PDF version

Review

Prasanthi Puvanachandra[1,2], Anthony Laverty[3], Maria Ghaly[1], Hala Sakr[4], Rania Abdelhamid[4], Kacem Iaych[5] and Margaret Peden[1,2]

[1]The George Institute UK, Imperial College London, School of Public Health, London, UK. [2]School of Population Health, University of New South Wales, Sydney, Australia.

[3]Public Health Policy Evaluation Unit, School of Public Health, Imperial College London, London, UK.

[4]WHO Regional Office for the Eastern Mediterranean, Cairo, Egypt.

[5]World Health Organization, Geneva, Switzerland. (Correspondence to Margaret Peden: mpeden@georgeinstitute.org.uk)

Abstract

Background: Road traffic injury is a major global health risk, however, under-reporting of road traffic crashes data and the use of different reporting systems have made it difficult to compare data across countries.

Aim: To examine published and grey literature for better understanding of available health and non-health road traffic data systems in the Eastern Mediterranean Region (EMR) countries.

Methods: We conducted a systematic search of databases to identify studies reporting road traffic data systems in the EMR countries between 2011 and January 2022. We also searched grey literature on the websites of government, WHO, World Bank, UNICEF, regional economic

commissions and other relevant institutions. We assembled the data in Microsoft Excel and presented the counts of data sources, data types and data quality.

Results: We included 84 of 2238 studies accessed in this review. One-third of the publications was from the Islamic Republic of Iran while 10% was from Pakistan. Police databases were the primary sources of data in most of the studies (79%) while hospital and death registration systems together accounted for one-quarter of the databases. The most common indicators reported in the publications were deaths (61%), crashes (48%) and injuries (35%). Only 40% of the studies disaggregated their analyses by gender and 44% by age. No papers identified permanently linked data sources, although more than a quarter of the papers reviewed used some form of modelling or data mining.

Conclusion: This scoping review highlights an over-reliance on police data, poor quality traffic data systems, and multiple stakeholders collecting similar data, leading to redundancy. EMR countries need to establish robust road safety data systems to provide data for relevant policies and interventions.

Keywords: road safety, road traffic injury, road traffic accident, police, road crashes, Eastern Mediterranean

Citation: Puvanachandra P, Laverty A, Ghaly M, Sakr H, Saad R, Iaych K, Peden M. A scoping review of road traffic data systems in the Eastern Mediterranean Region. East Mediterr Health J. 2024;30(3):238–247. https://doi.org/10.26719/emhj.24.012.

Received: 12/06/23; Accepted: 30/11/23

Copyright: © Authors 2024; Licensee: World Health Organization. EMHJ is an open access journal. All papers published in EMHJ are available under the Creative Commons Attribution Non-Commercial ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; https://creativecommons.org/licenses/by-nc-sa/3.0/igo).

Introduction

More than 1.3 million people lose their lives to road traffic crashes every year and millions more are injured, some with lifelong consequences (1). Mortality rates due to road traffic crashes in the Eastern Mediterranean Region (EMR) are comparable to the global average (17.8 per

100 000 population) (2). These estimates are approximate because under-reporting of official data has been identified as a significant problem across the region (1,3,4). This makes it difficult to estimate the actual number of deaths, non-fatal injuries and disabilities and makes comparison between countries almost impossible. This challenge was highlighted in a WHO/EMRO Regional Committee road safety progress report (5) calling on all countries in the region to work towards improved road safety data systems.

At the commencement of the 2nd Decade of Action for Road Safety (2021–2030) (6) we reviewed published and grey literature to understand what health and non-health road traffic data systems were available in EMR countries. Data from the review was to provide useful baseline for the region and identify countries where WHO could offer technical support for the improvement or linkage of databases for more robust data that would allow an assessment of the outcome of road safety interventions during the decade. We chose the scoping review because it would allow us to understand the issue, convey the scope of evidence and its summary, which may not be possible with systematic review (7).

Methods

Review of literature

The scoping review included empirical studies from EMR countries published in peer-reviewed journals, and grey literature, in Arabic, English and French. We used the Joanna Briggs Institute methodological guidelines (8) to conduct the review and the 20-item PRISMA-ScR for reporting (9).

Table 1 presents the inclusion and exclusion criteria. We explored studies from 2011 until January 2022 focusing on road safety, specifically data systems, databases, linkages, modelling, and underreporting conducted in an EMR country. We excluded studies on non-EMR countries and those which did not focus primarily on road safety (e.g. overall injuries). We searched several databases including:

Health databases: PubMed, Medline, Scopus, EMBASE, SafetyLit, Cochrane Database of SRs,

Google Scholar;

Transport databases: TRIS, TRID;

French database: Catalogue et Index des Sites Médicaux de langue Française (CiSMeF);

Doctoral theses: Ethos (UK thesis database), DART (Europe E-theses Portal), ProQuest (international thesis database);

Arabic databases: Index Medicus Eastern Mediterranean Region (IMEMR) as well as a search in Arabic in Google Scholar.

Search strategy

We tailored our search strategy to each database using the MeSH terms and keywords. The searches included article titles and abstracts and searches in Arabic and French used translated keywords. We conducted specific manual searches for countries and data systems that were poorly represented in the automated searches. We also manually searched grey literature on the websites of WHO, World Bank, UNICEF, regional economic commissions, governments as well as multiple electronic resources at the British Library.

We got information on other relevant literature from selected experts and practitioners in the region including WHO staff, national data coordinators, and members of expert and academic networks and professional associations.

Two independent reviewers screened the search results using Rayyan software and disagreements were resolved by consensus (10).

Data analysis

We used the criteria proposed in the WHO data systems manual (11) as the basis for our data analysis framework. This includes the source of the data (police, health, etc), the type of data

collected (indicators) and whether these were disaggregated by age and sex, and the quality of the data (under-reporting, etc). We noted the type of analysis used (modelling, descriptive, GIS, etc). We collated the data in Microsoft Excel and presented them in tables and charts.

Results

Selection of sources

After removing the duplicates, we identified 2238 references (Figure 1) and after title and abstract screening we excluded 2040 of them. We screened the full text of 198 references and selected 84 for the final review. We excluded articles that did not focus on road traffic data systems, were on specified health outcomes (injury or death), did not use national data (e.g. used modelled WHO or IHME data exclusively), were pilot projects that were discontinued, were outside the geographic area, and/or included descriptive or burden information only.

Data sources

More than one-third of the publications were from Islamic Republic of Iran and 10% were from Pakistan. Despite additional manual search, no publications were found for Kuwait, Somalia, Sudan, and Syria.

Majority of the papers (79%, 66/84) used a police database as the primary source of information (Table 2); all countries included in the review had at least one publication that used police data. Hospital and death registration systems together accounted for another one-quarter of the databases. We found a variety of other sources, including trauma registries, prehospital records, household surveys, and media records.

Health data—prehospital (or ambulance), hospital admission, trauma registry, surveillance, autopsy, and death registration data (or combinations thereof)—were used regularly in publications from Bahrain, Egypt, Islamic Republic of Iran, Iraq, Morocco, Pakistan, Saudi Arabia, and United Arab Emirates.

Some publications (n=17, 20%) from countries such as Islamic Republic of Iran, Pakistan, Egypt, and Saudi Arabia used multiple sources for the same publication. For example, a study by Bhatti et al from Pakistan examined the differences in reporting across police, hospital and pre-hospital sources and reported significant under-reporting of injuries and deaths in the police database (12). A study by Mohammadi et al from Islamic Republic of Iran compared and evaluated data elements pertaining to road traffic indicent reporting across the police, hospital and media sources to develop a minimum dataset for an information management system (13).

Table 1 Inclusion and exclusion criteria

Data indicators

The most common indicators reported in reviewed publications were fatalities (n=51, 61%), crashes (n=40, 48%) and injuries (n=29, 35%) (Table 3). A few papers also included road user groups (n=6, 7%), nature of injuries (n=4, 5%), injury severity (n=6, 7%), and costs (n=3, 4%). One or 2 papers used vehicle, infrastructure or GPS indicators. A few papers used multiple indicators to compare data sources. For example, a study from Saudi Arabia used police data and hospital death registration data to ascertain trends in mortality rates and to assess consistency of reporting (14).

Only 40% (34/84) of the studies disaggregated their analysis by gender and 44% (40/84) by age.

Quality of data

Although many papers reported “poor quality or missing data” or “under-reporting” only one paper from Pakistan fully quantified the quality issue (15). The Pakistani study matched data from 5 public sector hospitals with official police data from the same catchment area and showed that more than 90% of hospital data did not match those in the police database (15). This study highlighted several challenges including a lack of awareness, firstly, on the part of the victims who did not report collisions if they thought such collisions were not serious enough and, secondly, on the part of police authorities who were more focused on the crime than on their reporting obligations.

Few papers included actual definitions for road traffic deaths, although these data are available from the 2018 regional status report (16) and show that there is wide discrepancy, ranging from “on the scene” to “unlimited” periods with 12 countries applying the 30-day definition. Three used “unlimited” definition in hospital records and 2 reported only those deaths that happened at the scene of the crash.

One regional study assessed crash data systems in 14 Arab countries in a survey that identified any fundamental dysfunctions in data management and collection (17). It applied novel data mining techniques to 3 characteristics – crashes, vehicles and road users – to better understand crash circumstances and crash severity. A shortlist of 25 variables across the 3 characteristics

and an electronic investigation form were proposed towards achieving an Arab road safety observatory under the auspices of UN-ESCWA. The UN Road Safety Fund is funding a project in Tunisia, Lebanon and Qatar to establish common and standardized processes, methods and tools for efficient recording, processing and analysis of disaggregated data on road crash fatalities and injuries in the Arab region (18).

Three papers identified regional specificities. One student thesis from Saudi Arabia showed the importance of connecting road safety data to development strategies, particularly the relationship between pedestrian casualties and pilgrimages to Mecca (19). The second paper, from Iraq, showed the linkages between increases in reported road traffic deaths and conflict situations (20) suggesting that the absence of security and safety precautions on the roads led to increases in collisions but that data collection was still possible even in these difficult circumstances. Another paper from Lebanon (21) connected institutional issues, including data collection and analysis, with road security.

Type of analysis

Most studies (63%, 53/84) used simple descriptive statistics to analyse their data (Figure 2). Majority of the studies were retrospective except for one case-control study which was conducted in Islamic Republic of Iran and used sophisticated analysis methods such as partial least squares discriminant analysis (PLS-DA) and a variable importance in the projection (VIP) index to predict fatal outcomes in pedestrian collisions (22).

A further 11% (9/84) of the studies used multiple years of data to develop trend analyses. For example, a 6-year retrospective analysis of deaths registered in the forensic medicine database in Kermanshah Province, Islamic Republic of Iran, found that although there was a reduction in the rate per 100 000 population there was a clustering of collisions at certain locations, particularly around rush hours, suggesting the need for better enforcement and improved infrastructure (23). The other 2 time-trend studies were conducted in Pakistan (24,25) and used hospital-based data.

Just over one-quarter of the publications (27%, 23/84) used some type of modelling or machine learning techniques to estimate or adjust data. For example, studies from Egypt and Islamic Republic of Iran used data mining and modelling techniques to mitigate the limitations of various databases within the countries, considering mislabelling, miscounting and other missing variables to build more accurate road safety profiles (26,27).

Nine percent of the papers (9/84) assessed blackspots or collision sites using GIS techniques. A doctoral thesis conducted at the University of Bahrain developed a GIS database from coordinates derived from data collected by the General Traffic Department and analysed these data using mapping techniques and spatial analysis to better understand the distribution of collisions against the backdrop of urban settlements, road networks and blackspots (28). A second study conducted in Ilam Province, Islamic Republic of Iran identified collision hotspots in unexpected areas with high rainfall and mountainous roads, coupled with inappropriate post-crash response (29). These 2 studies highlight the useful role of GIS analysis in identifying causal factors related to infrastructure and geography.

Data sources were infrequently linked. Only 4 of the studies used capture-recapture techniques. Three of these studies were conducted in Islamic Republic of Iran – one which used death registration and the forensic medicine database to estimate the true magnitude of road traffic deaths in one Iranian province (30,31) and another one that used the technique to estimate the economic burden of fatal injuries at the national level (32). The former study showed a discrepancy of 121 deaths between the 2 fatal databases and recommended that the registries should be integrated to provide more realistic estimates. The latter compared 3 data sources – the 2 death registries and police records – showing that combination of the 3 sources provided a good estimate of fatal injuries in the country. The Pakistan study used the technique to estimate the true magnitude of fatalities by matching police and health data (33). It found that the police database underestimated the fatalities by 55% and the health database by 20% and recommended the combination of sources to obtain more reliable estimates on which to base a response.

Only 2 studies and one discussion paper used qualitative methods to supplement quantitative methodologies. One study in Islamic Republic of Iran used focus group discussions to investigate the challenges and opportunities to improve the trauma registry in Kashan (34). It showed how important data flow is in obtaining good quality data – an aspect that is oftentimes overlooked in busy accident and emergency departments where personnel are primarily focused on clinical care. The second qualitative study in Islamic Republic of Iran used semi-structured interviews with key government stakeholders to understand key obstacles due to the multiple databases in the country (35). It found multiple registry systems and many duplicated variables but also missing critical indicators such as alcohol and substance abuse, child restraint and helmet usage. It called for an integrated and comprehensive surveillance system, which is now being done in the country.

Discussion

This scoping review of road safety data systems in EMR found at least one published article on road traffic data systems from 18 of the 22 countries in the region in the last decade. Papers from Islamic Republic of Iran and Pakistan were overwhelmingly more than other countries; they

accounted for more than half of the papers.

Our review highlights that majority of the studies used police data as their sole source. A recent systematic review found only 4 papers that quantified the exact extent of underreporting by these data sources and this may be an issue for studies relying only on a single data source (36). This under-reporting can be especially problematic among vulnerable road users, therefore, the use of multiple data sources is generally recommended. The reasons for this concentration of studies among only these countries is unclear, and a better understanding of this issue would be useful.

No papers from this study identified permanently linked data sources. Although this is recommended by WHO headquarters and WHO/EMRO (1,16), experiences in countries such as Australia highlight difficulties in permanent data linkage (37). Data linkage has been successfully used in some low-resourced settings like Ethiopia (38), Malawi (39), Zambia (40), the Philippines (41), and Uganda (42) to understand where under-reporting was most common (e.g. among vulnerable road users, females, younger age groups, etc.). Some countries such as Tunisia are beginning to consider and plan for data linkage as they improve their data systems (43).

The quality of data was not well documented in any of the publications, however, general statements such as “poor quality data” were mentioned without supporting evidence. Most of the papers relied on death data and disaggregation of these data by road user type, however, nature and severity of injuries, age and sex were infrequently reported. More studies using hospital databases and definitive injury severity measurements such as the injury severity score would be useful in assessing outcomes and potential reductions in unnecessary deaths in the post-crash phase.

Another way to overcome the shortcomings of individual databases is the use of more innovative methods of data collection or intelligent crash reporting systems (44). It was thus encouraging to note that more than a quarter of the papers included in this scoping review used some type of modelling such as time-series, PLS-DA, artificial neural network (ANN) or data mining. This could be extended in the future to include big data, crowd-sourced data (already being used in Africa) (45) or other more cutting-edge digital technologies (46). It was encouraging to note the development of some observatories, including an Arabic Road Safety Observatory (47) and the Asia Pacific Road Safety Observatory (APRSO).

The overwhelming majority of papers analysed reported quantitative indicators. Only 2 papers used qualitative methodologies to assess the quality of the data systems. Qualitative methods can encourage practitioners and policymakers to “think outside the box” particularly if it uses methodologies that incorporate “citizen science”, which could provide innovative answers and improve ownership of solutions (48).

Study limitations

One of the limitations of this review is that only one of the investigators could read Arabic and thus 2 of the included studies could not be fully assessed. We did not search in local languages such as Farsi and, therefore, additional papers may have been missed. Further reviews could be conducted in local languages such as Farsi or Persian to mitigate any potential biases especially in Islamic Republic of Iran where we found a considerable number of papers. Synthesising studies that are not in English language is important to overcome biases inherent in relying on single languages and can help harness crucial geographically diverse evidence (49). Additionally, a considerable number of the studies was from Islamic Republic of Iran and Pakistan, indicating that public health research in the EMR remains considerably lower than the global average (50). We have no reason to believe that this is due to issues with our search strategy, but reviews in local languages could contribute to our understanding of the reasons.

We limited this review to assessing road safety databases only, however, we noted some databases for “all injuries” which could have been included if we expanded our MESH terms to all types of injuries, but analyses of these would not have been feasible. We did not assess the quality of the papers that we reviewed, future studies that include such assessment may yield new insights. Finally, the studies we reviewed used data from a range of timeframes, it is possible that national road safety efforts have evolved since the end of these studies.

Implications and conclusions

Countries need robust road safety data systems to inform policies and interventions on injuries due to collisions. This rapid scoping review revealed several important conclusions: (a) an over-reliance on police data only, despite acknowledging that these data are often under-reported; (b) poor quality data, lacking in granularity on which to base specific and focused interventions; (c) multiple stakeholders or agencies collecting similar data; and (d) the need for training in data system management and reporting.

To enhance the usefulness of this research, we recommend that the research community and policymakers undertake country by country assessments of current government-based data systems much like the study conducted in India by Barffour et al (51) or Puvanachandra in Egypt (52) to assess the completeness, etc. of data. WHO has a series of tools that can assist

countries with their assessments, including the series of global status reports (1) and regional summaries (16), and tools to improve the quality of CRVS data in the countries. The Save LIVES road safety technical package (53) contains a step-by-step country assessment tool including a questionnaire to evaluate the current data collection system. Questions include what data is available, what data systems exist, and what is the quality of the data? While this would be resource-intensive, it would generate useful information that could provide better information on the strengths and weaknesses of the data sources currently being used at a country level. Countries should consider the inclusion of additional indicators beyond just deaths and injuries so that the full spectrum of outcomes (injuries, disabilities, economic consequences, etc) can be assessed. Finally, we encourage researchers and countries to conduct in-depth surveys and focus group discussions to provide valuable insights into database issues, which can be readily and easily rectified to provide more robust information.

Funding: None.

Competing interests: None declared.

Étude exploratoire des systèmes de données relatifs à la circulation routière dans la Région de la Méditerranée orientale

Résumé

Contexte : Les traumatismes dus aux accidents de la circulation représentent un risque majeur pour la santé mondiale. Cependant, la sous-notification des données en la matière et l'utilisation de systèmes de notification différents ont rendu difficile la comparaison des résultats entre les pays.

Objectif : Passer en revue la littérature publiée et la littérature grise afin de mieux comprendre les systèmes de données sanitaires et non sanitaires disponibles concernant la circulation routière dans les pays de la Région de la Méditerranée orientale.

Méthodes : Nous avons mené une recherche systématique dans les bases de données afin d'identifier les études mentionnant les systèmes de données relatifs à ce domaine dans ces pays de début 2011 à janvier 2022. Nous avons également consulté la littérature grise disponible sur les sites Web des gouvernements, de l'OMS, de la Banque mondiale, de l'UNICEF, des commissions économiques régionales et d'autres institutions concernées. Nous avons réuni ces données dans Microsoft Excel et présenté le décompte des sources de

données, leurs différents types ainsi que leur qualité.

Résultats : Nous avons inclus 84 des 2238 études consultées dans la présente analyse. Un tiers des publications provenaient de la République islamique d'Iran et 10 % étaient issues du Pakistan. Les bases de données de la police constituaient les principales sources dans la plupart des études (79 %), tandis que les systèmes d'enregistrement des hospitalisations et des décès représentaient à eux deux un quart des bases de données. Les indicateurs les plus courants mentionnés dans les publications étaient les décès (61 %), les accidents (48 %) et les traumatismes (35 %). Dans seulement 40 % des études, les analyses ont été ventilées par sexe et dans 44 % par âge. Aucun article n'a identifié de sources de données ayant une liaison permanente, même si plus d'un quart des études examinées avaient recours à une forme de modélisation ou d'extraction de données.

Conclusion : La présente étude exploratoire met en évidence une dépendance excessive à l'égard des données provenant de sources policières, une mauvaise qualité des systèmes de données relatifs à la circulation routière, et une multitude de parties prenantes qui recueillent des données similaires, entraînant des redondances. Les pays de la Région de la Méditerranée orientale doivent mettre en place des systèmes de données solides sur la sécurité routière afin de fournir des données permettant d'élaborer des politiques et des interventions pertinentes.

[illegible]

[illegible]

[illegible]

[illegible]

WHO EMRO | A scoping review of road traffic data systems in the Eastern Mediterranean Region

: أجرينا بحثًا منهجيًّا في قواعد البيانات لتحديد الدراسات التي أبلغت عنطرق البحث نُظُم بيانات حركة المرور على الطرق في بلدان إقليم شرق المتوسط بين عام 2011 ويناير / كانون الثاني 2022. وبحثنا أيضًا في المنشورات غير الرسمية المتوفرة على المواقع الإلكترونية للحكومات ومنظمة الصحة العالمية والبنك الدولي واليونيسف واللجان الاقتصادية الإقليمية، وغيرها من المؤسسات ذات الصلة . وجمعنا البيانات في ملف مايكروسوفت إكسل، وعرضنا إحصاءات مصادر وأنواع ا وجودة البيانات .

: أدرجنا 84 دراسة من أصل 2238 دراسة اطَّلعنا عليها في نطاق هذا الاستعراض .النتائ **ج** وكان ثلث المنشورات من جمهورية إيران الإسلامية، في حين كان 10% منها من باكستان . وكانت قواعد بيانات الشرطة هي المصادر الرئيسية للبيانات في معظم الدراسات (79% ، 66-84) ، في حين شكَّلت نُظم التسجيل في المستشفيات ونُظم تسجيل الوفيات معًا ربع قواعد البيانات . وكانت أبرز المؤشرات المُبلَغ عنها في المنشورات هي الوفيات (61%) ، والتصادمات (48% ، 84-40) ، والإصابات (35% ، 84-29). وصُنِّفت التحليلات فيما نسبته 40% وحسب (84-34) من الدراسات حسب نوع الجنس وفي 44% (84-40) حسب العُمر . ولم تحدد أيٌّ دراسات مصادرَ بيانات مترابطة ترابطًا ثابتًا، على الرغم من أن أكثر من ربع الدراسات المقطعية استخدمت شكلًا من أشكال النمذجة أو استخراج البيانات .

: يبرز هذا الاستعراض الاستكشافي الاعتماد المفرط على بيانات الشرطة،الاستنتاجات وسوء جودة نظم بيانات حركة المرور، وتعدد أصحاب المصلحة الذين يجمعون بيانات مماثلة، وهو ما يؤدي إلى التكرار . ويتعين على بلدان إقليم شرق المتوسط أن تنشئ نُظُمًا قوية لبيانات السلامة على الطرق لتوفير البيانات اللازمة للسياسات والتدخلات ذات الصلة .

References

1. World Health Organization. Global status report on road safety 2018. Geneva: World Health Organization, 2018. https://www.who.int/publications/i/item/9789241565684.
2. World Health Organization. Global Health Estimates: Life expectancy and leading causes of death and disability. Geneva: World Health Organization, 2020. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates.
3. World Health Organization. Road safety in the Eastern Mediterranean Region: facts from the global status report on road safety 2018. Cairo: World Health Organization Regional Office for the Eastern Mediterranean, 2020. https://www.emro.who.int/fr/violence-injuries-disabilities/violence-events/road-safety-in-the-region-facts-from-the-global-status-report-on-road-safety-2018.html#:~:text=The%20overall%20road%20traffic%20death,Asia%20(20.7%20per%20100%20000.
4. European Union-funded EuroMed Transport Support Project (EuroMed TSP) and the World Health Organisation. Understanding and bridging the differences between country-reported and WHO-estimated road traffic fatality data. Geneva: WHO & EuroMed Transport Support Project, 2019. https://www.ssatp.org/sites/ssatp/files/publication/who-euromed_understanding_differences_between_country-reported_and_who-estimated_road.pdf.
5. World Health Organization. Progress report on road safety. Cairo: World Health

13 / 17

Organization Regional Office for the Eastern Mediterranean. https://apps.who.int/iris/bitstream/handle/10665/123283/RC_Techn_paper_2013_inf_doc_7_14992_EN.pdf?sequence=1

6. World Health Organization. Global Plan: Decade of Action for Road Safety 2021-2030. Geneva: World Health Organization, 2021. https://www.who.int/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2021-2030.

7. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implement Sci. 2010;5:69. doi: 10.1186/1748-5908-5-69.

8. Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, McInerney P, Godfrey CM, Khalil H. Updated methodological guidance for the conduct of scoping reviews. JBI Evid Synth. 2020 Oct;18(10):2119-2126. doi: 10.11124/JBIES-20-00167.

9. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med. 2018;169(7):467-473. doi: 10.7326/M18-0850.

10. Ouzzani M, Hammady H, Fedorowicz Z, et al. Rayyan—a web and mobile app for systematic reviews. Syst Rev 2016;(5):210. https://doi.org/10.1186/s13643-016-0384-4.

11. World Health Organization. Data systems: a road safety manual for decision-makers and practitioners. Geneva: World Health Organization, 2010. https://iris.who.int/handle/10665/44256?&locale-attribute=ar.

12. Bhatti JA, Razzak JA, Lagarde E, Salmi LR. Differences in police, ambulance, and emergency department reporting of traffic injuries on Karachi-Hala road, Pakistan. BMC Res Notes 2011;4:75. doi: 10.1186/1756-0500-4-75.

13. Mohammadi A, Ahmadi M, Gharagozlu A. Developing a Minimum Data Set for an Information Management System to Study Traffic Accidents in Iran. Iran Red Crescent Med J. 2016;18(3):e23677. doi: 10.5812/ircmj.23677.

14. Barrimah I, Midhet F, Sharaf F. Epidemiology of road traffic injuries in qassim region, saudi arabia: consistency of police and health data. Int J Health Sci (Qassim). 2012;6(1):31-41. doi: 10.12816/0005971.

15. Younis MW, Batool Z, Bukhari M, ur Rehman Z, Shahzad S, ur Rehman A, et al. Pattern of underreporting of Road Traffic Injuries (RTIs): An investigation of missing burden of RTIs in Pakistan. J Trans Health 2019;14:100575. https://doi.org/10.1016/j.jth.2019.100575.

16. World Health Organization. Road safety in the Eastern Mediterranean Region: Facts from the Global status report on road safety 2018. Cairo: World Health Organization Regional Office for the Eastern Mediterranean, 2020. https://www.emro.who.int/fr/violence-injuries-disabilities/violence-events/road-safety-in-the-region-facts-from-the-global-status-report-on-road-safety-2018.html#:~:text=The%20overall%20road%20traffic%20death,Asia%20(20.7%20per%20100%20000.

17. Abounoas Z, Raphael W, Badr Y, Faddoul R, Guillaume A: Crash data reporting systems in fourteen Arab countries: challenges and improvement. Archives of Transport 2020; 56(4): 73-88. https://doi.org/10.5604/01.3001.0014.5628.

18. United Nations Road Safety Fund. Strengthening evidence-based interventions for road safety in the Arab region. New York: United Nations Road Safety Fund. https://roadsafetyfund.un.org/projects/strengthening-evidence-based-interventions-road-safety-arab-region.

19. Alahmadi RN. Modelling the relationship between pilgrims' pedestrian casualties and

land use type: a case study of Al Madinah Al Monawarah. (Thesis). Edinburgh Napier University. http://researchrepository.napier.ac.uk/id/eprint/8797.

20. Joni HH, Mohammed AA, Shakir AA. Classification of traffic accidents datasets between 2003-2017 in Iraq. Data Brief. 2019 Nov 28;28:104902. doi: 10.1016/j.dib.2019.104902.

21. Kobeissy F, Carnis L. The excuse is worse than the fault: It's time now to improve road safety in Lebanon. Case Studies on Transport Policy 2021;9(2):500-510. https://doi.org/10.1016/j.cstp.2021.02.006.

22. Jamali-Dolatabad M, Sadeghi-Bazargani H, Sarbakhsh P. Predictors of fatal outcomes in pedestrian accidents in Tabriz Metropolis of Iran: Application of PLS-DA method. Traffic Inj Prev. 2019;20(8):873-879. doi: 10.1080/15389588.2019.1666373.

23. Zangeneh A, Najafi F, Karimi S, Saeidi S, Izadi N. Spatial-temporal cluster analysis of mortality from road traffic injuries using geographic information systems in West of Iran during 2009-2014. J Forensic Leg Med. 2018;55:15-22. doi: 10.1016/j.jflm.2018.02.009.

24. Mirza FH, Hassan Q, Jajja N. An autopsy-based study of death due to road traffic accidents in metropolis of Karachi. J Pak Med Assoc. 2013;63(2):156-160. PMID: 23894886.

25. Shamim S, Razzak JA, Jooma R, Khan U. Initial results of Pakistan's first road traffic injury surveillance project. Int J Inj Contr Saf Promot. 2011;18(3):213-217. doi: 10.1080/17457300.2011.555559.

26. Yahaya M, Fan W, Fu C, Li X, Su Y, Jiang X. A machine-learning method for improving crash injury severity analysis: a case study of work zone crashes in Cairo, Egypt. Int J Inj Contr Saf Promot. 2020;27(3):266-275. doi: 10.1080/17457300.2020.1746814.

27. Alikhani M, Nedaie A, Ahmadvand A. Presentation of clustering-classification heuristic method for improvement accuracy in classification of severity of road accidents in Iran. Safety Science 2013:60:142-150. https://doi.org/10.1016/j.ssci.2013.06.008.

28. Mustapha B, Hashim A. Traffic accidents in Bahrain: A statistical and spatial GIS-based analysis. J King Saud Univer: Arch & Plann. 2011;23:1-18. https://cap.ksu.edu.sa/sites/cap.ksu.edu.sa/files/imce_images/jap_ksu_jan2011_e1.pdf.

29. Aghajani MA, Dezfoulian RS, Arjroody AR, Rezaei M. Applying GIS to Identify the Spatial and Temporal Patterns of Road Accidents Using Spatial Statistics (case study: Ilam Province, Iran). Trans Res Procedia 2017;25:2126-2138. https://doi.org/10.1016/j.trpro.2017.05.409.

30. Khorasani Zavareh D, Mohammadi R, Laflamme L, Naghavi M, Zarei A, Haglund BJ. Estimating road traffic mortality more accurately: use of the capture-recapture method in the West Azarbaijan province of Iran. Int J Inj Contr Saf Promot. 2008;15(1):9-17. doi: 10.1080/17457300701794105.

31. Entezami N, Hashemi-Nazar S, Soori H, Khosravi A, Heidarian Miri H. Application of capture-recapture method to estimate traffic accident mortality rate. Trauma Monthly 2018;23(3). doi: 10.5812/traumamon.57926

32. Ghodsi Z, Saadat S, Barzegar A, Alaeddini F, Rahimi-Movaghar V, Zafarghandi M, Sheikhazadi A, AkbariSari A, Salamati P. The completeness of the registration system and the economic burden of fatal injuries in Iran. Ulus Travma Acil Cerrahi Derg. 2020;26(5):671-677. English. doi: 10.14744/tjtes.2019.34903.

33. Lateef MU. Estimation of fatalities due to road traffic crashes in Karachi, Pakistan, using capture-recapture method. Asia Pac J Public Health. 2010;22(3):332-341. doi:

10.1177/1010539509356808.

34. Meidani Z, Mahdian M, Ayan A, Mohammadzade M, Nickfarjam A, Moosavi GA. Registry Data Coordinator (RDC): a Proper Accessible Strategy for Improving Road Traffic Injury (RTI) Hospital Based Trauma Registry Systems in Developing Countries and Low Income Countries. Acta Inform Med. 2018;26(1):35-41. doi: 10.5455/aim.2018.26.35-41.

35. Sadeghi-Bazargani H, Sharifian S, Khorasani-Zavareh D, Zakeri R, Sadigh M, Golestani M, Amiri M, Masoudifar R, Rahmani F, Mikaeeli N, Namvaran J, Pour-Ebrahim K, Rezaei M, Arabzadeh B, Samadirad B, Seyffarshad A, Mirza-Mohammadi-Teimorloue F, Kazemnezhad S, Marin S, Sheikhi S, Mohammadi R. Road safety data collection systems in Iran: A comparison based on relevant organizations. Chin J Traumatol. 2020;23(5):265-270. doi: 10.1016/j.cjtee.2020.06.004.

36. Heydari S, Hickford A, McIlroy R, Turner J, Bachani AM. Road Safety in Low-Income Countries: State of Knowledge and Future Directions. Sustainability. 2019;11(22):6249. https://doi.org/10.3390/su11226249.

37. Watson A, Watson B, Vallmuur K. Estimating under-reporting of road crash injuries to police using multiple linked data collections. Accid Anal Prev. 2015;83:18-25. doi: 10.1016/j.aap.2015.06.011.

38. Abegaz T, Berhane Y, Worku A, Assrat A, Assefa A. Road traffic deaths and injuries are under-reported in Ethiopia: a capture-recapture method. PLoS One. 2014;9(7):e103001. doi: 10.1371/journal.pone.0103001.

39. Samuel JC, Sankhulani E, Qureshi JS, Baloyi P, Thupi C, Lee CN, Miller WC, Cairns BA, Charles AG. Under-reporting of road traffic mortality in developing countries: application of a capture-recapture statistical model to refine mortality estimates. PLoS One. 2012;7(2):e31091. doi: 10.1371/journal.pone.0031091.

40. Mwale M, Mwangilwa K, Kakoma E, Iaych K. Estimation of the completeness of road traffic mortality data in Zambia using a three source capture recapture method. Accid Anal Prev. 2023;186:107048. doi: 10.1016/j.aap.2023.107048.

41. Rivera AS, Lam HY. Applying the capture-recapture method to estimate road traffic deaths and injuries in three non-contiguous cities in the Philippines. Int J Inj Contr Saf Promot. 2019;26(1):16-20. doi: 10.1080/17457300.2018.1473447.

42. Magoola J, Kobusingye O, Bachani AM, Tumwesigye NM, Kimuli D, Paichadze N. Estimating road traffic injuries in Jinja district, Uganda, using the capture-recapture method. Int J Inj Contr Saf Promot. 2018;25(4):341-346. doi: 10.1080/17457300.2018.1431934.

43. Saidi W, et al. 559 Road traffic fatalities in Tunisia: a multisector sources data linkage. Injury Prevention 2022;28(Suppl 2):A86-A86. DOI:10.1136/injuryprev-2022-safety2022.255.

44. Imprialou M, Quddus M. Crash data quality for road safety research: Current state and future directions. Accident Analysis & Prevention 2019:130:84-90. https://doi.org/10.1016/j.aap.2017.02.022.

45. Usami DS, Persia L, Meta E, Fava A, Azarko A, Saporito MR, et al. Improving road safety knowledge in Africa through crowdsourcing: the African Road Safety Observatory. Transportation Research Procedia 2020:45:418-425. https://doi.org/10.1016/j.trpro.2020.03.034.

46. Torbaghan ME, Sasidharan M, Reardon L, Muchanga-Hvelplund LCW. Understanding the potential of emerging digital technologies for improving road safety. Accident Analysis & Prevention 2022:166. https://doi.org/10.1016/j.aap.2021.106543.

47. Abounoas Z, Raphael W, Badr Y, Faddoul R, Guillaume A: Crash data reporting systems in fourteen Arab countries: challenges and improvement. Archives of Transport 2020;56(4):73-88. https://doi.org/10.5604/01.3001.0014.5628.

48. Holmes BD, Haglund K, Beyer KMM, Cassidy LD. Qualitative methods of road traffic crash research in low- and middle-income countries: a review. Int J Inj Contr Saf Promot. 2019;26(2):194-199. doi: 10.1080/17457300.2018.1535512.

49. Amano T, Berdejo-Espinola V, Christie AP, Willott K, Akasaka M, Báldi A, et al. Tapping into non-English-language science for the conservation of global biodiversity. PLoS Biol. 2021;19(10):e3001296. doi: 10.1371/journal.pbio.3001296.

50. AlHamawi R, Saad RK, Abdul Rahim HF, Mir Islam Saeed K, Husseini A, Khader Y, Al Nsour M. Supporting Public Health Research Capacity, Quality, and Productivity in a Diverse Region. Interact J Med Res. 2023;12:e39154. doi: 10.2196/39154.

51. Barffour M, Gupta S, Gururaj G, Hyder AA. Evidence-based road safety practice in India: assessment of the adequacy of publicly available data in meeting requirements for comprehensive road safety data systems. Traffic Inj Prev. 2012;13 Suppl 1:17-23. doi: 10.1080/15389588.2011.636780.

52. Puvanachandra P, Hoe C, El-Sayed HF, Saad R, Al-Gasseer N, Bakr M, Hyder AA. Road traffic injuries and data systems in Egypt: addressing the challenges. Traffic Inj Prev. 2012;13 Suppl 1:44-56. doi: 10.1080/15389588.2011.639417.

53. World Health Organization. Save LIVES: A road safety technical package. Geneva: World Health Organization, 2017. https://www.who.int/publications/i/item/save-lives-a-road-safety-technical-package.

Thursday 11th of July 2024 01:54:28 PM