

UNDERREPORTING OF ROAD TRAFFIC ACCIDENTS: A BIBLIOMETRIC ANALYSIS FROM WEB OF SCIENCE DATABASE

(Kemalangan Jalan Raya yang Tidak Terlapor: Analisis Bibliometrik dari Pangkalan Data Web of Science)

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ABSTRACT

According to the 2030 Agenda for Sustainable Development Goals (SDGs), the 9th and 11th goals: "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation," and "Make cities and human settlements inclusive, safe, resilient, and sustainable" are both the vision and mission of the result from this paper are accomplishing for. Although road traffic accidents are a common occurrence in most countries, there is evidence indicating that the number of actual accidents is not properly reported. The proof can be evaluated from a mismatched record between the police and hospital data. This concern has a significant impact on public safety and other components of a country as well. In layman's terms, "underreporting" is the act of reporting fewer numbers than the exact count. In justifying this prevailing research situation, this paper applies the Bibliometric Analysis using the Bibliometrix and Biblioshiny software packages to analyze and visualize the data of a search conducted in the Web of Science Core Collection Database yielded publication results spanning from 1970 to 2023. The results indicate (i) 4,915 papers using the keyword "underreporting", (ii) 33 papers using the keyword "underreporting of road traffic accidents", and (iii) 3 papers using the keyword "underreporting of road traffic accidents in Malaysia". This study is expected to provide an overview of underreporting of road traffic accidents. The impact of underreporting contributes to the setback of incomplete statistical analysis. Although official records are the most useful source of information and exactness, underreporting complements the computation of true results.

Keywords: underreporting; road traffic accidents; Bibliometric Analysis; Web of Science

ABSTRAK

Matlamat ke-9 dan ke-11 yang terkandung di dalam Agenda 2030 dari keseluruhan 17 Matlamat Pembangunan Lestari (SDGs) iaitu: "Membina infrastruktur kukuh, mempromosikan industri yang menyeluruh dan mampan serta merangsang inovasi" dan "Menjadikan bandar dan penempatan yang inklusif, selamat, kukuh dan mampan" merupakan visi dan misi yang ingin dicapai hasil dari kajian ini. Walaupun kemalangan jalan raya merupakan perkara biasa yang berlaku di kebanyakan negara, terdapat bukti yang menunjukkan bahawa sebilangan dari kejadian ini tidak dilaporkan dengan tepat. Ini dapat dibuktikan dari rekod yang didapati tidak sepadan di antara data polis dan data hospital. Kebimbangan ini memberi impak yang besar terhadap keselamatan awam dan komponen lain dalam sesebuah negara. Dalam istilah mudah, "tidak terlapor" adalah tindakan melaporkan jumlah yang lebih sedikit berbanding dari jumlah yang sebenar. Bagi mengesahkan kenyataan ini, Analisis Bibliometrik yang mengandungi pakej perisian Bibliometrix dan Biblioshiny digunakan untuk menganalisis dan menggambarkan keseluruhan data dari carian Pangkalan Koleksi Teras Web of Science dengan capaian penerbitan dari tahun 1970 hingga 2023. Hasil carian tersebut menunjukkan terdapat sebanyak (i) 4,915 manuskrip yang menggunakan kata kunci "tidak terlapor", (ii) 33 manuskrip yang menggunakan kata kunci "kemalangan jalan raya yang tidak terlapor", dan (iii) 3 manuskrip yang menggunakan kata kunci "kemalangan jalan raya yang tidak terlapor di Malaysia". Hasil dari kajian ini diharap dapat memberi

pendedahan tentang kemalangan jalan raya yang tidak dilaporkan. Isu ini merupakan penyumbang kepada analisis statistik yang tidak lengkap. Walaupun rekod rasmi merupakan sumber yang paling berguna dan sahih, maklumat dari data “tidak dilaporkan” melengkapkan pengiraan agar menjadi lebih sempurna.

Kata kunci: tidak dilaporkan; kemalangan jalan raya; Analisis Bibliometrik; Web of Science

1. Introduction

Underreporting is the practice of providing incomplete or inaccurate information to an outside party, such as a government agency, an employer, or a creditor. This practice is often done intentionally to avoid legal or financial obligations. Underreporting exists on occasions such as not reporting all of one's income and property, not accurately reporting the number of hours worked on a job, not reporting road traffic accidents that have happened, and many more.

1.1. Overview of road traffic accidents

In most countries including Malaysia, a police report is the official statistical database on any occurrence of reported traffic road accidents. Reporting rate of traffic road accidents may vary in a few categories such as by location, time, environment, types of roads, age of the involved victims, injury level whether it is minor or major, and also the number of vehicles involved in the traffic road accidents (Alsop & Langley 2001). Unfortunately, there is also a situation where there are traffic road accidents happen, but there are no records reported. This scenario is called underreported data.

In the research conducted by Ward *et al.* (2006), it is agreeable that there is the existence of underreporting of casualties to the police at some point. In sub-Saharan Africa, accurate data is scarce, and underreporting from primary data sources is common although road traffic injuries are the major cause of preventable death (Samuel *et al.* 2012). Underreported traffic road accidents do occur, just not recorded due to some reasons: (i) the person/party involved does not want to make it a big deal, (ii) the injury is very minor, (iii) settlement between both parties been done personally, and (iv) they find it so inconvenience to report it to the authorities.

A proper recording system in the database is essential and it must be as accurate as possible because there are few related authorities and groups that use the data for certain purposes (Maxwell *et al.* 2018). Other groups that use the information on traffic road accidents data for different kinds of purposes include:

- The road safety engineers – for analysis and development measures;
- Lawyers – for legal purposes;
- Insurance companies – for insurance claims;
- Researchers – for analytical and further research;
- Policymakers – for designing the policy on road safety; and
- Safety administrators – to create an awareness program for society.

Road traffic accidents are unfortunately a common occurrence around the world. In many countries, traffic fatalities are reported and tracked, but in some cases, there is evidence that indicates that the number of actual fatalities is much higher than what is reported. Underreporting of road traffic accidents, which can have serious consequences for the public's safety, is primarily the criticism for this.

Underreporting of road traffic accidents can occur for several reasons. In some cases, traffic fatalities may not be reported because the local authorities do not have the resources to do so. This is especially true in developing countries, where there may not be adequate infrastructure or resources available to conduct investigations into traffic accidents. In other cases, traffic deaths may not be reported because of cultural taboos around discussing death or because of a lack of understanding about the need to report accidents. In some cases, families may not report a death to avoid paying for a funeral or other expenses associated with the death.

The consequences of underreporting in road traffic accidents can be serious. Accurate reporting of traffic fatalities is important for understanding the problem's scope and developing strategies to address the issue. Without accurate data, it is more difficult to identify areas of risk and develop targeted public safety initiatives. In addition, underreporting of road traffic accidents can lead to a false sense of security, as people may believe that the roads are safer than they are.

1.2. Objectives of the study

The objective of this study is to highlight the topic of underreporting of road traffic accidents by applying the Bibliometric Analysis and discussing the consequences if no action were taken to overcome the incidents.

The previous study mainly focuses on the literature on road traffic injury (Jing *et al.* 2021; Sharma *et al.* 2018), issues and challenges (Singh 2017), and the risk factors of road traffic accidents (Touahmia 2018; Sami *et al.* 2013), plus, there are few and limited papers employing the Bibliometric Analysis as the research approach.

2. Literature Review

2.1. Unveiling underreporting: An overview across various disciplines

Underreporting refers to the phenomenon where incidents or events are not reported or documented in official records. This phenomenon can occur in various fields and disciplines, not just limited to road traffic accidents. To explain underreporting in other disciplines, below are some of the common fields that are troubled by the incidents:

- (1) Healthcare - Underreporting of medical errors and adverse events, underreporting of hospital-acquired infections, and underreporting of patient injuries. Underreporting health statistics can lead to inadequate patient care, medical errors, and potentially life-threatening situations. Inaccurate data can also lead to misdiagnosis and incorrect treatment of illnesses, which can have long-term medical consequences.
- (2) Retail - Underreporting of sales figures, underreporting of inventory, and underreporting of customer complaints. This may lead to difficulties in reporting the business operation and performance.
- (3) Financial services - Underreporting of income, underreporting of expenses, and underreporting of customer complaints. Underreporting of financial information can lead to misstated financial statements, inaccurate financial reporting, and potential fraud. This can lead to financial losses, increased legal and regulatory scrutiny, and reputational damage.
- (4) Manufacturing - Underreporting of product defects, underreporting of safety incidents, and underreporting of employee injuries. Underreporting of production data can lead to

decrease customer satisfaction, financial loss, and reputational damage. It can also lead to a lack of insight into production processes and product quality, which can result in higher production costs and lost orders.

- (5) Technology - Underreporting of software bugs, underreporting of security breaches, and underreporting of customer complaints. This situation will cause the technology service provider to be left behind the others in the same industry.
- (6) Education sector - Underreporting student performance data can lead to an inaccurate assessment of the quality of education offered by an institution. This can lead to students being misled about the education they can expect to receive and make it difficult for educational institutions to measure and improve their performance.

2.2. Case study – Example of underreporting in healthcare policy

A study conducted by Wu *et al.* (2015) entitled “Underreporting of maternal mortality in Taiwan: A data linkage study” investigated the extent of underreporting of maternal mortality in Taiwan's official published statistics. The sources of data employed in the study are from the National Health Insurance claims of two million samples, which were linked with the official published mortality data. The scope of the study is women aged between 15-49 years, who have been hospitalized with pregnancy, passed away either during the pregnancy or within 42 days after it ended, and with the range period of the year 2000 to 2009.

The results of the study found 26 maternal deaths, only nine of which were included in the officially published mortality data. This means that the underreporting rate was 65% [(26 - 9) / 26]. The revised maternal mortality ratio was 14.1 deaths per 100,000 live births (95% confidence interval: 8.7-19.5), which was about three times higher than the officially reported ratio of 4.9 (95% confidence interval: 1.7-8.1). The most common causes of maternal deaths were amniotic fluid embolism with 10 cases, followed by eclampsia and preeclampsia with 4 cases, obstetric hemorrhage, cerebrovascular and cardiovascular disease with 3 cases each, puerperal infection with 2 cases, and lastly is the category of others with only 1 case.

The study concluded that around two-thirds of the maternal deaths in Taiwan went unreported in the officially published mortality data. Therefore, it is crucial to have routine nationwide data linkage to accurately monitor maternal mortality in Taiwan.

2.3. Underreporting of road traffic accidents

The amount of research discussing the topic of road traffic accidents scenario in Malaysia was conducted broadly. To name a few, Mustaffa and Hokao (2013) developed a database system for road traffic accidents that can be used to reduce the fatalities of road accidents only for the state of Johor Bahru, while Kamaluddin *et al.* (2019) studied data linkage of matching police and hospital record in the state of Melaka which yield only a 4.7% matching rate, with hospital data as a reference.

Besides that, Nik Zamri and Zamzuri (2019) attempt to estimate the proportions of unreported accidents in Malaysia through a questionnaire survey conducted on the issue and found that the proportions of unreported accidents for slight and serious injuries are at an alarming rate, approximately 50% for both. On top of that, Md Isa *et al.* (2022) determines the prevalence and factors associated with non-fatal injuries (NFIs) due to road traffic accidents among Malaysia's adult population which are positively becoming one of the causes of public health problems worldwide that significantly affect the morbidity of the society and also increase the cost of healthcare in particular. Below are the listings of some issues with underreporting in road traffic accidents:

- (1) Lack of awareness of reporting requirements - Many people may not be aware that they are required to report road traffic accidents, or may be unaware of the process for doing so.
- (2) Fear of the consequences - People may be reluctant to report road traffic accidents for fear of being held accountable for their actions or for fear of legal effect.
- (3) Difficulty to gather information - It can be very difficult for people to accurately report the details of a road traffic accident, especially if they are severely injured or in shock themselves.
- (4) Cost of reporting - People may be reluctant to report a road traffic accident due to the associated cost of doing so, such as the cost of obtaining an accident report from the police or the cost of paying for a lawyer.
- (5) Fear of insurance increases - People may be concerned that reporting a road traffic accident will result in their insurance premiums increasing.
- (6) Time allocation - People may be reluctant to report a road traffic accident due to the amount of time it can take to do so, including the time taken to fill out the paperwork and/or attend the court proceedings.
- (7) Acknowledgment - People may not be motivated to report a road traffic accident due to a lack of incentive to do so, such as a reward for reporting or a recognition of the time and effort they took to report.

3. Methodology

3.1. Data sources

Web of Science (WoS) is one of the most important databases for indexing and abstracting legitimate, peer-reviewed scientific material. The sources of data used for this paper are particularly from the WoS, a platform that presents access to numerous databases of documents ranging from academic journal articles, editorial material, reviews, and conference proceedings papers. The main information about the data provides several variables: timespan, sources (books, journals, proceedings), and the documents containing the authors, keywords, abstract, references and etcetera. WoS provides various academic disciplines diversifying in the field of sciences, social sciences, arts, humanities, engineering, transportation, and healthcare, to name a few.

WoS database's core collection was used as the data source for this paper. There are 3 stages of search keyword/terms used: (i) Stage 1 – using the keyword “underreporting”, (ii) Stage 2 – using the terms “underreporting of road traffic accidents”, and (iii) Stage 3 – using the terms “underreporting of road traffic accidents in Malaysia”. The chosen literature consists entirely of documents in the English language and the document types encompass articles, proceedings papers, editorial materials, and review papers, spanning from 1970 to 2023 (as of March 2023).

3.2. Research methods

This study employs Bibliometric Analysis to compile all the quantitative data on the topic of underreporting research patterns. According to Xu *et al.* (2022), Bibliometric Analysis serves as an extensive overview of research literature by providing accessible quantitative and objective descriptions of research topics for the past and current periods.

Bibliometric Analysis is a conventional and one of the most favored quantitative approaches for analyzing the publication patterns of authors and scholarly works (Ninglasari

& Himmawan 2021). It is frequently used to assess publishing trends and patterns related to particular themes in library and information science studies. The Bibliometric Analysis has the advantage that it evaluates all articles that have been published on a given subject objectively, eliminating any potential selection biases (Paltrinieri *et al.* 2023).

Figure 1 illustrates the sequence of workflow in Bibliometric Analysis using RStudio. Researchers or user can choose their preferred e-databases such as WoS, Scopus, and Science Direct (Elsevier), and etcetera to perform the analysis. In the next step of the search string, researchers are free to type any keyword/s, whether to use both or only one of the operators of “And” and/or “Or”, depending on their topic.

WoS was chosen as the database for this study as the search results using the keyword “underreporting” with the publication date range from 1970 to 2023 resulted in 5019 publications compared to Scopus which resulted in only 601 publications, with the same variables used for searching in WoS.

The study of analysis comparing the two main academic literature collections (WoS and Scopus) by Chadegani *et al.* (2013), reveals that WoS has extensive coverage dating back to 1990, with a majority of journals published in English. On the other hand, Scopus includes a greater number of journals but with lower impact and focuses mainly on recent articles.

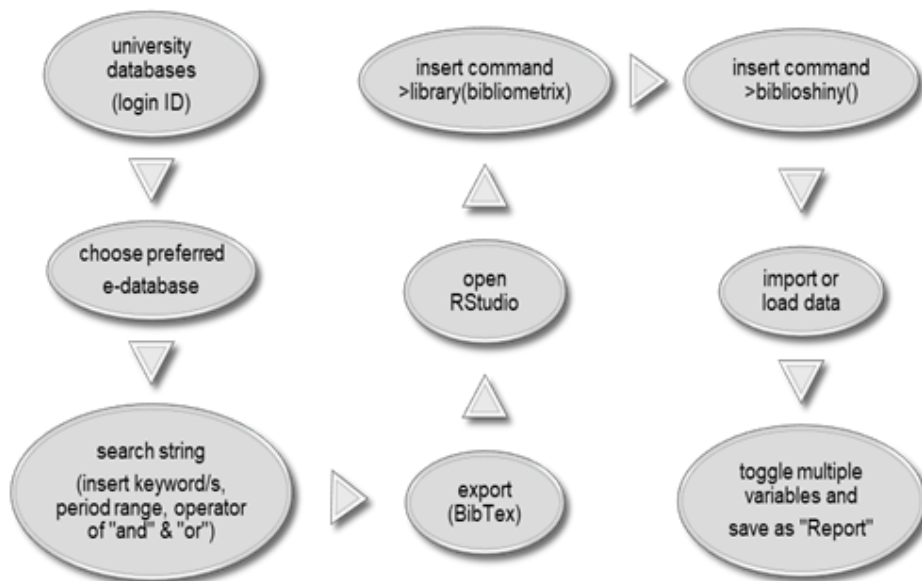


Figure 1: Sequence of workflow in Bibliometric Analysis using RStudio

This study reviews all document types including the article, proceedings paper, editorial material, and review paper. The keyword used was “underreporting”, “underreporting of road traffic accidents”, and “underreporting of road traffic accidents in Malaysia”, which resulted in 4,915 results, 33 results, and 3 results respectively.

The data selection was all in the English language, with the publication date of 1970 to 2023 chosen to search string as the period is the only selection of “All years” that is available in the WoS Core Collection. Unexpectedly, the results of exported data managed to provide the publication from the year 1994 to 2022 alone, and Table 1 indicates the fraction of publications over the years from 1994 to 2022.

Table 1: Exported data from Bibliometric Analysis of 33 publications

Year	Mean Total Citation per Article	N	Mean Total Citation per Year	Citable Years
1994	107	1	3.57	30
2002	27.5	2	1.25	22
2005	26	1	1.37	19
2008	119	1	7.44	16
2009	14	1	0.93	15
2010	13.5	2	0.96	14
2012	46.5	2	3.88	12
2013	140	1	12.73	11
2014	18	1	1.80	10
2015	33.67	3	3.74	9
2016	11.5	4	1.44	8
2017	30	1	4.29	7
2018	16.6	5	2.77	6
2019	13.8	5	2.76	5
2020	1	1	0.25	4
2021	5	1	1.67	3
2022	1	1	0.50	2
Total		33		

The Bibliometrix R package is a set of tools for quantitative research methods in scientific computation/analysis. It is developed in R, a platform and ecosystem that is available open-source and free. The upper hand in using R languages over other languages lies in the characteristics of the availability of numerous powerful statistical algorithms, accessibility to excellent numerical routines, and incorporated data visualization tools (Aria & Cuccurullo 2017).

This study employs the RStudio programming language, which comes with the function of "Biblioshiny", a user-friendly graphical interface for performing Bibliometric Analysis to evaluate the data (Aria & Cuccurullo 2017). By generating editable tables and figures in Excel and visualization networks with VOSviewer, the pattern of publication growth on the topic of underreporting in road traffic accidents is analyzed. The Bibliometric Analysis for this study is focusing based on the average citations, corresponding author's countries, high-frequency keywords, thematic map, and word dynamics that can be constructed and visualized using the VOSviewer application (van Eck & Waltman 2010).

Adding to the package, Massimo Aria created Biblioshiny as a follow-up to the Bibliometrix-based Shiny package in the R language, encapsulating the main code of Bibliometrix and producing a web-based online data analysis framework. The interactive web interface allows users to perform pertinent scientific measurement and visual analysis tasks, which to some extent lowers the user's threshold of use and information input intensity (Xu *et al.* 2022).

4. Results

4.1. Analysis of document types

This section presents the results of the Bibliometric Analysis employ for the study. Table 2 outlines the document types on underreporting of road traffic accidents for the period of 1994 to 2022. The distribution of the 33 publications used for the study comprised 4 different document types, namely (i) article – which amounted to 26 papers, (ii) editorial material –

which amounted to 1 paper, (iii) proceedings paper – which amounted to 4 papers, and (iv) review – which amounted to 2 papers.

From Table 2, it can be concluded that the articles from the journals contribute the highest value of document type used for the research topic of underreporting on road traffic accidents to almost 79% (26 papers), while editorial material contributes only 3% amounted to 1 paper respectively. The proceedings paper is 2nd on the list, contributing to 12% of the total number of papers, and the 3rd document type on the list is the review paper which allocates 6% of the overall total. As the references are sourced from reputable journals, this provides substantial justification for their validation and reliability.

Table 2: Document types

No	Document Types	Number of articles
1	Article	26
2	Editorial material	1
3	Proceedings Paper	4
4	Review article	2
	Total	33

4.2. Analysis of most relevant sources

Figure 4.1 below shows the most relevant sources on the research topic of underreporting in road traffic accidents. Accident Analysis & Prevention has published the highest number of papers amounting to 5 papers, followed by Traffic Injury Prevention with 4 papers, International Association of Traffic and Safety Sciences (IATSS) Research at the 3rd place with 3 papers, and both the International Journal of Injury Control & Safety and Safety Science with 2 papers respectively. The balance of 17 papers out of 33 papers used in the study is from the 17 other sources with the publication of 1 paper each and the details can be found in Figure 2 below.

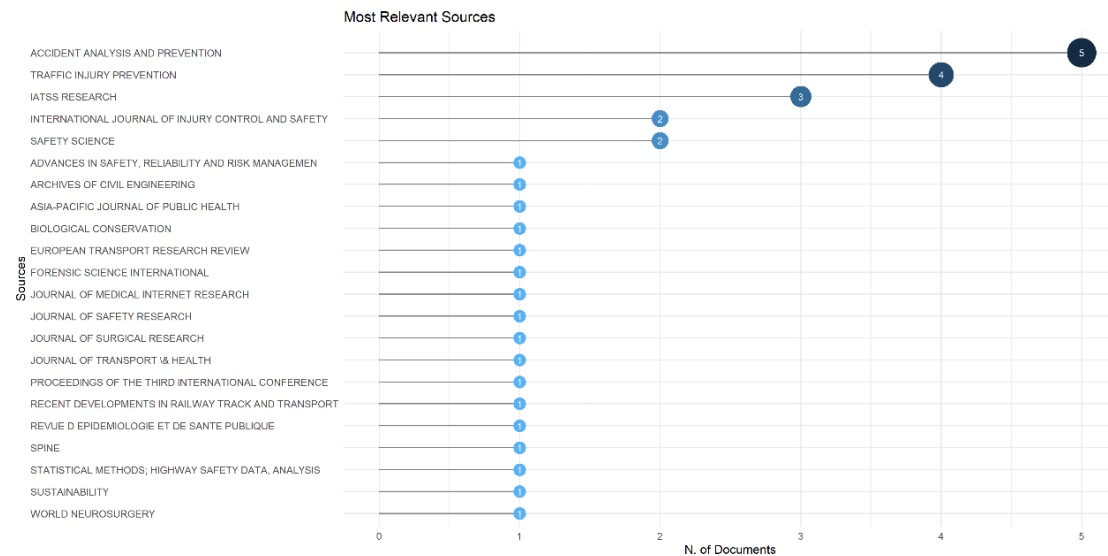


Figure 2: Most relevant sources

4.3. Analysis of top-3 publications on underreporting of road traffic accidents in Malaysia

In Bibliometric Analysis using the terms “Underreporting of Road Traffic Accidents in Malaysia” resulted in a total number of 3 papers as presented in Table 3. From Table 3, András Várhelyi was involved in those 3 publications himself followed by Muhammad Marizwan Abdul Manan with 2 publications out of the top 3 papers on the same research topic.

Table 3 indirectly indicates that throughout the period from 1994 to 2022, there were only 3 publications on the same research topic (underreporting of road traffic accidents in Malaysia), in which the gap has remained vacant for a period of 5 years, with the most recent publications dating back to 2018.

Table 3: Top-3 publications on underreporting of road traffic accidents in Malaysia (WoS)

No	Authors	Year	Title	Journal
1	Noor Azreena Kamaluddin, Camilla Sloth Andersen, Mette Kathrine Larsen, Katrine Rabjerg Melfoite, and András Várhelyi	2018	Self-reporting traffic crashes – a systematic literature review	European Transport Research Review
2	Muhammad Marizwan Abdul Manan and András Várhelyi	2012	Motorcycle fatalities in Malaysia	International Association of Traffic and Safety Sciences (IATSS) Research
3	Muhammad Marizwan Abdul Manan, András Várhelyi, Ali Kemal Çelik, and Hizal Hanis Hashim	2018	Road characteristics and environment	International Association of Traffic and Safety Sciences (IATSS) Research

^aWeb of Science (WoS).

4.4. Analysis of average citations per year

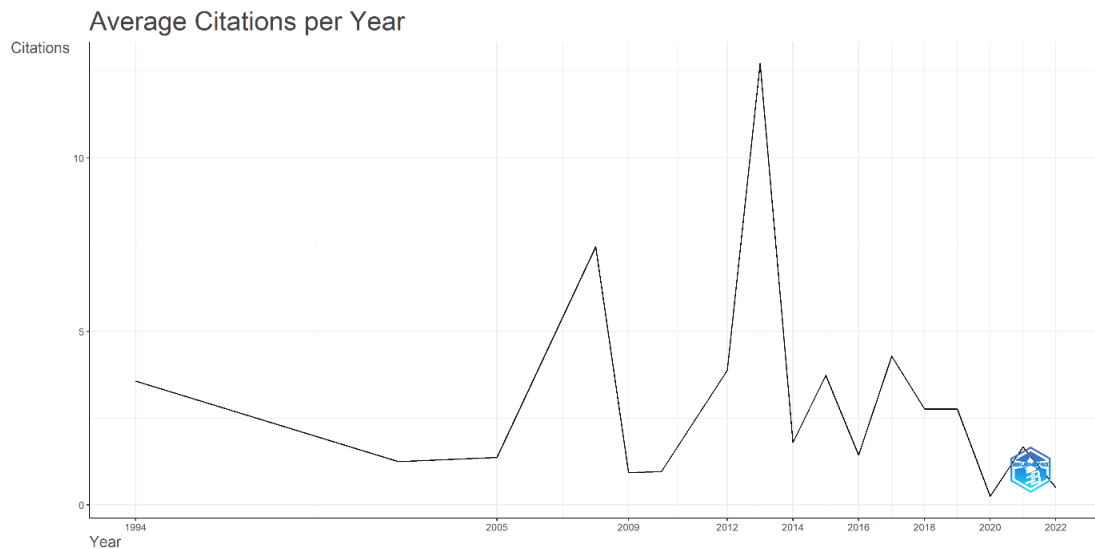


Figure 3: Average citations per year

Figure 3 shows an irregular pattern of the average citations per year starting 1994 to 2022. It shows that the early research period on underreporting started back in 1994. Unfortunately, at the beginning of the period, it already shows a decreasing trend and it continues a few times

more for the 30-year time-span. Especially in 2020, the average number of citations per year was at the lowest point (< 0.5).

For the first 10 years, it shows a decrease and unstable pattern, with an average of 1.5 to 1.8. And for the second 10 years (2005 to 2014), it continues to increase especially in 2008, the average citations almost hit 7.5 before declining tremendously in 2009. Starting in 2012, the average number of citations skyrocketed and reached its highest point of more than 12.5 in 2013. Once again, the pattern shows a decrease and before the end of the period of 20 years, in 2014 the average number of citations per year is at 2.0.

For the last period of 2015 to 2022, the pattern starts to show an irregular pattern again towards the end of 2022. Only from 2018 to 2019, the trend is horizontal with an average citation of 2.8. Surprisingly, the average number of citations hits the bottom line and reached the lowest in 2020 with 0.5, the lowest during the 3 decades of research. Overall, this indicates that the research on underreporting in road traffic accidents was not had a steady trend for the past 30 years since early of its acknowledgment in 1994.

4.5. Analysis of corresponding author's countries

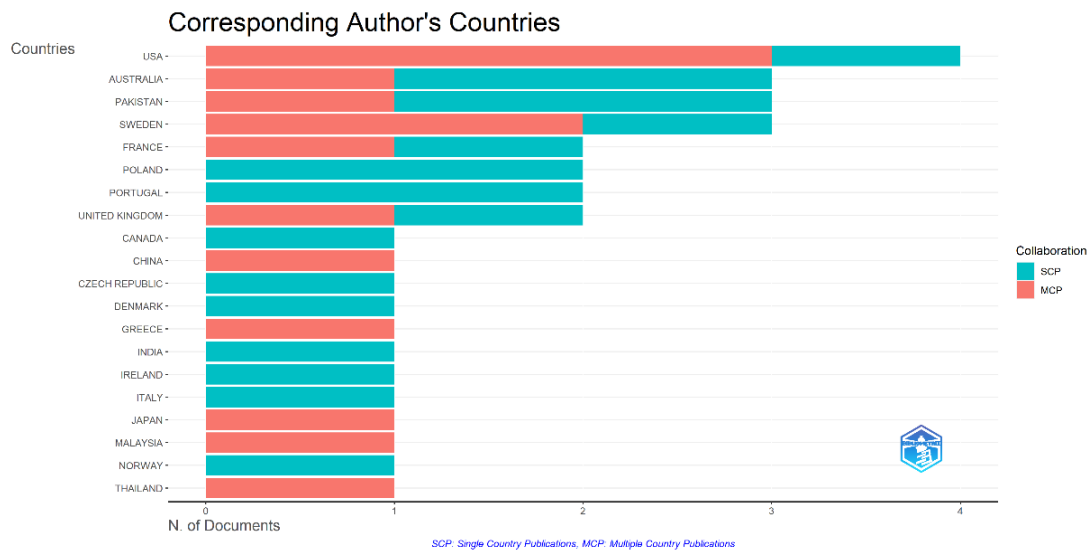


Figure 4: Corresponding author's countries

There are 2 types of collaboration on the publication based on the corresponding author's countries: (1) Single Country Publications (SCP), and (2) Multiple Country Publications (MCP). Figure 4 presented the 33 published papers from 20 corresponding authors' countries that were distributed in the following sequence: (i) one paper each from Thailand, Norway, Malaysia, Japan, Italy, Ireland, India, Greece, Denmark, Czech Republic, China, and Canada, (ii) two papers each from United Kingdom (UK), Portugal, Poland, and France, (iii) three papers each from Sweden, Pakistan, and Australia, and (iv) four papers are solely from United States of America (USA).

Statistically, SCP contributed to 58% of the research on underreporting of road traffic accidents and it consists of a total of 19 papers from the 20 corresponding authors' countries except China, Greece, Japan, Malaysia, and Thailand. While on the other hand, MCP amounts to 42% of the research on underreporting of road traffic accidents and it consists of a total of

Finally, the keyword “2005 – 2014” in the light grey-colored box of Figure 6 illustrates that during the period, underreporting of road traffic accidents is the talk of the town as it correlates to the highest citation in 2013 as analyzed earlier.

4.7. Analysis of thematic map

To enhance the quality of the findings, an analysis is conducted using the Bibliometric R-package. By selecting the thematic map function, this paper categorizes themes according to their centrality and density. Density can be used as a stand-in for a subject's development, and centrality can be defined as the subject's significance concerning the overall study area. While the density measures the strength of a theme's internal ties (i.e., between the keywords belonging to the respective theme), the centrality, on the other hand, measures the strength of external ties to other themes (Cobo *et al.* 2011).

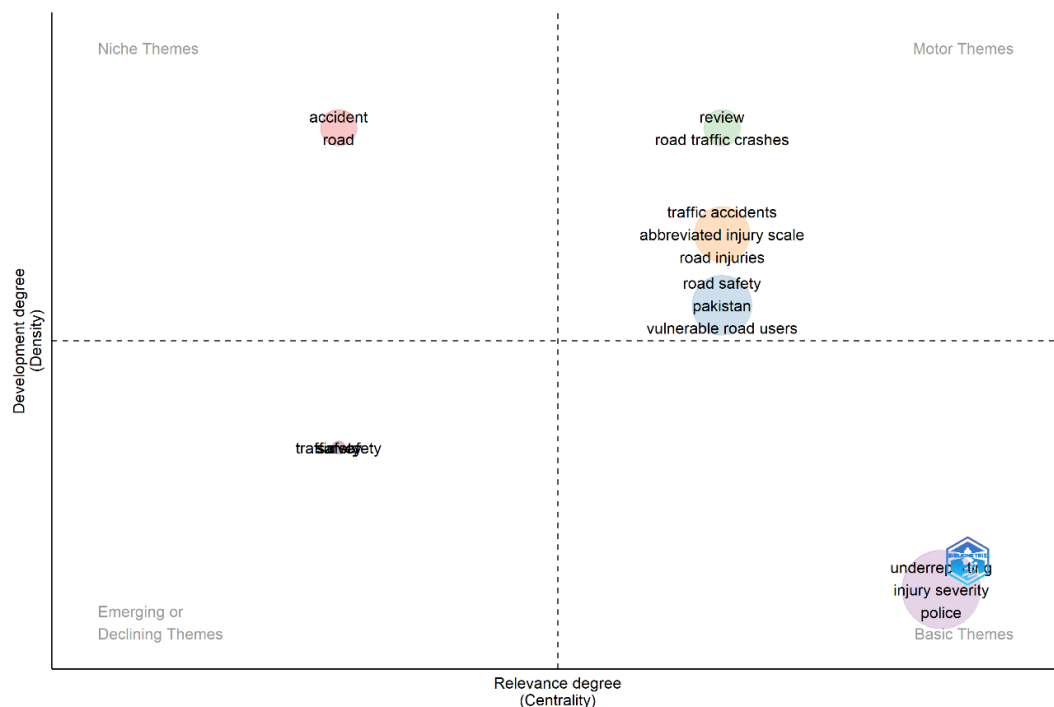


Figure 7: Thematic map

Based on these two parameters, the themes can be categorized into the following four quadrants as illustrated using a thematic grid in Figure 7.

- Quadrant I – Motor themes (high density/high centrality). Although motor themes are commonly used for the development of research topics, they also have strong internal ties. This means that they tend to appear more frequently together (Schöggl *et al.* 2020). Based on the analysis, “road safety” and “traffic accidents” occupy this quadrant.
- Quadrant II – Niche or isolated themes (high density/low centrality). These themes are specialized and can be regarded as external, but they differ from emerging/declining themes in a way that they have greater internal ties and a higher density.
- Quadrant III – Emerging or declining themes (low density/low centrality). In this quadrant, the themes have relatively few internal and external ties to other themes. Therefore, they can be treated as being of minimal importance in the respective field.

This scenario justifies that “underreporting” is a crucial part to be acknowledged as a drawback and needs to be fixed accordingly. Meanwhile, Figure 8 shows the word cloud, justifying “underreporting” as the most relatable keyword in this Bibliometric Analysis of underreporting in road traffic accidents.

5. Discussion

Various attempts have been made in investigating and researching the cause of the crash on the road and traffic accident occurrences. Some of them are such as related to the designing of the roadway, the environmental attributes, traffic congestion, and other tangible and intangible factors. Several steps can be taken to address underreporting of road traffic accidents. According to the research study conducted by Rezaein *et al.* (2016), there are a total of eight most important attributes causing road traffic accidents and one of them is the road geometric characteristic. Governments can invest in improving infrastructure and resources to ensure that all traffic fatalities are reported.

Commonly, in every country, most of the related authorities and government agencies especially the police departments, and hospitals are directly engaged with the up-to-date statistics and latest data to monitor the country's economic performance and social development. A proper recording system in the database is essential and it must be as accurate as possible because there are few related authorities and groups that use the data for certain purposes (Maxwell *et al.* 2018). In most of the past papers, the source of data is commonly based on the police report, in which the presence of extra zeros is often observed, indicating the underreporting scenario, possibly due to minor or no injury accidents (Singh *et al.* 2018; Ytterstad *et al.* 2018; Shinar *et al.* 2018). In Malaysia, the amount of research focusing on the underreporting scenario in Malaysia is still limited.

The underreporting rate also can be estimated through the data linkage technique. Neish (2015) states that in the process of integrating and managing data, the technologies of linked data show great promise. This approach has been done in traffic accident analysis as can be found in the research of Boufous *et al.* (2008) in which they linked the hospital and traffic crashes data sets to obtain a more comprehensive picture of traffic injuries in New South Wales (NSW), Australia. In Watson *et al.* (2015), the linkage of police-reported road crash data with hospital data is also examined to explore the potential for linked data to enhance the quantification of serious injury.

A comprehensive and complete database on the existence of road traffic accidents should be reported accurately to portray the actual number that will eventually provide information for the policy and lawmakers to construct road safety policies. The report data results can also benefit society as it will create guidelines for road safety awareness for them. In addition, public education campaigns can be used to raise awareness about the importance of reporting road traffic accidents and to encourage people to speak out if they have witnessed or been affected by a traffic accident. Finally, governments can implement policies to ensure that traffic fatalities are accurately reported, such as requiring that all deaths be registered with the local authorities. Below are the listings of recommendations that can be taken into consideration to overcome underreporting in road traffic accidents:

- (1) Increase awareness of the importance of reporting road traffic accidents;
- (2) Create public-friendly reporting systems to encourage people to report accidents without fear of punishment;
- (3) Implement stronger penalties for those who fail to report an accident;

- (4) Introduce incentives for people who report an accident, such as waived fines or free insurance coverage;
- (5) Provide better education for drivers on the importance of reporting accidents;
- (6) Improvement of technologies usage such as dash cameras and closed-circuit television (CCTV), which can provide evidence of accidents and encourage reporting;
- (7) Increase response times of emergency services to accidents, to ensure that victims receive the help they need quickly; and
- (8) Introduce a system of random checks to ensure that all accidents have been reported (check-and-balance).

Nowadays, road accidents are becoming life-threatening, which is considered one of the most hazardous in public health. As road transportation and logistics are growing rapidly, accidents due to this transportation lead to serious human and financial loss. Ensuring road safety is a foremost concern for a safe transportation service to society by the government of any country. But, most of the current road accident studies only focus on the highlight of the risk factors analysis, and rarely on looking into the underreported data of traffic road accidents.

6. Concluding Remark

Underreporting is indeed a certain issue that is both widespread and serious. It can lead to inaccurate data and a lack of trust in statistics and research, as well as a lack of accountability and transparency in reporting. It also has a significant economic and social impact, as it can lead to the misallocation of resources and a lack of understanding of the true state of affairs. The impact of underreporting contributes to the setback of incomplete statistical analysis. Although official records are the most useful source of information and accuracy, underreporting complements the computation of true results.

This study offers extensive knowledge and guidelines through a Bibliometric Analysis focused on the underreporting of road traffic accidents. The findings have the potential to provide valuable insights to authorities, consumers, policymakers, researchers, and academics, aiding them in their respective endeavors. The topic of underreporting of road traffic accidents opens various opportunities for in-depth directions for future research.

Since the data sources of this paper were only selected using a single indexing database (Web of Science), the coverage of perspectives on the topic is quite limited. Therefore, to complement the insufficiency and to facilitate further research, it is recommended to explore the perspectives of authors and researchers regarding other databases as well in enhancing the features of these databases and provide improved facilities based on user feedback. Perhaps the data sources can be expanded to other references such as Scopus-indexed publications, Science Direct (Elsevier), and Google Scholar to comprehensively engaged with the scenario.

References

- Alsop J. & Langley J. 2001. Under-reporting of motor vehicle traffic crash victims in New Zealand. *Accident Analysis & Prevention* **33**(3): 353-359.
- Aria M. & Cuccurullo C. 2017. Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics* **11**(4): 959-975.
- Boufous S., Finch C., Hayen A. & Williamson A. 2008. *Data linkage of hospital and police crash datasets in NSW*. Technical Report. Sydney: NSW Injury Risk Management Research Centre, University of New South Wales.

- Chadegani A.A., Salehi H., Yunus M.M., Farhadi H., Fooladi M., Farhadi M. & Ebrahim N.A. 2013. A comparison between two main academic literature collections: Web of Science and Scopus databases. *arXiv preprint arXiv:1305.0377*.
- Cobo M.J., López-Herrera A.G., Herrera-Viedma E. & Herrera F. 2011. An approach for detecting, quantifying, and visualizing the evolution of a research field: a practical application to the Fuzzy Sets Theory field. *Journal Informetrics* **5**(1): 146–166.
- Jing L., Shan W. & Zhang Y. 2021. A bibliometric analysis of road traffic injury research themes, 1928–2018. *International Journal of Injury Control and Safety Promotion* **28**(2): 266-275.
- Kamaluddin N.A., Abd Rahman M.F. & Várhelyi A. 2019. Matching of police and hospital road crash casualty records - a data-linkage study in Malaysia. *International Journal of Injury Control and Safety Promotion* **26**(1): 52-59.
- Maxwell O., Mayowa B.A., Chinedu I.U. & Peace A.E. 2018. Modelling count data; A generalized linear model framework. *American Journal of Mathematics and Statistics* **8**(6): 179-183.
- Md Isa Z., Ismail N.H., Ismail R., Mohd Tamil A., Ja'afar M.H., Nasir N.M., Miskan M., Abidin N.Z., Ab Razak N.H. & Yusof K.H. 2022. Assessing factors associated with non-fatal injuries from road traffic accidents among Malaysian adults: A cross-sectional analysis of the PURE Malaysia study. *International Journal of Environmental Research and Public Health* **19**(14): 8246.
- Mustaffa A.A. & Hokao K. 2013. Database development of road traffic accident case study Johor Bahru, Malaysia. *Journal of Society for Transportation and Traffic Studies* **3**: 1–8.
- Neish P. 2015. Linked data: what is it and why should you care? *The Australian Library Journal* **64**(1): 3-10.
- Nik Zamri N.S. & Zamzuri Z.H. 2019. Estimating the proportion of non-fatality unreported traffic accidents in Malaysia. *ASM Sc. J.* **12**(1): 239-245.
- Ninglasari S.Y. & Himmawan M.F. 2021. Mosque library: Bibliometrics Analysis based on Web of Science (WOS) database. *Library Philosophy and Practice (e-journal)* 6455.
- Paltrinieri A., Hassan M.K., Bahoo S. & Khan A. 2023. A bibliometric review of sukuk literature. *International Review of Economics and Finance* **86**: 897-918.
- Rezaein A., Shokohyar S. & Zolfaghari S. 2016. Clustering and classification of road accidents in Iran using data mining techniques. *International Journal of Business & Information* **11**(3): 365-383.
- Sami A., Moafian G., Najafi A., Aghabeigi M.R., Yamini N., Heydari S.T. & Lankarani, K.B. 2013. Educational level and age as contributing factors to road traffic accidents. *Chinese Journal of Traumatology* **16**(5): 281-285.
- Samuel J.C., Sankhulani E., Qureshi J.S., Baloyi P., Thupi C., Lee C.N., Miller W.C., Cairns B.A. & Charles A.G. 2012. Under-reporting of road traffic mortality in developing countries: Application of a capture-recapture statistical model to refine mortality estimates. *PloS ONE* **7**(2): e31091.
- Schöggel J.-P., Stumpf L. & Baumgartner R.J. 2020. The narrative of sustainability and circular economy - A longitudinal review of two decades of research. *Resources, Conservation, and Recycling* **163**: 105073.
- Sharma N., Bairwa M., Gowthamghosh B., Gupta S.D. & Mangal D.K. 2018. A bibliometric analysis of the published road traffic injuries research in India, post-1990. *Health Research Policy and Systems* **16**(1): 18.
- Shinar D., Valero-Mora P., van Strijp-Houtenbos M., Haworth N., Schramm A., Bruyne G.D., Cavallo V., Chliaoutakis J., Dias J., Ferraro O.E., Fyhri A., Sajatovic A.H., Kuklane K., Ledesma R., Mascarell O., Morandi A., Muser M., Otte D., Papadakaki M., Sanmartín J., Dulf D., Saplioglu M. & Tzamalouka G. 2018. Under-reporting bicycle accidents to police in the COST TU1101 international survey: Cross-country comparison and associated factors. *Accident; Analysis and Prevention* **110**: 177-186.
- Singh P., Lakshmi P.V.M., Prinja S. & Khanduja P. 2018. Under-reporting of road traffic accidents in traffic police records - a cross-sectional study from North India. *International Journal of Community Medicine and Public Health* **5**(2): 579-584.
- Singh S.K. 2017. Road traffic accidents in India: Issues and challenges. *Transportation Research Procedia* **25**: 4708-4719.
- Touahmia M. 2018. Identification of risk factors influencing road traffic accidents. *Engineering, Technology & Applied Science Research* **8**(1): 2417-2421.
- van Eck N.J. & Waltman L. 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **84**: 523–538.
- Ward H., Lyons R. & Thoreau R. 2006. *Under-reporting of Road Casualties? Phase I*. In Road Safety Research Report No. 69, London.
- Watson A., Vallmuur K. & Watson B. 2015. How serious are they? The use of data linkage to explore different definitions of serious road crash injuries. *Proceedings of the 2015 Australasian Road Safety Conference in Gold Coast, Australia*, pp. 1-10.
- Wu T.-P., Huang Y.-L., Liang F.-W. & Lu T.-H. 2015. Underreporting of maternal mortality in Taiwan: A data linkage study. *Taiwanese Journal of Obstetrics and Gynecology* **54**(6): 705-708.

- Xu X., Chen Q. & Zhu Z. 2022. Evolutionary overview of land consolidation based on bibliometric analysis in a Web of Science from 2000 to 2020. *International Journal of Environmental Research and Public Health* **19**(6): 3218.
- Ytterstad B., Gressnes T. & Harborg T. 2018. PW 1663 Injury surveillance in a hospital leads to complete traffic injury data, sustainable injury prevention, and update police underreporting. *Injury Prevention* **24**(2): A179.

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