IUG Journal of Natural Studies
Peer-reviewed Journal of Islamic University-Gaza

ISSN 2409-4587

IUGNS
Vol 27, No 1, 2019, pp 53-60

Received on (27-02-2018) Accepted on (01-08-2018)

Bibliometric analysis of Traffic Medicine – related publications: 2008 – 2015

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Abstract

Background: Approximately 1.25 million deaths annually due to road traffic accidents (RTA). Research has proven to improve traffic safety. Therefore, this study was carried out to analyze data in the field of traffic medicine to endorse and support the *Decade of Action for Road Safety* plan, and to enrich the literature in the field of RTA.

Method: Scopus database was used to retrieve relevant data, then it was refined to traffic medicine field. Bibliometric indicators were presented and data visualization was carried out using VOSviewer and ArcGIS10.1

Results: A total of 2029 traffic medicine–related publications were retrieved, with *h*-index of 46. The relative growth rate declined from 0.63 in 2008 to 0.18 in 2015 while doubling time increased from 1.1 in 2008 to 3.55 in 2015. In 2008, traffic medicine-related publications were approximately 70% of total publications on traffic accidents and dropped to approximately 67% in 2015. Retrieved documents had a total of 8,478 authors, from 101 different countries with the USA having the largest share (498; 25.54%). Sweden, the UK and Canada had the highest percentage of inter-country collaboration. The most active institution was the *University of Toronto* (36 documents). *Accident Analysis and Prevention* was the most preferred for publishing RTA documents.

Conclusion: The study period was characterized by slow growth of traffic medicine – related publications, which may suggest relative lack of interest or funding. To reverse fatalities due to RTA and injuries, researchers need to be more involved in RTA research to present solutions for better safety.

Keywords:
At least four keywords or phrases in alphabetical order.

Background

Road traffic accidents (RTA) are believed to be responsible for approximately 1.25 million deaths per year [1]. The more painful news is that 48% of these global deaths occur in people aged 15 – 44 years old. To save lives and enhance traffic safety, the *United Nations General Assembly* launched in 2010 an action plan called "*Decade of Action for Road Safety (2011 – 2020)*" [2]. In 2015, the World Health Organization (WHO) has issued the "*Global status report on road safety 2015*" which indicated that the deaths due to RTA has plateaued, with the highest burden of fatality rates occur in poor countries [3].In the second half of the *Decade of Action for Road Safety (2011 – 2020)*, the WHO aims to reverse the number of annual fatalities from RTA. Achieving such aim requires multi-level collaboration, increased awareness, and

implementing legislations that enhance road safety. Furthermore, targeting potential risk factors responsible for RTA such as drinking alcohol, use of hypnotics, marijuana, speed, and wear of protective seatbelts and helmets are of paramount importance [4, 5]. One potential mechanism that can help in reversing fatality numbers pertaining to RTA is to carry out research and increase input of the scientific committee toward this subject. Research on RTA can help prioritize resources and direct researchers to aspects in which a gap is to be filled for reaching an optimum national health.

A recent article considered traffic injuries as a neglected health topic and called for an increase attention to the topic [6]. In the past decade, two published articles assessed the worldwide research output in the field of traffic safety. The first article was a specific one and the authors did a scientometric analysis of data pertaining to traffic medicine using the "Web of Science" (WoS) database and topic search methodology [7]. A second article was a general one and did a qualitative analysis in road safety research between 1900 and 2010 [8]. After five years of implementing the "*Decade of Action for Road Safety (2011 – 2020)"*, and the absence of any scientometric or bibliometric analysis of traffic medicine data published after 2008, a new analysis needs to be carried out. Such new analysis needs to add new dimension to the already present literature and to avoid any bias that could have been made in similar previously published articles. Therefore, the objective of this study was to carry out a bibliometric analysis of traffic medicine – related publications. To add a new dimension to this study, Scopus database instead of WoS was used to retrieve the required data. Scopus is a well-known database and is at least 20% larger than WoS [9]. Furthermore, many of the journals produced by developing countries, where the burden of RTA is high, are indexed in Scopus. Furthermore, since the term traffic-medicine is a wide one, we used a strategy that retrieved articles published in journals that have been indexed in Scopus database under subjects categorized as health. In previous publications, the term traffic-medicine was practically defined as those publications pertaining to public health which might have actually led to under-representation of the topic.

This study is an effort to endorse and support the *Decade of Action for Road Safety (2011 – 2020)* plan in its second half and to enrich the literature in the field of RTA and to fill in gaps in the field of traffic medicine.

Methods

In this study, keywords used to retrieve publications on traffic accidents included keywords used in previous studies with new additions [7]. The results obtained were limited by data published in journals categorized under health subjects in Scopus. This step was done to focus analysis on traffic medicine publications. **Figure 1** shows the search strategy and search query that included keywords used, time period, and type of source included in the analysis while **Figure 2** shows the health – related subjects that were selected to retrieve refine raw data to obtain traffic medicine - related publications. For the purpose of this study, Scopus database was used to retrieve data and present bibliometric indictors pertaining to quantity and quality of publications. Hirsch index (*h*-index) was used as measure of quality. The time span set for this study was from 2008 to 2015. The choice of this time span was made because it has not been covered by previous similar studies [7].

To visualize inter-country collaboration, VOSviewer technique, a software tool used for visualization of bibliometric indicators, was used [10]. ArcGIS 10.1, which is a geographic information system software, was used to present the geographical distribution of publications. For calculation of author productivity as well as annual growth of publications, previously used equations were elaborated along with each table of data presented and the appropriate citation for equations used.

Results

A total of 2,029 journal articles were found. Therefore, the mean productivity per year was 254 documents. The majority (1,671; 82.36%) were research articles. Types and frequencies of

retrieved documents were shown in **Table 1.** The majority of traffic medicine – related publications were in English (1,717; 84.6%). Other commonly encountered languages include Spanish (87; 4.28%) and Portuguese (55; 2.71%). Retrieved documents received a total of 13,883 citations, a mean of 6.8 ± 14.6 citations per document; a median of 2 (Q1=0; Q3=7). The *h*-index of retrieved documents was 46.

Growth of publications

A gradual increase in the number of traffic medicine – related publications was observed. A total of 327 documents were published in 2015 and a total of 216 documents were published in 2008. Citation analysis showed a decline in the number of total citations with time. **Table 2** shows detailed citation analysis per year while **Table 3** shows analysis of growth of publications with time. The relative growth rate (RGR) of publications declined from 0.63 in 2008 to 0.18 in 2015. However, the doubling time (DT), which is the time required number of publications to double, increased from 1.1 in 2008 to 3.55 in 2015. **Figure 3** shows the annual growth of traffic medicine – related publications and those pertaining to search query in general. In 2008, traffic medicine - related publications were approximately 70% of total publications on traffic accidents in general. In 2015, this percentage dropped to approximately 67%.

Productivity and authorship pattern

Retrieved publications were authored by 8,478 researchers. The mean number authors per document was 4.18 and showed an increasing trend with time (**Table 4**). Single – authored publications constituted 11.33% of retrieved documents while multiple – authored publications constituted 88.66% suggesting a high prevalence of team research. Multi-authored publications had a collaboration index (CI) ranging from 4.36 to 5.12 with a mean of 4.58 (**Table 5**).

Country profile and Geographical distribution of publications

Geographic distribution of publications was presented in world map using ArcGIS 10.1 software (**Figure 4)**. Researchers from 101 different countries were involved in publishing the relevant documents. **Table 6** is a list of countries with a minimum productivity of 50 publications. The USA was the leading country in terms of productivity followed by India and Canada. Inter-country collaboration among active countries indicated that Sweden, the UK and Canada are leading in international collaboration while Brazil and India are lagging behind in international collaboration. Extent of collaboration among countries listed in table 6 is shown in **Figure 5**. International collaboration links were strongest in the following cases: USA – Canada (link strength = 27); USA – UK (link strength=9); USA – China (link strength = 19); USA – Australia (link strength = 12).

Active institutions and preferred source titles

Most active institutions involved in traffic medicine research were presented in **Table 7. F**ive active institutions were in the USA while four institutions were in Canada. *University of Toronto* was the leading institution and produced a total of 36 documents. Preferred source titles for publishing traffic medicine – related publications were listed in **Table 8**. *Accident Analysis and Prevention* ranked first with 211 documents followed by *Traffic Injury Prevention* and *Injury Prevention*.

Top cited documents

Table 9 shows a list of top 20 cited articles. The article that received the highest citation was published in *Accident Analysis and Prevention* and received a total of 228 citations [11]. Six articles in the top cited list were published in *Accident Analysis and Prevention* and four articles were published in sleep medicine - related journals.

Discussion

In this study we aimed to analyze traffic medicine – related data published after 2008 in journals indexed in Scopus. The strategy used in this study was using title search for phrases that had been

used in previously published articles in the field of traffic safety or traffic medicine. Title search strategy is considered a conservative strategy since it will not retrieve irrelevant or false positive results compared to topic search strategy in which title/abstract/keywords are searched for the particular phrase. In this study we tried to minimize false positive or irrelevant results even if this could lead to a small percentage of false negative results. The use of Scopus in this study is justified since we were aiming to retrieve the largest number of published data which can be achieved using Scopus rather than WoS or PubMed. One more point regarding the methodology adopted in this study was refining retrieved data to narrow the results to traffic medicine related publications. Scopus has the advantage of categorizing results into subjects based on the indexing of the journals. Therefore, the process of retrieving traffic medicine – related publications was facilitated by limiting the general search to subjects considered within the health scope.

The growth of traffic medicine – related publications during the study period was slow. The overall growth during the study period was 51.39%. This is relatively low compared to the growth rate in other scientific fields such as mobile technology [12], malaria vector resistance [13], spine surgery [14], and others [15]. The research activity in traffic medicine does not seem to match reported mortalities and morbidities from traffic crashes and accidents from several parts of the world. From 1990 to 2010 there has been an increase in total number of deaths due to road traffic injuries by 46% which made RTI to occupy the eight position as a leading cause of death by 2010 and if the trend of fatalities continue as is then RTI will be the fifth leading cause of death by 2030 [16, 17]. Reports from certain parts of the world called for an immediate action due to the increasing numbers of deaths and injuries due to RTA. A study from Iran reported that there was an annual average of 21,000 deaths which needs serious attentions[18]. Similar results were presented by a study in India [19]. The slow growth of traffic medicine – related publications was also accompanied by slow growth of citations and the overall *h*-index of publications in this field was relatively low compared to those in other medical fields such as certain rare diseases such as Stevens Johnson Syndrome [20]. A potential reason for the slow growth of traffic medicine – related publications is the lack of relatively suitable budget for research funding particularly in low and middle income countries[6, 21]. The 10/90 gap was described by the Global Forum of Health Research to indicate the imbalance in expenditures relevant to health problems in LMICs [22].

Research productivity in the field of traffic medicine is dominated by the USA. The USA was leading and ranked first in productivity in many other medical subjects [23, 24]. However, the active country list included countries other than European countries such as Iran, India, Turkey, and Brazil. According to WHO, 90% of road traffic deaths occur in LMICs. International collaboration in research is believed to increase research output and enhance quality of research[25]. Unfortunately, the level of international collaboration in over-populated countries such as India or China is less than optimal. Training and research contributed positively in preventing RTA and injuries in high-income countries. The *Road Traffic Injuries Research Network* (RTIRN) was created more than 15 years ago to facilitate reductions in the burden of road traffic injuries in low and middle – income countries (LMICs) by supporting evidence-based research and capacity building in road safety research [26].

Of the top cited articles, four were published in sleep related journals. Such highly cited articles focused on effect of sleep apnea and use of hypnotics on incidence of road traffic accidents. Several studies have linked the use of sleep aid and hypnotics with increased risk of motor accidents [27-29]. Use of alcohol and psychoactive drugs have been reported to increase the risk of traffic accidents and fatalities [30-32]. One of the top cited articles in the field of traffic medicine was a review article published in *Pharmacoepidemiology and Drug safety Journal* which discussed the impact of medications on traffic safety with the emphasis that larger studies in this field are

urgently needed [33]. Certain clinical conditions such as sleep apnea have also been associated with increased risk of traffic accidents [34, 35]. A review article published in Journal of *Accident Analysis and Prevention* discussed the role of sleep disorders and other medical conditions [36].

In our study, the most preferred source title for traffic medicine publication was journal of *Accident Prevention and Analysis*. This journal is a multi-disciplinary journal published from the UK since 1969 and has an impact factor of approximately 2. Seven of the top cited articles were published in the journal of *Accident Prevention and Analysis.* Several other journals in the field of traffic injury were preferred for publications such as *Traffic Injury Prevention, Injury Prevention,* and *Transportation Research.* This is expected since these are specialized journals in the field of traffic engineering and transportation safety. However, other preferred journals in the field of health were seen such as BMC Public Health, Gaceta Sanitaria, and Emergency Medicine.

This bibliometric analysis, is not the first one in the field of traffic medicine. However, it has some advantages over other and has some limitations like any other bibliometric study. In our study, Scopus constitutes a point of advantage since it is larger than WoS. Also, refining the data of traffic publications by all subjects listed in Scopus as health discipline is another point of strength. However, the search query used in this study might not be comprehensive and false negative results is a possibility. Furthermore, the use of title search created minimum false positive but might have created some false negative results. As an overall, this article is a step forward in endorsing an important field that constitute a real health and global burden. Furthermore, this study will be a baseline data for the Decade of Action launched by the UN. Future assessment will used the data presented here for comparison.

Conclusions

The study period which included the first half of the *Decade of Action for Road Safety* was characterized by slow growth of traffic medicine – related publications, decreased relative growth rate and increased doubling time suggestive of relative lack of global interest or lack of funding to traffic research. The bulk of research in this field is dominated by American and Canadian institutions. The most preferred source title for traffic medicine – related publications was Journal of *Accident Prevention and Analysis.* Articles with high citations in this field were diverse and included topics related to medication, sleep apnea, predictors of traffic accidents, and role of age in RTA.

Abbreviations

USA: United States of America;
UK: United Kingdom
RTA: Road traffic accidents
RTI: Road traffic injuries

Declarations

Ethics Approval and Consent to Participate: Not applicable

IRB at An-Najah National University, Palestine requires no approval for bibliometric studies

Consent for publication: Not applicable

Availability of data and materials: all data presented in this manuscript are available on Scopus database using the search query listed in the methodology section.

Competing interests

The authors declare that they have no competing interests.

Funding: None

Authors' contributions: all authors contributed equally to this manuscript. All contributed to idea, design, analysis, writing and submission.

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