one study uses the

sample of the combination of new driver and experience driver. Detail information on the research sample can be found in Diagram 2 and Table 2.

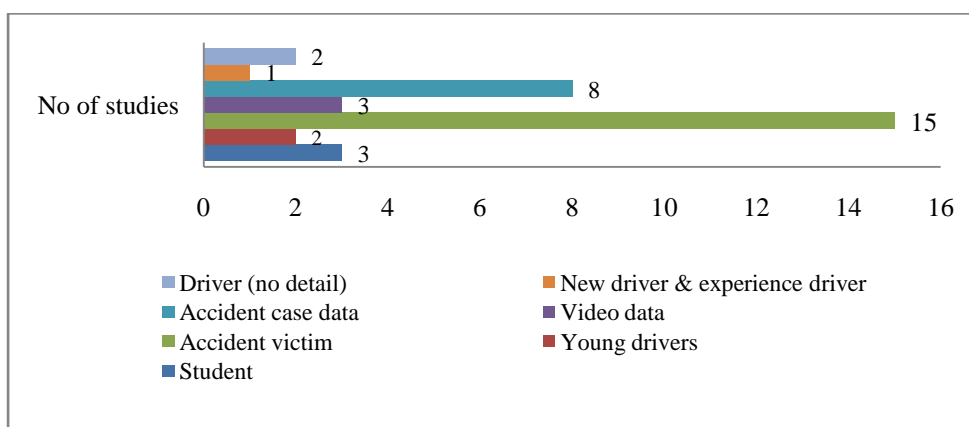


Diagram 2: Detail on research sample (participant)

d) Research Design

All 34 included studies used seven types of research designs to undertake the data collection process. Majority of the studies (n = 12) used the research design of case series, followed by eight studies used the case control study design and six studies gathered the data through the survey of questionnaires.

Moreover, five studies used the study design of observation and the remaining three studies use the study design of case cohort, combination of observation and case control and finally the combination of survey (questionnaire) and interview respectively. Detail information on the research design can be found in Diagram 3 and Table 2.

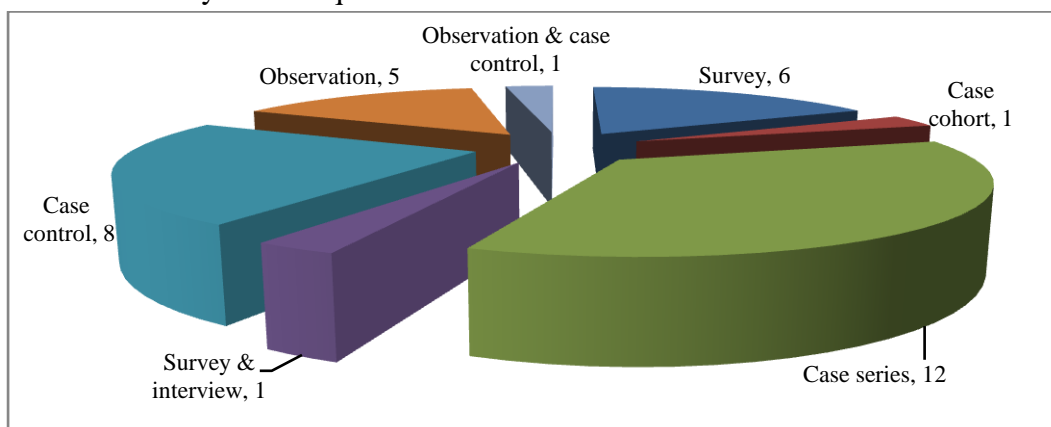


Diagram 3: Detail on research design

V. DISCUSSION AND CONCLUSION

Based on the presented result, it can be summarized that majority of studies which investigate on the application of technology specifically the usage of mobile phone while driving were published in the journal of Accident Analysis and Prevention under the publisher of Elsevier Ltd. Apart from that, the

trend analysis also shows that all studies were being investigated after the year of 2000 and majority of the studies were being published around the year from 2011 onwards. Next, it also can be identified that majority of the included studies were undertaken in the Western and European countries. In addition to that, there is also an emerging trend of such

study being undertaken in the Asian setting specifically in China. Subsequently, it can also be concluded that most of the authors used the research sample (participant) of the actual accident victim who either suffered from the injuries or fatalities and the research design of case series which mostly been provided by the authorities who handle the road accident investigation such as police and other governmental bodies. All the data of accident cases were sorted and summarized by the authors in order to identify the main factors of the occurrence of road accident.

Based on this review, it can be summarized that the illegal use of mobile phone while driving is indeed one of the significant road accident causation factors around the world. Based on the overall analysis pattern, this topic is one of the emerging study and now *attracting* ever more *attention* among researchers. As a result, it can be recommended for the other researchers who interested to pursue on this topic and conduct the study within other research setting to further enrich the body of knowledge. Moreover, the trend also shows that majority of the authors choose to publish their study in the journal of Accident Analysis and Prevention. Up to date (until May 2019) this journal is one of the pertinent journals that published study related to road accident and being listed in Web of Science with impact factor of 2.584 (Q2 for transportation research) as well as in Scopus with impact factor of 2.94 (Q1 for safety research). Thus, it has also been recommended for future researchers to publish their studies in this journal since this journal has a very good impact factor and listed in both dominant academic databases of Web of Science and Scopus.

Next, it also further has been recommended for the future study to use other research design to collect the data. This is

because the application of research design of case series provides information mainly limited to the demographic profile of the accident victims and the factors which cause the road accident. On the other hand, by applying the other research design of both cross-sectional study and longitudinal study through interview and survey, researchers can gathered richer information, for example the accident victims' perception on the effectiveness of the government road accident prevention plan and the suggestion for further improvement on the current road safety measure. These are among the valuable information which can be used by the researcher to further propose on the better countermeasure plan for the government to reduce the road accident statistics. Finally, referring back to one of the famous English axiom by Benjamin Franklin "an ounce of prevention is worth a pound of cure", it is well reminded that some action should be avoided in order to prevent a greater loss. Therefore, illegal use of mobile phone while driving need to be avoided in order to prevent the unfortunate incident of road accidents, unless the drivers really ready to bear the consequences of their action.

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Table 2: Detail information of all included studies

No	Study	Country	Sample size	Study Design	Journal
1	Al Reesi, Al Maniri (8)	Oman	1003 students	Survey (questionnaire)	Accident Analysis and Prevention
2	Alver, Demirel (6)	Aydin, Izmir, Manisa and Usak (Turkey)	2057 young drivers	Survey (face-to-face-questionnaire)	Accident Analysis and Prevention
3	Asbridge, Brubacher (9)	British Columbia, Canada	312 accident victims	Case series	International Journal of Epidemiology
4	Asefa, Ingale (10)	Mekelle and Tigray (Northern Ethiopia)	712 taxi drivers (188 accident victims)	Survey (questionnaire)	Plos One
5	Backer-Grøndahl and Sagberg (11)	Norway	4307 drivers (accident victims)	Survey (questionnaire)	Safety Science
6	Bakiri, Galera (12)	French	955 drivers (accident victims)	Case control study	Accident Analysis and Prevention
7	Bener, Yildirim (13)	Istanbul, Turkey	515 drivers	Case control study	Journal of Traffic and Transportation Engineering-English Edition
8	Bianchi Piccinini, Engström (14)	Shanghai, China	24 drivers	Observational study	Journal of Safety Research
9	Cades, Arndt (15)	US	100 videotape data	Observational study	ITE Journal (Institute of Transportation Engineers)
10	Cades, Arndt (15)	US	100 videotape data	Observational study	ITE Journal (Institute of Transportation Engineers)
11	Carney, Harland (16)	Arizona, Colorado, Illinois, Iowa, Minnesota, Missouri, Nevada and Wisconsin (US)	400 teen drivers (accident victims)	Observational study	Journal of Safety Research
12	Carney, Harland (4)	Arizona, Colorado, Illinois, Iowa, Minnesota, Missouri, Nevada and Wisconsin (US)	8228 crash videos	Observational study	Journal of Safety Research
13	Chen and Zhang (17)	Jiangxi and Shaanxi (China)	71,695 accident cases	Case series	SpringerPlus
14	Chen, Wang (18)	China	189 accident cases	Case series	Plos One
15	Chung (19)	Taiwan	7634 motorcycle accident cases	Case series	Accident Analysis and Prevention
16	Galera, Orriols (20)	France	955 drivers (accident victims)	Case control study	British Medical Journal
17	Gil-Jardine, Nee (21)	France	954 drivers (accident victims)	Case control study	Plos One
18	Klauer, Guo (22)	Washington, D.C (US).	42 newly licensed drivers and 109 adult experience drivers	Case cohort study	New England Journal of Medicine
19	Lam (23)	New South Wales, Australia	107,283 accident victims (young drivers)	Case series	Accident Analysis and Prevention
20	Li (24)	Hualien, Taiwan	10,053 accident cases	Case series	Tzu Chi Medical Journal
21	Marmor and Marmor (25)	Massachusetts, Connecticut, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Maine (US)	34,501 accident cases	Case series	American Journal of Public Health
22	M'Bailara, Atzeni (5)	France	955 accident victims	Case control study	Psychiatry Research
23	McEvoy, Stevenson (26)	Perth, Australia	274 accident victims	Case control study	Accident Analysis and Prevention
24	McEvoy, Stevenson (27)	Perth, Australia	1367 accident victims	Case control study	Accident Analysis and Prevention
25	Mohammadi (28)	Kerman, Iran	First phase: 265 college students	Frist phase: Observation and Second phase: Case	Chinese Journal of Traumatology (English Edition)

			Second phase: 8498 accident victims	control study	
26	Muehlegger and Shoag (29)	Mid-sized European country (no detail provided)	6700 accident cases	Case series	Procedia Engineering
27	O'Connor, Whitehill (30)	Seattle, Washington (US)	383 college students	Survey (online questionnaire)	Journal of Adolescent Health
28	Philip, Chauton (31)	Aquitaine, France	272 accident victims and 272 drivers (control)	Case control study	Plos One
29	Scott-Parker and Oviedo-Trespacios (32)	Australia, New Zealand and Columbia	Australia: 378 young drivers, New Zealand: 324 young drivers and Columbia: 392 young drivers	Australia and Columbia: Online questionnaire New Zealand: Phone interview	Accident Analysis and Prevention
30	Shawky, Hassan (33)	Abu Dhabi	3819 accident cases	Case series	Canadian Journal of Civil Engineering
31	Shen and Neyens (34)	South Carolina (US)	34,796 male and 43,374 female teens (accident victims)	Case series	Journal of Transport & Health
32	Sultan, Ngadiman (35)	Malaysia	210 students	Survey (questionnaire)	Planning Malaysia
33	Wang, Huang (36)	Xi'an, China	3038 accident victims	Case series	ActaPolytechnicaHungarica
34	Wilson and Stimpson (37)	US	51,857 accident cases (fatalities)	Case series	American Journal of Public Health