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# BMJ Open

## Current pesticide suicide surveillance methods used across the African continent – A scoping review protocol

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## Current pesticide suicide surveillance methods used across the African continent – A scoping review protocol

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Pesticide, suicide, Africa, low- and middle-income countries, pesticide suicide surveillance, surveillance systems, self-harm, pesticide suicide, pesticide self-harm

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## ABSTRACT

### Introduction

Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion. Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries (LMICs). The full burden of pesticide suicides in African countries remains poorly documented, one reason being the lack of systematic data collection. It is essential to know the number of pesticide self-harm cases as it will help prevent further cases occurring by informing policy and legislation, implementation of targeted bans, raising community awareness around the use of these pesticides, training of health care personnel as well as influencing the type and level of clinical facility investments into this area of health care. In this scoping review we aim to investigate how pesticide suicide deaths in Africa are recorded by identifying and assessing the various surveillance systems in place, as well as highlighting key limitations and data collection barriers.

### Methods and analysis

A scoping review carried out with the five-stage methodological frameworks as set out by Arksey & O'Malley and the JBI Institute. Studies in English that looked at pesticide suicide in African countries will be extracted and screened independently by two reviewers against the inclusion and exclusion criteria of this review. Data will be extracted from these studies and a descriptive synthesis of the main findings of included studies given, as guided by the approach of Levac and colleagues. Each identified surveillance system will be evaluated based on the surveillance attributes described by the European Centre for Disease Control and Prevention (ECDC).

### Ethics and dissemination

Ethics approval is not required for this review as no human participants will be involved. The study findings will be distributed in a peer-reviewed publication.

### Registration details

This protocol has been submitted for publication to BMJ Open.

## ARTICLE SUMMARY

### Strengths and limitations of this study:

- As far as we are aware of, this scoping review will be the first to document and provide an analysis of the pesticide suicide surveillance methods used across the African continent.
- This protocol follows the scoping review methodological framework as set out by Arksey & O'Malley, the JBI Institute, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews checklist to ensure methodological rigour.
- As only English studies will be included this may bias the results of this review, given that publications in Africa may be in French, Portuguese, Arabic or other languages spoken across the continent.

## INTRODUCTION

Pesticide suicide is a major health problem globally. Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion(1). Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries (LMICs)(2,3). In 2010 deliberate pesticide ingestion as a means of committing suicide was estimated to account for anywhere between 250 000 to 370 000 deaths every year(4). A systematic review of fatal self-poisoning with pesticides showed that an estimated 168 000 pesticides suicides occurred annually between the years of 2006 and 2015(5). It has been seen that within rural communities of predominantly LMICs, pesticide suicides and acute pesticide poisonings are more common(4,6). This could be due to the wide availability and use of pesticides, as many of these rural communities engage and rely on agricultural practices, where pesticides are frequently encountered(4). Therefore, should this ease of access continue, pesticide suicides may become even more frequent. However, the full burden of pesticide suicides in African countries still remains poorly documented for several reasons(2,7). One reason is the lack of systematic data collection, especially since less than 10% of the countries in Africa report mortality data to World Health Organisation (WHO)(8). Lack of human resources and institutional capacity, as well as political and economic struggles in some countries, contributes to disrupted data collection systems on this continent. Stigma associated with suicide and criminalisation of attempted suicide in several countries of the region may be another reason for gaps in suicide reporting (9).

### **Pesticide poisoning and pesticide suicide reporting and data**

Pesticide suicide reporting appears to follow two main pathways. One pathway involves the use of the health system where specific in and outpatient-facilities, such as hospitals, report pesticide poisonings, deaths and suicides, while the other pathway involves police system reporting, including mortuary data, and is often used if death occurred outside of hospitals(10–12). Within the health care systems there is

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2  
3 sometimes the option of a Poison Information Centre as well. These are either based in a hospital or  
4 operated as a call centre through which such cases can be reported (10–12). Both reporting pathways  
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6 need to be considered to present a comprehensive picture of the situation.  
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12 As it will be further explored in the section below, available data on pesticide suicides in Africa are mostly  
13 based on small studies conducted among different populations with diverse economic, social, and cultural  
14 backgrounds. According to the WHO, Africa is the only region that experienced an increase in suicide  
15 rates between 2000-2012, where there was an estimated 38% increase in the rate(2). Gunnell and  
16 colleagues in 2007 had estimated that 15–33% (n=7800 deaths) of suicides on the continent of Africa  
17 were pesticide self-poisoning(7). This estimate was, however, based on four studies carried out in urban  
18 settings in four countries, namely Nigeria, Malawi, Tanzania and South Africa, that all made use of verbal  
19 autopsy data collected from specific urban areas within these countries(7). Deaths from pesticide  
20 poisoning are more common in the rural setting where there is limited access to health care services and  
21 where the highly hazardous pesticides are widely used. Urban settings, may therefore, not be entirely  
22 representative of pesticide suicide deaths.  
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40 In contrast to the study done by Gunnell and colleagues, a systematic review on the global burden of  
41 pesticide suicides conducted by Mew and colleagues(5) using the World Health Organisation's mortality  
42 data and information from literature published in a number of relevant databases between 2006 and  
43 2015, estimated that only 3.5% (n=2100) of the suicide deaths in Africa were pesticide suicides(5). It is  
44 important to note that this study highlighted that the limited amount of data available for the African  
45 continent may have resulted in an underestimation of the pesticide suicide rate, due to the data source  
46 used, and that the rate was more likely to coincide with that of the Gunnell and colleagues study(5,7).  
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3 Finally, another systematic review performed in 2014 by Mars and colleagues using data from 1998 to  
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5 2013 concluded that pesticide poisoning was one of the two most frequently used methods of suicide  
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7 among countries that had suicide incidence available on the African continent(8). The differences in  
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9 estimations between these studies further points to the challenges of pesticide suicide surveillance on  
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11 the African continent and highlights the need for a standardised method of surveillance as well as greater  
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13 surveillance capacity and a greater expansion of the coverage of surveillance methods.  
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18 Other available primary data on pesticide poisoning and pesticide suicides are from a select few hospital-  
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20 based studies, not covered by the Mew and colleagues study(5,13). A study done between 1998 and  
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22 1999 in 8 urban referral hospitals in Zimbabwe showed pesticides were responsible for nearly 60% (70  
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24 out of 123) of all the poisoning deaths, and 41% (1142 out of 2764) of the poisoning cases were deliberate  
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26 self-harm(14). In Kampala, Uganda, out of the 100 patients admitted to three major urban hospitals in  
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28 2002 following deliberate self-harm, 40% were pesticide suicides(15). An additional study done that  
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30 looked at hospital records from both urban and rural settings in Uganda over a six-and-a-half-year period,  
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32 from January 2010 to August 2016, found that, in the urban setting, 63.3% of the 212 pesticide poisoning  
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34 cases were deliberate self-harm(16). In the rural setting, 25% of the 101 pesticide poisoning cases were  
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36 deliberate self-harm(16).  
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42 A retrospective study from 2000 to 2003, based on mortuary records of the urban set Queen Elizabeth  
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44 Central Hospital (QECH) and College of Medicine, Blantyre, Malawi, revealed that pesticides was the  
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46 mode for 79% (66 out of 84) of the suicides(17). A study done at a tertiary hospital in an urban setting in  
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48 South Africa found that ingestion or inhalation of pesticides occurred in 19 of the 238 deliberate self-harm  
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50 cases over an nine-month period, from June 2014 to March 2015(18). This study indicated that pesticide  
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52 poisoning is not as common in urban settings in South Africa(18). An additional study in South Africa that  
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54 made use of census data and the Department of Home Affairs records, which captures information on  
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3 births and deaths in South Africa, between the years of 1991 and 2016, found that of the 8573 suicides  
4 recording throughout that time period, 1.7% were categorised as pesticide poisoning suicides(19).  
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9 From these studies it can be seen that while pesticide suicide may not be the most common method of  
10 suicide in all settings, it remains a problem on a larger scale of country-context in many African countries.  
11 Furthermore, fewer pesticide suicides recorded does not necessarily mean fewer pesticide suicides but  
12 could suggest that the reporting systems used in these studies may not be capturing the true number of  
13 pesticide suicides in these countries reported.  
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21 Underreporting of pesticide self-harm and suicides on the African continent could be a direct result of  
22 non-availability of an established surveillance system to capture the pesticide suicides. Improved  
23 pesticide surveillance system in South Africa has shown to capture cases of acute unintentional and  
24 severe poisoning ten times more than the routine notification system(20). This indicates that a general  
25 trend towards underreporting of poisoning cases, be it intentional or not, currently exists in Africa.  
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### 35 **Pesticide poisoning and pesticide suicide surveillance**

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37 Surveillance is defined as ongoing systematic collection, analysis and interpretation of data essential to  
38 planning, implementation and evaluation of public health practice(21). Pesticide poisoning and pesticide  
39 suicide surveillance is a vital tool for decision-makers and regulators of pesticides to manage the inherent  
40 risks associated with pesticide use for agriculture and public health. However, in comparison to other  
41 diseases, pesticide poisoning in general is a complex condition for surveillance, mainly because it  
42 includes several clinical presentations depending on the type of pesticide used, duration of exposure to  
43 the pesticide as well as the circumstances under which the exposure occurred. In addition, a successful  
44 pesticide poisoning surveillance system demands triangulated data from multiple sources, including  
45 health, agriculture, and industries. Data from health care institutions, toxicology analytical laboratories,  
46 forensic laboratories, police, or crime bureaus are further needed for a complete image on pesticide  
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3 suicides. Pesticide suicide surveillance is equally as challenging and presents the same complexities  
4 mentioned above, however, there is an added layer of challenges when considering the legal and social  
5 circumstances that may surround suicide (e.g., criminalisation of attempted suicide in the law, cultural,  
6 religious, and social taboos). What is required is an understanding of how suicide surveillance could be  
7 improved or implemented with existing surveillance systems in Africa.  
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17 Currently an existing surveillance structure, which could be used as a potential data source are national  
18 Poison Information Centres (PICs). These centres provide information on all types of poisoning and are  
19 helpful for clinicians and the public as a source of timebound information and advice for poisoning cases,  
20 as well as collect data around these cases(22). Currently, PICs are limited in Africa (approximately 10  
21 and not all in different countries) and of those that exist, many are under-resourced(23,24). These PICs  
22 would need to be linked to a national systematic recording system to be fully effective and efficient in  
23 monitoring and collecting data on pesticide poisoning linked to suicides.  
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35 National Health Management Information Systems (HMIS) data is another potential source for pesticide  
36 poisoning and suicide information that could be used for monitoring and policy making. These systems  
37 collect routine quantitative data in the health care system, such as deaths and cause of death, that can  
38 be used to identify areas of health care and reporting that can be improved on, in a cost-effective  
39 manor(25,26). A HMIS focused on pesticide suicides would require diligent investigations into suspected  
40 pesticide suicides, followed by capturing of any necessary information surrounding the death including  
41 the kind of pesticide used, active ingredient and the circumstances of the death. In countries where vital  
42 registration is not well established, verbal autopsy data is an alternative, in which an immediate family  
43 member or a caretaker is interviewed to identify the conditions and wider circumstances prior to death  
44 and thereby establish a cause of death. DHIS2 is an example of a successful digital HMIS that has been  
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3 adopted by 67 countries(27). DHIS2 involves the use of a software platform established for collection,  
4 management, analysis and use of health data collected by health professional in these countries(27).  
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10 In South Africa, an additional source of data is the National Injury and Mortality Surveillance System  
11 (NIMSS)(28). This is a surveillance system that was established in 1999 and collates information from  
12 mortuary investigations and services and state forensic laboratory records(28). This kind of data is ideal  
13 for capturing poisoning related deaths and would easily identify pesticide poisoning cases.  
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20 While hospital records and data capturing systems are useful in pesticide suicide surveillance, any  
21 deaths that occur outside the hospital may be missed. It is therefore important to also consider police  
22 reporting of deaths as an important step in the surveillance pathway(11). Suicides reported to the police  
23 could be further investigated and suspected pesticide suicides reported and documented for  
24 surveillance purposes. This would indicate the burden of pesticide suicides outside of the health care  
25 system.  
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### 37 **RATIONALE**

38 Pesticide suicides in Asian and South American countries are known to be significant, with an estimated  
39 160,000, pesticide suicides a year in South East Asia and 8,000 in Central and South America, according  
40 to a systematic review conducted in 2007(7). A study done in a rural community in China found that  
41 80.5% of the 297 suicide attempts were done via pesticide ingestion(6), while a study done in India  
42 between 1993 and 2003 found that 92 000 suicides were committed using pesticides(12). In contrast, the  
43 status of pesticide suicide on the African continent is hardly reported. Meanwhile pesticide imports and  
44 sales are on the rise. In Tanzania, pesticide imports showed a five-fold increase from 500 tons in 2000  
45 to 2500 tons in 2003, and the number of registered pesticides had risen from 682 to 874 over a five-year  
46 period starting from 2006(29). In Ethiopia, the registered number of pesticides has increased from 226 in  
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3 2013 to 326 by 2016 and an additional 16 companies have begun importing pesticides for the same  
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5 period. There has been a 47% increase in the pesticide imports in Uganda during 1980- 2004, this is in  
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7 addition to the unknown quantities that were smuggled through non secured country borders(29).  
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12 All this is amidst the escalating rates of pesticide sales in the African region and agriculture transition to  
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14 cash crops(30), supporting high utilisation, and hence the availability of pesticides in the farming  
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16 communities. Rising trends in pesticide usage is not limited to the larger commercial farms and estates,  
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18 but also penetrated to the smallholder farmers. Half of the vegetable smallholder farmers in northern  
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20 Tanzania showed increased amounts of pesticide use in 2005 compared to preceding five years(31).  
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22 Therefore, it is worthwhile to understand the causes underlying this low reporting of pesticide self-harm  
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24 in the African Continent. Is it due to low numbers in these countries or is it due to the existing surveillance  
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26 systems not capturing such incidents?  
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33 It is essential to know the number of pesticide self-harm cases as this information will help in preventing  
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35 further cases from occurring through informing policy and legislation, implementation of targeted bans,  
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37 raising community awareness around the use of these pesticides, training of health care personnel as  
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39 well as influencing the type and level of clinical facility investments into this area of health care.  
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#### 44 **SCOPING REVIEW OBJECTIVES**

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47 In this scoping review we aim to present a broad picture of how pesticide suicide deaths in Africa are  
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49 recorded by identifying and assessing the various surveillance systems in place, as well as highlighting  
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51 key limitations and data collection barriers.  
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54 The following objectives will be explored to address the aim of this review:

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56 1. To review the current literature on pesticide suicides in Africa.  
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2. To determine which surveillance methods, including those of collecting, compiling, reporting, and analysing, are currently being used to identify pesticide suicides in Africa.
3. To assess these existing surveillance methods based on quality and coverage.
4. To identify associations, if any, existing between possible social, economic, and cultural practices and the type of surveillance used.

To achieve these objectives, this scoping review will address the following questions:

What current surveillance systems are in place in African countries to capture and record suicide by pesticides? What are the potential barriers or limitation to these currently existing surveillance systems?

## METHODS AND ANALYSIS

The methods for this scoping review were designed in accordance with the five-stage methodological frameworks as set out by Arksey & O'Malley and the JBI Institute(32,33).

The scoping review will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)(34).

### Stage 1: Identifying the research question

As recommended by JBI(33), the PCC mnemonic for Population, Concept and Context was used to develop the question that includes a Population, Concept and Context – Population being those who commit pesticide suicide, Concept being the varying reporting or surveillance methods and Context being the African continent with various limitations as indicated in the inclusion criteria.

### Patient and Public Involvement

No patients involved.

## Stage 2: Identifying relevant studies

### Information sources

This review will conduct searches in the following databases: MEDLINE (via PubMed), Scopus (which includes considerable Embase content), Web of Science Core Collection, Biological Abstracts, SciELO (on Web of Science platform), Academic Search Premier, Africa-Wide Information, Biological and Agricultural Index, CINAHL, Health Source Nursing/ Academic, APA PsycInfo, General Science (EBSCOhost platform).

Grey literature will be sourced from the following databases: Database of African Theses and Dissertations (DATAD), ProQuest Dissertations and Theses, WorldCat Dissertations and Theses, International Association for the Prevention of Suicide conference proceedings, African Index Medicus, Eastern Mediterranean Index Medicus, Global Index Medicus, OpenDoar, OpenGrey, CGIAR repositories, and PapersFirst.

Finally, we will hand search the reference lists of included papers to identify further relevant articles not captured in the initial search and do forward citation tracking of reference lists using a citation index like Scopus, to identify further relevant papers.

### Search

The search strategy was developed using terms for the Population (Suicide + Pesticide) and the Context (the African continent) while search filters for the Concept (Surveillance) were omitted to ensure that relevant studies on data collection or reporting of pesticide suicides would not be missed.

Search strategy for PubMed (to be adapted to other databases)

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Population: Suicide and Pesticide suicide search

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#1 MeSH term: Suicide

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#2 MeSH term: Poisoning  
Poisoning[subheading]

#3 Text word: Overdose OR parasuicide OR poisoning OR self-destruction OR self-destructive OR self-destructing OR self-harm OR self-injurious OR self-poison OR self-poisoning OR self-inflicted OR self-mutilation OR suicide

#4 #1 OR #2  
OR #3

Pesticide search:

#5 MeSH terms: Pesticides

#6 MeSH terms: Pesticides [Pharmacological Action]

#7 Text word: acaricides OR agricultural chemical OR agrochemical OR aluminium phosphide OR carbamate OR chemosterilant OR defoliant OR fungicide OR hazardous compounds OR hazardous substances OR herbicide OR Insect control OR Insect repellent OR insecticide OR miticide OR molluscacides OR organochlorine OR organophosphate OR organophosphorus OR paraquat OR pest control OR pesticide OR poisons OR rodent control OR rodenticide OR toxic substances OR toxins OR weedkiller

#8 #5 OR #6  
OR #7

#9 #4 AND #8

Concept: Omitted filters for surveillance in order to keep search as broad as possible  
Surveillance

Context: Geographic Filter:

#10 MeSH terms: Africa

#11 Text word: Africa OR African OR Algeria OR Angola OR Benin OR Botswana OR "Burkina Faso" OR Burundi OR "Cabo Verde" OR Cameroon OR Cameroun OR "Canary Islands" OR "Cape Verde" OR "Central African Republic" OR Chad OR Comoros OR Congo OR "Cote d'Ivoire" OR "Democratic Republic of Congo" OR Djibouti OR Egypt OR Eritrea OR eSwatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR Guinea-Bissau OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Reunion OR

Rwanda OR "Saint Helena" OR "Sao Tome" OR Senegal OR Seychelles OR  
 "Sierra Leone" OR Somalia OR "St Helena" OR Sudan OR Swaziland OR  
 Tanzania OR Togo OR Tunisia OR Uganda OR "Western Sahara" OR Zaire  
 OR Zambia OR Zimbabwe

#12 #10 OR #11

#13 #9 AND #12

Filter to Human Studies

#14 MeSH Animals NOT Humans

#15 #13 NOT #14

### Stage 3: Study selection

#### Inclusion and exclusion criteria

The criteria for including studies in this scoping review are:

**Table 1. Inclusion and exclusion criteria**

Inclusion criteria	Exclusion criteria
Articles in English only	Articles with no English translation
Articles that conducted research on the African continent only	Studies outside the African continent
Peer-reviewed articles or articles from a specified grey literature database (listed above)	Articles not subject to a peer-review process
Articles on pesticide poisoning only	Articles on poisoning using chemicals not classified as a pesticide
Articles on suicide only	Articles on accidental pesticide poisoning
Articles on human studies only	Animal studies
Articles that mention pesticide suicide surveillance systems	Articles that do not mention surveillance systems
Articles with data of any type (quantitative, qualitative, or mixed)	
Official government records	
No limits on publication date	

## Selection of sources of evidence

Sources will be selected through a process of screening based on the eligibility criteria outlined in Table in Table 1. A reviewer will conduct the search on the databases, with assistance from a librarian from University of Cape Town, extract the results and export them into EndNote and then into Rayyan after removing any duplicates. The PRISMA flow diagram (Appendix 1) will be used to keep track of the screening process. Two of the authors will independently conduct the title and abstract screening, or a similar kind of screening in the absence of an abstract, to determine the eligibility of each source for this study. Any sources that could not be determined as eligible or not from the abstract will be subject to full-text review. Following this each reviewer will perform full-text review on studies included from the title and abstract screening. Using Rayyan, each reviewer will indicate the sources to be included and the ones to be excluded and the reasons for exclusion. Any disagreements between the reviewers will be discussed and if a mutual decision is not reached, a third author will resolve the conflict. The final resulting sources will then be used for the analysis of this review.

## Stage 4: Data extraction

### Data charting process

Table 2 shows the extraction fields. It consists of categories used to assess the final eligible articles retrieved from the systematic search. This is a framework that might change as reviewers chart the results of the articles. Framework will be updated continuously, as the reviewers increase the awareness of the content of the included studies. The same two reviewers will oversee charting the data independently. We ensure inter-rater reliability of the extraction fields by comparing a sample of the eligible articles, independently rated by the two reviewers, and discuss any discrepancy.

**Table 2.** Data extraction items.

Category	Description
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1. URL/ source	URL address of the publication
2. Authors	Names and institutions
3. Title	As per the database
4. Year of publication	Month and year
5. Objective	Objective of the study
6. Study design	Cohort/ cross-sectional/ ecological etc...
7. Country/ies	Country/ies the study took place in
8. Setting	Urban or rural Area the study was based in Hospital based or community based
8. Type of data	Primary data collected for the study Secondary data from an existing source
9. Source of data	Eg Verbal autopsy, HMIS, census data, police records, or data collected for the specific study
10. Study duration	Time period over which the study took place or observed
11. Study population	The population of the study
12. Sample size	Size of the sample in the study
13. Results	Number of deaths reported / time period Location of the results from multiple sights
14. Conclusions	Conclusions drawn from the study
15. Timeliness of the data	Gap between the data origin and publication
16. Coverage of the data	Does it provide data on both pesticides and suicides?

17. Depth of data	Does it give information on the type of pesticide
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### Data items

The variables considered in this scoping review include the following:

- Number of suicides
- Number of pesticide poisonings
- Number of pesticide suicides
- Number of poisonings
- Number of deaths from pesticide poisonings
- Age of individuals in each study
- Occupation of individuals
- Setting of each study (e.g. rural, urban, hospitals or clinics)
- Source of data (primary, secondary)

### Critical appraisal of individual sources of evidence

As this is a scoping study, we will provide a descriptive synthesis of the main findings of included studies, guided by the approach of Levac and colleagues<sup>(35)</sup>. to demonstrate the current evidence for the different surveillance systems. Pesticide suicide rates for the African continent will be calculated based on each of the available surveillance system.

Each of the identified surveillance systems will be evaluated based on the surveillance attributes described by the European Centre for Disease Control and Prevention (ECDC). Some of such attributes are as follows:

1. Completeness and validity

- 2.
3. Sensitivity, specificity, positive predictive value and negative predictive value, case ascertainment
- 4.
5. Timeliness
- 6.
7. Usefulness
- 8.
9. Representativeness

## Stage 5: Collating, summarising, and reporting the results

### Synthesis of results

Data will be summarised according to the country/location, number of pesticide suicides and the time period. Data will be also summarised based on the different surveillance systems, number of pesticide suicides reported captured by each different surveillance system. Completeness, timeliness, sensitivity and specificity, usefulness and representativeness of the surveillance system will be assessed.

### ETHICS AND DISSEMINATION

This study will review the current literature and explore the scope of pesticide suicide research in Africa. As there are no human participants in this study, ethics is not required. The outcome of the scoping review will also be written up as a journal article and published.

### ACKNOWLEDGEMENTS

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### AUTHOR CONTRIBUTIONS

MB and Ak are co-first authors of this protocol and led the design and development of this study, drafting and finalising this protocol. LU, ME, FK and HAR gave guidance to the study conceptualisation

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3 and protocol development. All authors provided input and commented on drafts, as well as approved  
4  
5 the final manuscript.  
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9

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29  
30 Patient consent for publication not required.

31  
32 Dr. Utyasheva reports grants from Open Philanthropy Project, during the conduct of the study.

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34 Dr. Karunaratne reports grants from Open Philanthropy Project, during the conduct of the study  
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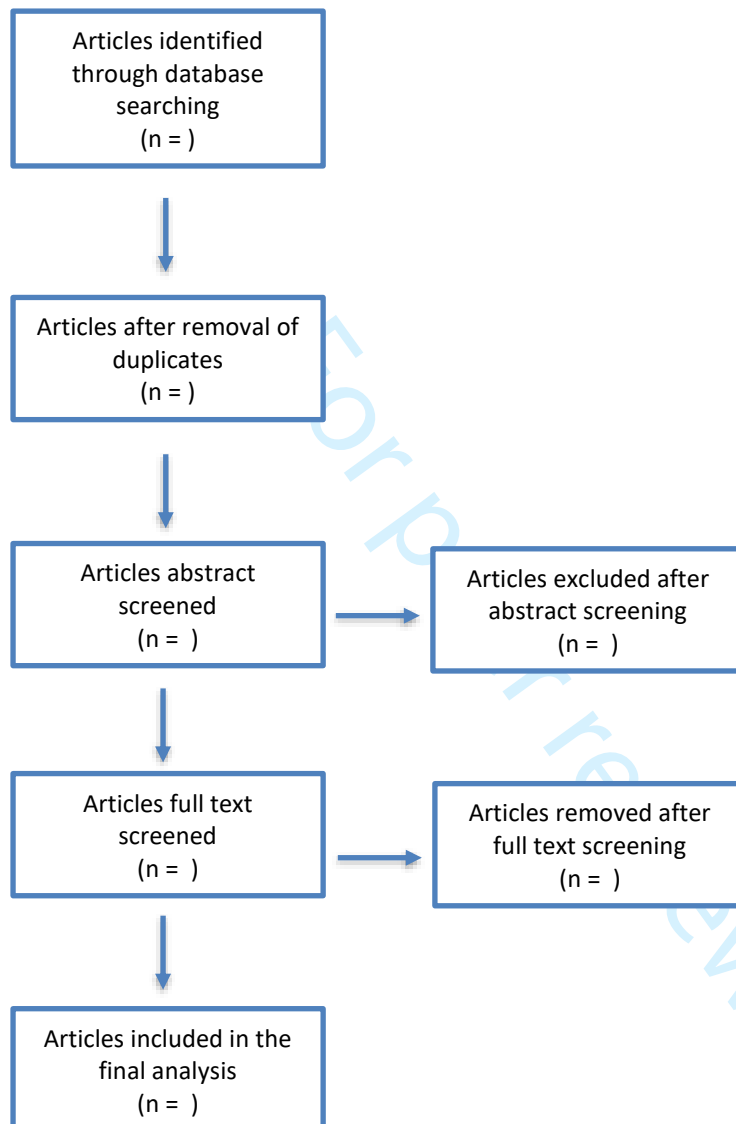
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For peer review only

## APPENDIX 1: Prisma flow diagram





## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2&3
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2-10
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	10
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	10
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	13&14
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	11
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12&13
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	14
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	15&16
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	16
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	17



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	17
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Click here to enter text.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Click here to enter text.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Click here to enter text.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Click here to enter text.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Click here to enter text.
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Click here to enter text.
Limitations	20	Discuss the limitations of the scoping review process.	Click here to enter text.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Click here to enter text.
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Click here to enter text.

JB1 = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. *Ann Intern Med*. 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



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# BMJ Open

## Current pesticide suicide surveillance methods used across the African continent – A scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055923.R1
Article Type:	Protocol
Date Submitted by the Author:	02-Jun-2022
Complete List of Authors:	Brassell, Maxine; University of Cape Town Faculty of Health Sciences, Division of Environmental Health Karunaratne, Ayanthi; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Utyasheva, Leah; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Eddleston, Michael; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Konradsen, Flemming; University of Copenhagen Department of Public Health, Global Health Section Rother, Hanna-Andrea; University of Cape Town Faculty of Health Sciences, Division of Environmental Health
<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	Occupational and environmental medicine, Mental health
Keywords:	Protocols & guidelines < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, Suicide & self-harm < PSYCHIATRY, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts

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4 **Current pesticide suicide surveillance methods used across the African continent – A scoping**  
5 **review protocol**  
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8 \*Maxine Brassell <sup>1\*</sup>, \*Ayanthi Karunaratne <sup>2\*</sup>, Dr Leah Utyasheva <sup>2,3</sup>, Flemming  
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35 **Key words:**

36 Pesticide, suicide, Africa, low- and middle-income countries, pesticide suicide surveillance, surveillance  
37 systems, self-harm, pesticide suicide, pesticide self-harm  
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40 Word count: 4693  
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## ABSTRACT

### Introduction

Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion. Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries. The full burden of pesticide suicides in African countries remains poorly documented, one reason being the lack of systematic data collection. It is essential to know the number of pesticide suicide cases to guide prevention of further cases occurring. This can be done by informing policy and legislation, and the implementation of targeted bans. As well as raising community awareness around the use of these pesticides, training of health care personnel, and influencing the type and level of clinical facility investments into this area of health care. The scoping review aims to investigate how pesticide suicide deaths in Africa are recorded by exploring the various surveillance systems in place, as well as highlighting key limitations and data collection barriers.

### Methods and analysis

A scoping review will be carried out with the five-stage methodological frameworks set out by Arksey & O'Malley and the JBI Institute. Studies in English that looked at pesticide suicide in African countries will be extracted and screened independently by two reviewers against the inclusion and exclusion criteria of this review. Studies data will be extracted, and a descriptive synthesis developed of their main findings, as guided by the approach of Levac and colleagues.

### Ethics and dissemination

Ethics approval is not required for this review as no human participants will be involved. The study findings will be distributed in a peer-reviewed publication.

### Registration details

This protocol has been submitted for publication to BMJ Open.

## ARTICLE SUMMARY

Strengths and limitations of this study:

- As far as we are aware of, this scoping review will be the first to document and provide an analysis of the pesticide suicide surveillance methods used across the African continent.
- This protocol outlines the methodological rigour of this scoping review by abiding by the frameworks of Arksey & O'Malley, the JBI Institute, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews checklist to ensure methodological rigour.
- A limitation is that only English language studies will be included in the review.

## INTRODUCTION

Pesticide suicide is a major health problem globally. Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion(1). Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries (LMICs)(2,3). In 2010, deliberate pesticide ingestion as a means of suicide was estimated to account for between 250 000 to 370 000 deaths every year(4). A systematic review of fatal self-poisoning with pesticides showed that an estimated 168 000 pesticides suicides occurred annually in the world between the years of 2006 and 2015(5). It has been seen that within rural communities of predominantly LMICs, pesticide suicides and acute pesticide poisonings are common(4,6). This could be due to the wide availability, easy access and extensive use of highly toxic pesticides within rural agricultural producing communities(4). Therefore, should this accessibility to pesticides continue, it is possible that pesticide ingestion may become an even more frequent method of suicide. However, the full burden of pesticide suicides in African countries still remains poorly documented for several reasons(2,7). One reason is the lack of systematic data collection, especially since less than 10% of the countries in Africa report mortality data to the World Health Organisation (WHO)(8). Lack of human resources and institutional capacity, as well as political and economic struggles in some countries, contributes to poor and disrupted data collection systems. Stigma, both societal and religious, associated with suicide and criminalisation of attempted suicide in several countries of the region may be another reason for gaps in suicide reporting(9).

### **Pesticide poisoning and pesticide suicide reporting and data**

Pesticide suicide reporting appears to follow two main pathways. One pathway involves the use of the health system where specific in- and outpatient-facilities, such as hospitals, report pesticide poisonings, deaths and suicides. While the other pathway involves police system reporting, including mortuary data, and is often used if death occurred outside of hospitals(10–12). Within the health care systems there is sometimes also the option of a Poison Information Centre. These are either based in a hospital or

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2  
3 operated as a call centre through which such cases can be reported(10–12). Both reporting pathways  
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5 need to be considered to present a comprehensive picture of the situation.  
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10 Available data on pesticide suicides in Africa are mostly based on small studies conducted among  
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12 different populations with diverse economic, social, and cultural backgrounds. According to the WHO,  
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14 Africa is the only region that experienced an increase in suicide rates between 2000-2012, where there  
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16 was an estimated 38% increase in the rate(2). Gunnell and colleagues in 2007 had estimated that 15–  
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18 33% (n=7800 deaths) of suicides on the continent were pesticide self-poisoning(7). This estimate was,  
19  
20 however, based on four studies carried out in urban settings in Nigeria, Malawi, Tanzania and South  
21  
22 Africa, that all made use of verbal autopsy data(7).  
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28 In contrast to the study done by Gunnell and colleagues, a systematic review on the global burden of  
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30 pesticide suicides conducted by Mew and colleagues(5), estimated that only 3.5% (n=2100) of the suicide  
31  
32 deaths in Africa were pesticide suicides(5). This was based on the World Health Organisation's mortality  
33  
34 data and information from literature published in a number of relevant databases between 2006 and  
35  
36 2015. It is important to note that this study highlighted that the limited amount of data available for the  
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38 African continent may have resulted in an underestimation of the pesticide suicide rate, due to the data  
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40 source used, and that the rate was more likely to coincide with that of the Gunnell and colleagues  
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42 study(5,7).  
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48 Finally, another systematic review, performed in 2014 by Mars and colleagues using data from 1998 to  
49  
50 2013, concluded that pesticide poisoning was one of the two most frequently used methods of suicide  
51  
52 among countries that had suicide incidence available on the African continent, with the other most  
53  
54 frequent method being hanging(8). The differences in estimations between these studies further points  
55  
56 to the challenges of pesticide suicide surveillance on the African continent and highlights the need for a  
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3 standardised method of surveillance as well as sufficient surveillance capacity and an expansion of the  
4 coverage of surveillance methods.  
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11 There is a significant lack of primary data on the pesticide suicides in countries of the African continent.  
12 Currently, the available data are limited and based on a few hospital-based studies in Tanzania,  
13 Zimbabwe, Uganda, Malawi, and South Africa. A Tanzanian hospital-based retrospective study from  
14 2000-2005 reports that majority (64.4%) of the acute pesticide poisoning cases (n=656) were suicides,  
15 and in 2006 a prospective study reported 84.6% (n=230) in the same hospital(13). Another Tanzanian  
16 study in Muhimbili University hospital in 2004 revealed that 24% (n=24) of the suicides were due to  
17 pesticides (14). Other available primary data on pesticide poisoning and pesticide suicides in Africa are  
18 from other hospital-based studies, not covered by the Mew and colleagues study(5,15). A study done  
19 between 1998 and 1999 in eight urban referral hospitals in Zimbabwe showed pesticides were  
20 responsible for nearly 60% (70 out of 123) of all the poisoning deaths, and 41% (1142 out of 2764) of the  
21 poisoning cases were deliberate self-poisoning suicide attempts(16). In Kampala, Uganda, out of the 100  
22 patients admitted to three major urban hospitals in 2002 following deliberate self-harm, 40% were  
23 pesticide suicides(17). An additional study done that looked at hospital records from both urban and rural  
24 settings in Uganda from January 2010 to August 2016, found that, in the urban setting, 63.3% of the 212  
25 pesticide poisoning cases were deliberate self-harm(18). In the rural setting, 25% of the 101 pesticide  
26 poisoning cases were deliberate self-harm(18).  
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49 A retrospective study in Blantyre, Malawi from 2000 to 2003, based on mortuary records from the urban  
50 based Queen Elizabeth Central Hospital (QECH) and College of Medicine, revealed that pesticides were  
51 the mode for 79% (66 out of 84) of the suicides(19). A study done at a tertiary hospital in an urban setting  
52 in South Africa found that ingestion or inhalation of pesticides occurred in 19 of the 238 deliberate self-  
53 harm cases over an nine-month period, from June 2014 to March 2015(20). This study indicated that  
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3 pesticide poisoning is not as common in urban settings in South Africa(20). An additional study in South  
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5 Africa that made use of census data and the Department of Home Affairs records, which captures  
6  
7 information on births and deaths in South Africa, between the years of 1991 and 2016, found that of the  
8  
9 8573 suicides recording throughout that time period, 1.7% were categorised as pesticide poisoning  
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11 suicides(21).  
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16 Deaths from pesticide poisoning are believed to be more common in rural areas where there is limited  
17  
18 access to health care services and where highly hazardous pesticides are widely used and accessible  
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20 (18,22,23). However, several factors complicate this assumption. Firstly, poisoned patients are frequently  
21  
22 transferred from rural to urban hospitals for advanced care and intensive care unit beds(18). Urban,  
23  
24 particularly poor, households have been shown to illegally use agricultural pesticides as a rodenticides  
25  
26 and household insecticides (i.e., *street pesticides*) and also for suicides(24–26). Urban settings, may  
27  
28 therefore, not be entirely representative of pesticide suicide deaths, but they cannot be excluded. Ideally  
29  
30 a sufficient surveillance system would include data collection from both rural and urban settings,  
31  
32 regardless of resource availability, providing a more complete picture of pesticide suicides.  
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41 From these studies, while pesticide suicide may not be the most common method of suicide in all settings,  
42  
43 it remains a problem on a larger scale of country-context in many African countries. Furthermore, fewer  
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45 pesticide suicides officially recorded does not necessarily mean fewer pesticide suicides but could  
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47 suggest that the reporting systems used in these studies may not be capturing the true number of  
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49 pesticide suicides in these countries.  
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53 Underreporting of pesticide suicides on the African continent could be a direct result of non-availability of  
54  
55 an established surveillance system to capture the pesticide suicides. Improved pesticide surveillance  
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57 system in South Africa has shown to capture cases of acute unintentional and severe poisoning ten times  
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3 more than the routine notification system(27). This indicates that a general trend towards underreporting  
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5 of poisoning cases, be it intentional or not, currently exists in Africa and the potential impact on decision  
6  
7 making if surveillance is improved.  
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### 10 11 12 **Pesticide poisoning and pesticide suicide surveillance** 13

14 Surveillance is defined as ongoing systematic collection, analysis and interpretation of data essential for  
15  
16 planning, implementation and evaluation of public health practice(28). Pesticide poisoning and pesticide  
17  
18 suicide surveillance is a vital tool for decision-makers and regulators of pesticides to manage the inherent  
19  
20 risks associated with and easy access to pesticide use for agriculture and public health. However, in  
21  
22 comparison to other diseases, pesticide poisoning, in general, is a complex condition for surveillance,  
23  
24 mainly because it includes several clinical presentations depending on the type of pesticide used,  
25  
26 duration of exposure to the pesticide as well as the circumstances under which the exposure occurred.  
27  
28 Pesticide poisoning (e.g., from organophosphates) is often misdiagnosed (some symptoms are confused  
29  
30 as the flu, for example), and health professionals receive limited training on the wide range of pesticide  
31  
32 classes and their related acute and chronic health effects. In addition, a successful pesticide poisoning  
33  
34 surveillance system demands triangulated data from multiple sources, including from health institutions  
35  
36 and departments, agricultural departments, and industries. Data from health care institutions, toxicology  
37  
38 analytical laboratories, forensic laboratories, police, or crime bureaus are further needed for filling in the  
39  
40 data gap on pesticide poisonings and suicides. Pesticide suicide surveillance is equally as challenging  
41  
42 and presents the same complexities as pesticide poisonings, however, there is an added layer of  
43  
44 challenges when considering the legal and social circumstances that may surround suicide (e.g.,  
45  
46 criminalisation of attempted suicide in the law, cultural, religious, and social taboos). What is required is  
47  
48 an understanding of how pesticide suicide surveillance could be improved or implemented with existing  
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50 general surveillance systems in Africa.  
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3 Currently an existing surveillance structure, which could be used as a potential data source, are national  
4 Poison Information Centres (PICs). These centres provide information on all types of poisoning and are  
5 helpful for clinicians and the public as a source of timebound information and advice for poisoning cases,  
6 as well as collect data around these cases(29). Currently, PICs are limited in Africa. There are  
7 approximately 12 PICs (i.e., Algeria – 2; Angola; Ghana; Kenya – 2; Senegal; South Africa – 3; Tanzania;  
8 and Zimbabwe). Of those that exist, many are under-resourced(30,31). These PICs would need to be  
9 linked to a national systematic recording system to be fully effective and efficient in monitoring and  
10 collecting data on pesticide poisoning linked to suicides.  
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23 National Health Management Information Systems (HMIS) data is another potential source for pesticide  
24 poisoning and suicide information that could be used for monitoring and policy making. These systems  
25 collect routine quantitative data in the health care system, such as deaths and cause of death, that can  
26 be used to identify areas of health care and reporting that can be improved on in a cost-effective  
27 manor(32,33). A HMIS focused on pesticide suicides would require diligent investigations into suspected  
28 pesticide suicides, followed by capturing of any necessary information surrounding the death including  
29 the type of pesticide used, the active ingredient or co-formulant that caused the death and the  
30 circumstances of the death. In countries where registration is not well established, verbal autopsy data  
31 is an alternative, in which an immediate family member or a caretaker is interviewed to identify the  
32 conditions and wider circumstances prior to death and thereby establish a cause of death. District Health  
33 Information Software 2 (DHIS2) is an example of a successful digital HMIS that has been adopted by 67  
34 countries(34). DHIS2 involves the use of a software platform established for collection, management,  
35 analysis and use of health data collected by health professional in these countries(34).  
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56 In South Africa, an additional source of data is the National Injury and Mortality Surveillance System  
57 (NIMSS)(35). This is a surveillance system that was established in 1999 and collates information from  
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3 mortuary investigations and services, as well as state forensic laboratory records(35). This type of data  
4  
5 is suitable for capturing poisoning related deaths and would easily identify pesticide poisoning cases. In  
6  
7 some cases, however, laboratories may not be able to identify some types of pesticides due to a lack of  
8  
9 available sample standards or existing data on pesticides, making it difficult to identify some pesticide  
10  
11 poisoning cases.  
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16 While hospital records and data capturing systems are useful in pesticide suicide surveillance, any  
17  
18 deaths that occur outside of a hospital may be missed. It is therefore important to also consider police  
19  
20 reporting of deaths as an important step in the surveillance pathway(11). Suicides reported to the police  
21  
22 could be further investigated and suspected pesticide suicides reported and documented for  
23  
24 surveillance purposes. This would indicate the burden of pesticide suicides outside of the health care  
25  
26 system.  
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32 Existing surveillance systems for pesticide poisonings and suicides on the African continent vary  
33  
34 depending on the context, resources and availability of information surrounding such cases. It is  
35  
36 important to investigate these existing systems to get an overall picture of the current pesticide suicide  
37  
38 and poisoning surveillance in Africa, and where this could be improved or adjusted.  
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## 44 **RATIONALE**

45  
46 Pesticide suicides in Asian and South American countries are known to be significant, with an estimated  
47  
48 160,000, pesticide suicides a year in South East Asia and 8,000 in Central and South America, according  
49  
50 to a systematic review conducted in 2007 and the more recent study in 2017(7,36). A study conducted  
51  
52 in a rural community in China found that 80.5% of the 297 suicide attempts were done via pesticide  
53  
54 ingestion(6). While a study in India between 1993 and 2003 found that 92 000 suicides were committed  
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56 using pesticides(12). In contrast, the status of pesticide suicide on the African continent is hardly reported.  
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Meanwhile, pesticide imports and sales are on the rise. In Tanzania, pesticide imports showed a five-fold increase from 500 tons in 2000 to 2500 tons in 2003, and the number of registered pesticides had risen from 682 to 874 over a five-year period starting from 2006(37). In Ethiopia, the registered number of pesticides has increased from 226 in 2013 to 326 by 2016 and an additional 16 companies have begun importing pesticides for the same period(37). There has been a 47% increase in the pesticide imports in Uganda during 1980- 2004, this is in addition to the unknown quantities that were smuggled through non secured borders(37).

All this is amidst the escalating rates of pesticide sales in the African region and agriculture transition to cash crops(38), supporting high utilisation, and hence the availability of pesticides in farming communities. Rising trends in pesticide usage is not limited to the larger commercial farms and estates, but also penetrated to the smallholder farmers. Half of the vegetable smallholder farmers in northern Tanzania showed increased amounts of pesticide use in 2005 compared to preceding five years(39). Despite the increases in utilisation, import and export of pesticides, low reporting levels of pesticide self-harm remain. Therefore, it is worthwhile to explore the causes underlying this low reporting of pesticide self-harm in the African Continent. Is it due to low numbers in these countries or is it due to the existing surveillance systems not capturing such incidents? This review will explore these ideas further with a focus on the current pesticide suicide surveillance systems being used in Africa and whether they are sufficient or perhaps a hinderance to reporting.

Furthermore, it is essential to be aware of the prevalence of pesticide self-harm cases or attempted pesticide suicide, which do not end in death. This information will help in preventing further cases from occurring through informing policy and legislation, implementation of targeted bans on dangerous pesticides, raising community awareness around the use of pesticides, training of health care personnel, as well as influencing the type and level of clinical facility investments into this area of health care.

## SCOPING REVIEW OBJECTIVES

In this scoping review we aim to present a broad picture of how pesticide suicide deaths and attempted pesticide suicides in Africa by identifying and exploring the various surveillance systems in place, as well as highlighting key limitations and data collection barriers.

The following objectives will be studied to address the aim of this review:

1. To review the current literature on pesticide suicides and attempted suicides in Africa.
2. To determine which surveillance methods, including those of collecting, compiling, reporting, and analysing, are currently being used to identify pesticide suicides and attempted suicides in Africa.

To achieve these objectives, this scoping review will address the following questions:

What current surveillance systems are in place in African countries to capture and record suicide by pesticides? What are the potential barriers or limitations to these existing surveillance systems?

## METHODS AND ANALYSIS

The methods for this scoping review were designed in accordance with the five-stage methodological frameworks as set out by Arksey & O'Malley and the Joanna Briggs Institute (JBI)(40,41).

The scoping review will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)(42).

### Stage 1: Identifying the research question

As recommended by JBI(41), one way to structure a research question is to follow the PCC mnemonic for Population, Concept and Context which was used to develop the review question.

*Population* is defined as those who engage in self-poisoning with pesticides and populations that have

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2  
3 cases of fatal and non-fatal pesticide poisoning. Since suicide is associated with significant stigma, not  
4  
5 all suicides may be reported as suicide but instead reported as accidental pesticide poisoning. This is  
6  
7 the reason why in addition to pesticide suicides and attempted suicide we included cases of non-  
8  
9 occupational pesticide poisoning. *Concept* in this review refers to the varying reporting or surveillance  
10  
11 methods. While *Context* is the African continent with various limitations as indicated in the inclusion  
12  
13 criteria.  
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### 19 **Patient and Public Involvement**

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21 As this is a scoping review, no patients will be directly involved.  
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### 26 **Stage 2: Identifying relevant studies**

#### 27 **Information sources**

28  
29 This review will conduct searches in the following databases: MEDLINE (via PubMed), Scopus (which  
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31 includes considerable Embase content), Web of Science Core Collection, Biological Abstracts, SciELO  
32  
33 (on Web of Science platform), Academic Search Premier, Africa-Wide Information, Biological and  
34  
35 Agricultural Index, CINAHL, Health Source Nursing/ Academic, APA PsycInfo, General Science  
36  
37 (EBSCOhost platform).  
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44 Grey literature will be sourced from the following databases: Database of African Theses and  
45  
46 Dissertations (DATAD), ProQuest Dissertations and Theses, WorldCat Dissertations and Theses,  
47  
48 International Association for the Prevention of Suicide conference proceedings, African Index Medicus,  
49  
50 Eastern Mediterranean Index Medicus, Global Index Medicus, OpenDoar, OpenGrey, CGIAR  
51  
52 repositories, and PapersFirst.  
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3 Finally, we will hand search the reference lists of included papers to identify further relevant articles not  
4 captured in the initial search and do forward citation tracking of reference lists using a citation index like  
5  
6 Scopus, to identify further relevant papers.  
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## 17 Search

18  
19 The search strategy was developed using terms for the Population (suicide and pesticide) and the  
20 Context (the African continent) while search filters for the Concept (surveillance) were omitted to ensure  
21 that relevant studies on data collection or reporting of pesticide suicides would not be missed.  
22  
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28 Search strategy for PubMed (to be adapted to other databases)  
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31 Population: Suicide and Pesticide suicide search  
32

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33 #1 MeSH term: Suicide  
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36 #2 MeSH term: Poisoning  
37 Poisoning[subheading]  
38  
39

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40 #3 Text word: Overdose OR parasuicide OR poisoning OR self-destruction OR self-  
41 destructive OR self-destructing OR self-harm OR self-injurious OR self-poison  
42 OR self-poisoning OR self-inflicted OR self-mutilation OR suicide  
43  
44

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45 #4 #1 OR #2  
46 OR #3  
47

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48 Pesticide search:  
49  
50  
51

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52 #5 MeSH Pesticides  
53 terms:  
54

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55 #6 MeSH Pesticides [Pharmacological Action]  
56 terms:  
57  
58  
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#7 Text word: acaricides OR agricultural chemical OR agrochemical OR aluminium phosphide OR carbamate OR chemosterilant OR defoliant OR fungicide OR hazardous compounds OR hazardous substances OR herbicide OR Insect control OR Insect repellent OR insecticide OR miticide OR molluscicides OR organochlorine OR organophosphate OR organophosphorus OR paraquat OR pest control OR pesticide OR poisons OR rodent control OR rodenticide OR toxic substances OR toxins OR weedkiller

#8 #5 OR #6  
OR #7

#9 #4 AND #8

Concept: Omitted filters for surveillance in order to keep search as broad as possible  
Surveillance

Context: Geographic Filter:

#10 MeSH Africa  
terms:

#11 Text word: Africa OR African OR Algeria OR Angola OR Benin OR Botswana OR "Burkina Faso" OR Burundi OR "Cabo Verde" OR Cameroon OR Cameroun OR "Canary Islands" OR "Cape Verde" OR "Central African Republic" OR Chad OR Comoros OR Congo OR "Cote d'Ivoire" OR "Democratic Republic of Congo" OR Djibouti OR Egypt OR Eritrea OR eSwatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR Guinea-Bissau OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Reunion OR Rwanda OR "Saint Helena" OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR "St Helena" OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe

#12 #10 OR #11

#13 #9 AND #12

Filter to Human Studies

#14 MeSH Animals NOT Humans

#15 #13 NOT #14

### Stage 3: Study selection

#### Inclusion and exclusion criteria

The criteria for including and excluding studies in this scoping review are presented in Table 1.

**Table 1. Inclusion and exclusion criteria**

Inclusion criteria	Exclusion criteria
Articles in English only	Articles with no English translation
Articles that conducted research on the African continent	Studies outside the African continent
Peer-reviewed articles or articles from a specified grey literature database (listed above)	Articles not subject to a peer-review process
Articles on pesticide poisoning	Articles on poisoning using chemicals not classified as a pesticide
Articles on suicide	Articles on accidental pesticide poisoning
Articles on human studies	Animal studies
Articles that mention pesticide suicide surveillance systems	Articles that do not mention surveillance systems
Articles with data of any type (quantitative, qualitative, or mixed)	
Official government records	
No limits on publication date	

#### Selection of sources of evidence

Sources will be selected through a process of screening based on the eligibility criteria outlined in Table

1. A reviewer will conduct the search on the databases, with assistance from a University of Cape Town librarian, extract the results and export them into EndNote and then into Rayyan after removing any duplicates. The PRISMA flow diagram (Supplementary data 1) will be used to keep track of the screening process. To determine the eligibility of each source for this study, two of the authors will independently conduct the title and abstract screening, or a similar kind of screening in the absence of an abstract.. Any sources that could not be determined as eligible or not from the abstract will be subject to full-text review.

Following this, each reviewer will perform a full-text review on studies included from the title and abstract screening. Using Rayyan, each reviewer will indicate the sources to be included and the ones to be

excluded and the reasons for exclusion. Any disagreements between the reviewers will be discussed and if a mutual decision is not reached, a third author will resolve the conflict. The final resulting sources will then be used for the analysis of this review.

#### Stage 4: Data extraction

##### Data charting process

Table 2 presents the extraction spreadsheet fields. It consists of categories used to assess the final eligible articles retrieved from the systematic search. This framework might change as reviewers chart the results of the articles. The framework will be updated continuously, as the reviewers increase their awareness of the content of the included studies. The same two reviewers will oversee charting the data independently. We ensure inter-rater reliability of the extraction fields by comparing a sample of the eligible articles, independently rated by the two reviewers, and discuss any discrepancy.

**Table 2.** Data extraction items.

Category	Description
1. URL/ source	URL address of the publication
2. Authors	Names and institutions
3. Title	As per the database
4. Year of publication	Month and year
5. Objective	Objective of the study
6. Study design	Cohort/ cross-sectional/ ecological etc...
7. Country/ies	Country/ies the study took place in
8. Setting	Urban or rural Area the study was based in Hospital based or community based

8. Type of data	Primary data collected for the study Secondary data from an existing source
9. Source of data	E.g., Verbal autopsy, HMIS, census data, police records, or data collected for the specific study
10. Study duration	Time period over which the study took place or observed
11. Study population	The population of the study
12. Sample size	Size of the sample in the study
13. Type of pesticide	The type (group) of pesticide used for self-harm or poisoning
14. Number of deaths from each pesticide	The number of deaths that were related to each pesticide identified in the study
15. Results	Number of deaths reported / period Location of the results from multiple sights
16. Conclusions	Conclusions drawn from the study
17. Timeliness of the data	Gap between the data origin and publication
18. Coverage of the data	Does it provide data on both pesticides and suicides?
19. Depth of data	Does it give information on the type of pesticide

### Data items

The variables considered in this scoping review include the following:

- Number of suicides
- Number of pesticide poisonings
- Number of pesticide suicides

- Number of poisonings
- Number of deaths from pesticide poisonings
- Type of pesticide
- Number of deaths from each type of pesticide
- Age of individuals in each study
- Occupation of individuals
- Setting of each study (e.g., rural, urban, hospitals or clinics)
- Source of data (primary, secondary)

### **Critical appraisal of individual sources of evidence**

As this is a scoping study, we will provide a descriptive synthesis of the main findings of included studies, guided by the approach of Levac and colleagues(43) to demonstrate the current evidence for the different surveillance systems. Pesticide suicide rates for the African continent will be calculated based on each of the available surveillance system.

### **Stage 5: Collating, summarising, and reporting the results**

#### **Synthesis of results**

Data will be summarised according to the country/location, number of pesticide suicides and the time period. Data will be also summarised based on the different surveillance systems, number of pesticide suicides reported captured by each different surveillance system.

### **CONCLUSION**

Pesticide suicides in Africa have not been well explored yet and this is evident through the current gap in the literature and lack of adequate data available on this matter. This scoping review will therefore contribute to the literature in this area of research, identifying gaps and a way forward for such research

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2  
3 in the future. With pesticide use on the rise in Africa, it seems fitting to explore the potential  
4 consequences of such a change.  
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## 7 **ETHICS AND DISSEMINATION**

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9  
10 This study will review the current literature and explore the scope of pesticide suicide research in Africa.  
11  
12 As there are no human participants in this study, ethics is not required. The outcome of the scoping  
13 review will also be written up as a journal article and published.  
14  
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17

## 18 **ACKNOWLEDGEMENTS**

19  
20  
21 The authors would like to acknowledge thank Mary Shelton, retired librarian from the University of Cape  
22 Town, for her contributions to the development of this protocol, especially the search strategy.  
23  
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27

## 28 **AUTHOR CONTRIBUTIONS**

29  
30 MB and Ak are co-first authors of this protocol and led the design and development of this study,  
31 drafting and finalising this protocol. LU, ME, FK and HAR gave guidance to the study conceptualisation  
32 and protocol development. All authors provided input and commented on drafts, as well as approved  
33 the final manuscript.  
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47  
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## COMPETING INTERESTS STATEMENT

Patient consent for publication not required.

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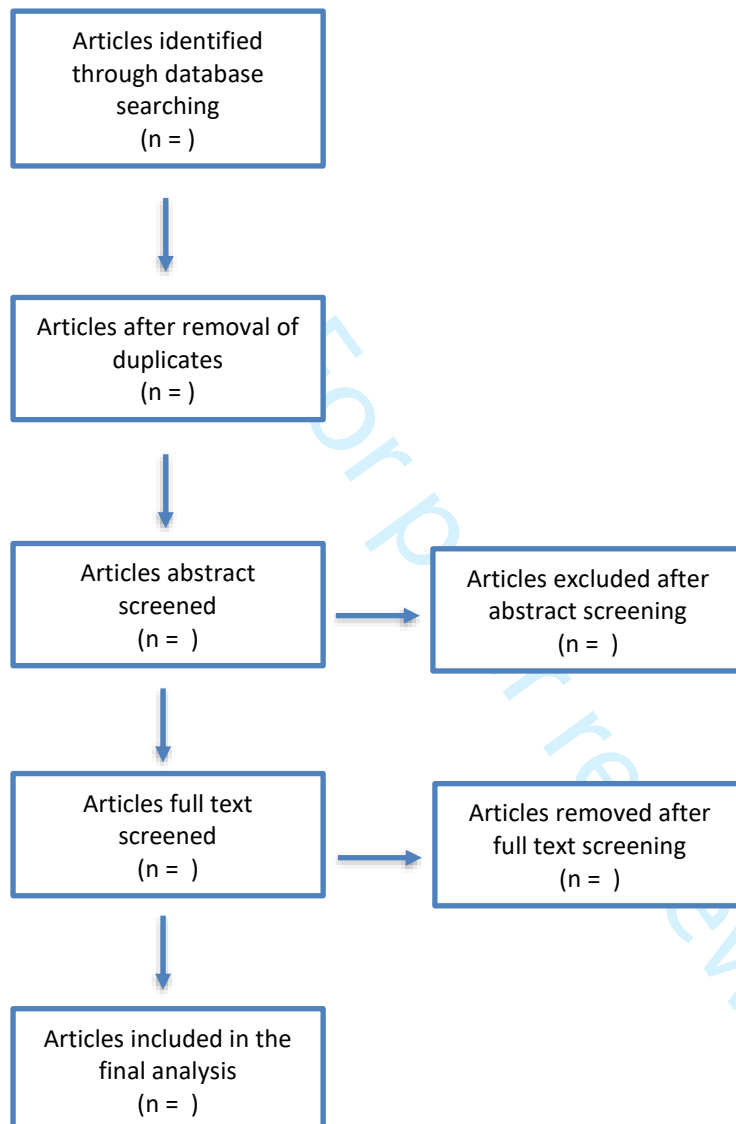


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## APPENDIX 1: Prisma flow diagram



## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2&3
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2-10
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	10
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	10
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	13&14
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	11
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12&13
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	14
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	15&16
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	16
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	17



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	17
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Click here to enter text.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Click here to enter text.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Click here to enter text.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Click here to enter text.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Click here to enter text.
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Click here to enter text.
Limitations	20	Discuss the limitations of the scoping review process.	Click here to enter text.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Click here to enter text.
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Click here to enter text.

JB1 = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: 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;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



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# BMJ Open

## Current pesticide suicide surveillance methods used across the African continent – A scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055923.R2
Article Type:	Protocol
Date Submitted by the Author:	23-Jun-2022
Complete List of Authors:	Brassell, Maxine; University of Cape Town Faculty of Health Sciences, Division of Environmental Health Karunaratne, Ayanthi; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Utyasheva, Leah; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Eddleston, Michael; The University of Edinburgh The Queen's Medical Research Institute, Centre for Pesticide Suicide Prevention Konradsen, Flemming; University of Copenhagen Department of Public Health, Global Health Section Rother, Hanna-Andrea; University of Cape Town Faculty of Health Sciences, Division of Environmental Health
<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	Occupational and environmental medicine, Mental health
Keywords:	Protocols & guidelines < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, Suicide & self-harm < PSYCHIATRY, PUBLIC HEALTH

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4 **Current pesticide suicide surveillance methods used across the African continent – A scoping**  
5 **review protocol**  
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8 \*Maxine Brassell <sup>1\*</sup>, \*Ayanthi Karunaratne <sup>2\*</sup>, Dr Leah Utyasheva <sup>2,3</sup>, Flemming  
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35 **Key words:**

36 Pesticide, suicide, Africa, low- and middle-income countries, pesticide suicide surveillance, surveillance  
37 systems, self-harm, pesticide suicide, pesticide self-harm  
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## ABSTRACT

### Introduction

Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion. Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries. The full burden of pesticide suicides in African countries remains poorly documented, one reason being the lack of systematic data collection. It is essential to know the number of pesticide suicide cases to guide prevention of further cases occurring. This can be done by informing policy and legislation, and the implementation of targeted bans. As well as raising community awareness around the use of these pesticides, training of health care personnel, and influencing the type and level of clinical facility investments into this area of health care. The scoping review aims to investigate how pesticide suicide deaths in Africa are recorded by exploring the various surveillance systems in place, as well as highlighting key limitations and data collection barriers.

### Methods and analysis

A scoping review will be carried out with the five-stage methodological frameworks set out by Arksey & O'Malley and the JBI Institute. Studies in English that looked at pesticide suicide in African countries will be extracted and screened independently by two reviewers against the inclusion and exclusion criteria of this review. Studies data will be extracted, and a descriptive synthesis developed of their main findings, as guided by the approach of Levac and colleagues.

### Ethics and dissemination

Ethics approval is not required for this review as no human participants will be involved. The study findings will be distributed in a peer-reviewed publication.

### Registration details

This protocol has been submitted for publication to BMJ Open.

## ARTICLE SUMMARY

Strengths and limitations of this study:

- As far as we are aware of, this scoping review will be the first to document and provide an analysis of the pesticide suicide surveillance methods used across the African continent.
- This protocol outlines the methodological rigour of this scoping review by abiding by the frameworks of Arksey & O'Malley, the JBI Institute, and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews checklist to ensure methodological rigour.
- A limitation is that only English language studies will be included in the review.



## INTRODUCTION

Pesticide suicide is a major health problem globally. Every year more than 800,000 people die from suicides of which an estimated 20% are from pesticide ingestion(1). Multiple studies have estimated that around 77% - 80% of these pesticide suicides occur in low- and middle-income countries (LMICs)(2,3). In 2010, deliberate pesticide ingestion as a means of suicide was estimated to account for between 250 000 to 370 000 deaths every year(4). A systematic review of fatal self-poisoning with pesticides showed that an estimated 168 000 pesticides suicides occurred annually in the world between the years of 2006 and 2015(5). It has been seen that within rural communities of predominantly LMICs, pesticide suicides and acute pesticide poisonings are common(4,6). This could be due to the wide availability, easy access and extensive use of highly toxic pesticides within rural agricultural producing communities(4). Therefore, should this accessibility to pesticides continue, it is possible that pesticide ingestion may become an even more frequent method of suicide. However, the full burden of pesticide suicides in African countries still remains poorly documented for several reasons(2,7). One reason is the lack of systematic data collection, especially since less than 10% of the countries in Africa report mortality data to the World Health Organisation (WHO)(8). Lack of human resources and institutional capacity, as well as political and economic struggles in some countries, contributes to poor and disrupted data collection systems. Stigma, both societal and religious, associated with suicide and criminalisation of attempted suicide in several countries of the region may be another reason for gaps in suicide reporting(9).

### **Pesticide poisoning and pesticide suicide reporting and data**

Pesticide suicide reporting appears to follow two main pathways. One pathway involves the use of the health system where specific in- and outpatient-facilities, such as hospitals, report pesticide poisonings, deaths and suicides. While the other pathway involves police system reporting, including mortuary data, and is often used if death occurred outside of hospitals(10–12). Within the health care systems there is sometimes also the option of a Poison Information Centre. These are either based in a hospital or

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3 operated as a call centre through which such cases can be reported(10–12). Both reporting pathways  
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5 need to be considered to present a comprehensive picture of the situation.  
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10 Available data on pesticide suicides in Africa are mostly based on small studies conducted among  
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12 different populations with diverse economic, social, and cultural backgrounds. According to the WHO,  
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14 Africa is the only region that experienced an increase in suicide rates between 2000-2012, where there  
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16 was an estimated 38% increase in the rate(2). Gunnell and colleagues in 2007 had estimated that 15–  
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18 33% (n=7800 deaths) of suicides on the continent were pesticide self-poisoning(7). This estimate was,  
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20 however, based on four studies carried out in urban settings in Nigeria, Malawi, Tanzania and South  
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22 Africa, that all made use of verbal autopsy data(7).  
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29 In contrast to the study done by Gunnell and colleagues, a systematic review on the global burden of  
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31 pesticide suicides conducted by Mew and colleagues(5), estimated that only 3.5% (n=2100) of the suicide  
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33 deaths in Africa were pesticide suicides(5). This was based on the World Health Organisation's mortality  
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35 data and information from literature published in a number of relevant databases between 2006 and  
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37 2015. It is important to note that this study highlighted that the limited amount of data available for the  
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39 African continent may have resulted in an underestimation of the pesticide suicide rate, due to the data  
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41 source used, and that the rate was more likely to coincide with that of the Gunnell and colleagues  
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43 study(5,7).  
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49 Finally, another systematic review, performed in 2014 by Mars and colleagues using data from 1998 to  
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51 2013, concluded that pesticide poisoning was one of the two most frequently used methods of suicide  
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53 among countries that had suicide incidence available on the African continent, with the other most  
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55 frequent method being hanging(8). The differences in estimations between these studies further points  
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57 to the challenges of pesticide suicide surveillance on the African continent and highlights the need for a  
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3 standardised method of surveillance as well as sufficient surveillance capacity and an expansion of the  
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11 There is a significant lack of primary data on the pesticide suicides in countries of the African continent.  
12 Currently, the available data are limited and based on a few hospital-based studies in Tanzania,  
13 Zimbabwe, Uganda, Malawi, and South Africa. A Tanzanian hospital-based retrospective study from  
14 2000-2005 reports that majority (64.4%) of the acute pesticide poisoning cases (n=656) were suicides,  
15 and in 2006 a prospective study reported 84.6% (n=230) in the same hospital(13). Another Tanzanian  
16 study in Muhimbili University hospital in 2004 revealed that 24% (n=24) of the suicides were due to  
17 pesticides (14). Other available primary data on pesticide poisoning and pesticide suicides in Africa are  
18 from other hospital-based studies, not covered by the Mew and colleagues study(5,15). A study done  
19 between 1998 and 1999 in eight urban referral hospitals in Zimbabwe showed pesticides were  
20 responsible for nearly 60% (70 out of 123) of all the poisoning deaths, and 41% (1142 out of 2764) of the  
21 poisoning cases were deliberate self-poisoning suicide attempts(16). In Kampala, Uganda, out of the 100  
22 patients admitted to three major urban hospitals in 2002 following deliberate self-harm, 40% were  
23 pesticide suicides(17). An additional study done that looked at hospital records from both urban and rural  
24 settings in Uganda from January 2010 to August 2016, found that, in the urban setting, 63.3% of the 212  
25 pesticide poisoning cases were deliberate self-harm(18). In the rural setting, 25% of the 101 pesticide  
26 poisoning cases were deliberate self-harm(18).  
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49 A retrospective study in Blantyre, Malawi from 2000 to 2003, based on mortuary records from the urban  
50 based Queen Elizabeth Central Hospital (QECH) and College of Medicine, revealed that pesticides were  
51 the mode for 79% (66 out of 84) of the suicides(19). A study done at a tertiary hospital in an urban setting  
52 in South Africa found that ingestion or inhalation of pesticides occurred in 19 of the 238 deliberate self-  
53 harm cases over an nine-month period, from June 2014 to March 2015(20). This study indicated that  
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3 pesticide poisoning is not as common in urban settings in South Africa(20). An additional study in South  
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5 Africa that made use of census data and the Department of Home Affairs records, which captures  
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7 information on births and deaths in South Africa, between the years of 1991 and 2016, found that of the  
8  
9 8573 suicides recording throughout that time period, 1.7% were categorised as pesticide poisoning  
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11 suicides(21).  
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16 Deaths from pesticide poisoning are believed to be more common in rural areas where there is limited  
17  
18 access to health care services and where highly hazardous pesticides are widely used and accessible  
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20 (18,22,23). However, several factors complicate this assumption. Firstly, poisoned patients are frequently  
21  
22 transferred from rural to urban hospitals for advanced care and intensive care unit beds(18). Urban,  
23  
24 particularly poor, households have been shown to illegally use agricultural pesticides as a rodenticides  
25  
26 and household insecticides (i.e., *street pesticides*) and also for suicides(24–26). Urban settings, may  
27  
28 therefore, not be entirely representative of pesticide suicide deaths, but they cannot be excluded. Ideally  
29  
30 a sufficient surveillance system would include data collection from both rural and urban settings,  
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32 regardless of resource availability, providing a more complete picture of pesticide suicides.  
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41 From these studies, while pesticide suicide may not be the most common method of suicide in all settings,  
42  
43 it remains a problem on a larger scale of country-context in many African countries. Furthermore, fewer  
44  
45 pesticide suicides officially recorded does not necessarily mean fewer pesticide suicides but could  
46  
47 suggest that the reporting systems used in these studies may not be capturing the true number of  
48  
49 pesticide suicides in these countries.  
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53 Underreporting of pesticide suicides on the African continent could be a direct result of non-availability of  
54  
55 an established surveillance system to capture the pesticide suicides. Improved pesticide surveillance  
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57 system in South Africa has shown to capture cases of acute unintentional and severe poisoning ten times  
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3 more than the routine notification system(27). This indicates that a general trend towards underreporting  
4  
5 of poisoning cases, be it intentional or not, currently exists in Africa and the potential impact on decision  
6  
7 making if surveillance is improved.  
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### 10 11 12 **Pesticide poisoning and pesticide suicide surveillance** 13

14 Surveillance is defined as ongoing systematic collection, analysis and interpretation of data essential for  
15  
16 planning, implementation and evaluation of public health practice(28). Pesticide poisoning and pesticide  
17  
18 suicide surveillance is a vital tool for decision-makers and regulators of pesticides to manage the inherent  
19  
20 risks associated with and easy access to pesticide use for agriculture and public health. However, in  
21  
22 comparison to other diseases, pesticide poisoning, in general, is a complex condition for surveillance,  
23  
24 mainly because it includes several clinical presentations depending on the type of pesticide used,  
25  
26 duration of exposure to the pesticide as well as the circumstances under which the exposure occurred.  
27  
28 Pesticide poisoning (e.g., from organophosphates) is often misdiagnosed (some symptoms are confused  
29  
30 as the flu, for example), and health professionals receive limited training on the wide range of pesticide  
31  
32 classes and their related acute and chronic health effects. In addition, a successful pesticide poisoning  
33  
34 surveillance system demands triangulated data from multiple sources, including from health institutions  
35  
36 and departments, agricultural departments, and industries. Data from health care institutions, toxicology  
37  
38 analytical laboratories, forensic laboratories, police, or crime bureaus are further needed for filling in the  
39  
40 data gap on pesticide poisonings and suicides. Pesticide suicide surveillance is equally as challenging  
41  
42 and presents the same complexities as pesticide poisonings, however, there is an added layer of  
43  
44 challenges when considering the legal and social circumstances that may surround suicide (e.g.,  
45  
46 criminalisation of attempted suicide in the law, cultural, religious, and social taboos). What is required is  
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48 an understanding of how pesticide suicide surveillance could be improved or implemented with existing  
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50 general surveillance systems in Africa.  
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3 Currently an existing surveillance structure, which could be used as a potential data source, are national  
4 Poison Information Centres (PICs). These centres provide information on all types of poisoning and are  
5 helpful for clinicians and the public as a source of timebound information and advice for poisoning cases,  
6 as well as collect data around these cases(29). Currently, PICs are limited in Africa. There are  
7 approximately 12 PICs (i.e., Algeria – 2; Angola; Ghana; Kenya – 2; Senegal; South Africa – 3; Tanzania;  
8 and Zimbabwe). Of those that exist, many are under-resourced(30,31). These PICs would need to be  
9 linked to a national systematic recording system to be fully effective and efficient in monitoring and  
10 collecting data on pesticide poisoning linked to suicides.  
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23 National Health Management Information Systems (HMIS) data is another potential source for pesticide  
24 poisoning and suicide information that could be used for monitoring and policy making. These systems  
25 collect routine quantitative data in the health care system, such as deaths and cause of death, that can  
26 be used to identify areas of health care and reporting that can be improved on in a cost-effective  
27 manor(32,33). A HMIS focused on pesticide suicides would require diligent investigations into suspected  
28 pesticide suicides, followed by capturing of any necessary information surrounding the death including  
29 the type of pesticide used, the active ingredient or co-formulant that caused the death and the  
30 circumstances of the death. In countries where registration is not well established, verbal autopsy data  
31 is an alternative, in which an immediate family member or a caretaker is interviewed to identify the  
32 conditions and wider circumstances prior to death and thereby establish a cause of death. District Health  
33 Information Software 2 (DHIS2) is an example of a successful digital HMIS that has been adopted by 67  
34 countries(34). DHIS2 involves the use of a software platform established for collection, management,  
35 analysis and use of health data collected by health professional in these countries(34).  
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56 In South Africa, an additional source of data is the National Injury and Mortality Surveillance System  
57 (NIMSS)(35). This is a surveillance system that was established in 1999 and collates information from  
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3 mortuary investigations and services, as well as state forensic laboratory records(35). This type of data  
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5 is suitable for capturing poisoning related deaths and would easily identify pesticide poisoning cases. In  
6  
7 some cases, however, laboratories may not be able to identify some types of pesticides due to a lack of  
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9 available sample standards or existing data on pesticides, making it difficult to identify some pesticide  
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11 poisoning cases.  
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16 While hospital records and data capturing systems are useful in pesticide suicide surveillance, any  
17  
18 deaths that occur outside of a hospital may be missed. It is therefore important to also consider police  
19  
20 reporting of deaths as an important step in the surveillance pathway(11). Suicides reported to the police  
21  
22 could be further investigated and suspected pesticide suicides reported and documented for  
23  
24 surveillance purposes. This would indicate the burden of pesticide suicides outside of the health care  
25  
26 system.  
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32 Existing surveillance systems for pesticide poisonings and suicides on the African continent vary  
33  
34 depending on the context, resources and availability of information surrounding such cases. It is  
35  
36 important to investigate these existing systems to get an overall picture of the current pesticide suicide  
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38 and poisoning surveillance in Africa, and where this could be improved or adjusted.  
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## 44 RATIONALE

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46 Pesticide suicides in Asian and South American countries are known to be significant, with an estimated  
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48 160,000, pesticide suicides a year in South East Asia and 8,000 in Central and South America, according  
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50 to a systematic review conducted in 2007 and the more recent study in 2017(7,36). A study conducted  
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52 in a rural community in China found that 80.5% of the 297 suicide attempts were done via pesticide  
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54 ingestion(6). While a study in India between 1993 and 2003 found that 92 000 suicides were committed  
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56 using pesticides(12). In contrast, the status of pesticide suicide on the African continent is hardly reported.  
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Meanwhile, pesticide imports and sales are on the rise. In Tanzania, pesticide imports showed a five-fold increase from 500 tons in 2000 to 2500 tons in 2003, and the number of registered pesticides had risen from 682 to 874 over a five-year period starting from 2006(37). In Ethiopia, the registered number of pesticides has increased from 226 in 2013 to 326 by 2016 and an additional 16 companies have begun importing pesticides for the same period(37). There has been a 47% increase in the pesticide imports in Uganda during 1980- 2004, this is in addition to the unknown quantities that were smuggled through non secured borders(37).

All this is amidst the escalating rates of pesticide sales in the African region and agriculture transition to cash crops(38), supporting high utilisation, and hence the availability of pesticides in farming communities. Rising trends in pesticide usage is not limited to the larger commercial farms and estates, but also penetrated to the smallholder farmers. Half of the vegetable smallholder farmers in northern Tanzania showed increased amounts of pesticide use in 2005 compared to preceding five years(39). Despite the increases in utilisation, import and export of pesticides, low reporting levels of pesticide self-harm remain. Therefore, it is worthwhile to explore the causes underlying this low reporting of pesticide self-harm in the African Continent. Is it due to low numbers in these countries or is it due to the existing surveillance systems not capturing such incidents? This review will explore these ideas further with a focus on the current pesticide suicide surveillance systems being used in Africa and whether they are sufficient or perhaps a hinderance to reporting.

Furthermore, it is essential to be aware of the prevalence of pesticide self-harm cases or attempted pesticide suicide, which do not end in death. This information will help in preventing further cases from occurring through informing policy and legislation, implementation of targeted bans on dangerous pesticides, raising community awareness around the use of pesticides, training of health care personnel, as well as influencing the type and level of clinical facility investments into this area of health care.



## SCOPING REVIEW OBJECTIVES

In this scoping review we aim to present a broad picture of how pesticide suicide deaths and attempted pesticide suicides in Africa by identifying and exploring the various surveillance systems in place, as well as highlighting key limitations and data collection barriers.

The following objectives will be studied to address the aim of this review:

1. To review the current literature on pesticide suicides and attempted suicides in Africa.
2. To determine which surveillance methods, including those of collecting, compiling, reporting, and analysing, are currently being used to identify pesticide suicides and attempted suicides in Africa.

To achieve these objectives, this scoping review will address the following questions:

What current surveillance systems are in place in African countries to capture and record suicide by pesticides? What are the potential barriers or limitations to these existing surveillance systems?

## METHODS AND ANALYSIS

The methods for this scoping review were designed in accordance with the five-stage methodological frameworks as set out by Arksey & O'Malley and the Joanna Briggs Institute (JBI)(40,41).

The scoping review will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)(42). The anticipated start date of this review is 1 July 2022 and the anticipated end date is 30 September 2022.

### Stage 1: Identifying the research question

As recommended by JBI(41), one way to structure a research question is to follow the PCC mnemonic for Population, Concept and Context which was used to develop the review question.

1  
2  
3 *Population* is defined as those who engage in self-poisoning with pesticides and populations that have  
4 cases of fatal and non-fatal pesticide poisoning. Since suicide is associated with significant stigma, not  
5 all suicides may be reported as suicide but instead reported as accidental pesticide poisoning. This is  
6 the reason why in addition to pesticide suicides and attempted suicide we included cases of non-  
7 occupational pesticide poisoning. *Concept* in this review refers to the varying reporting or surveillance  
8 methods. While *Context* is the African continent with various limitations as indicated in the inclusion  
9 criteria.

### 20 21 **Patient and Public Involvement**

22  
23 As this is a scoping review, no patients will be directly involved.

### 24 25 26 27 28 **Stage 2: Identifying relevant studies**

#### 29 30 **Information sources**

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32 This review will conduct searches in the following databases: MEDLINE (via PubMed), Scopus (which  
33 includes considerable Embase content), Web of Science Core Collection, Biological Abstracts, SciELO  
34 (on Web of Science platform), Academic Search Premier, Africa-Wide Information, Biological and  
35 Agricultural Index, CINAHL, Health Source Nursing/ Academic, APA PsycInfo, General Science  
36 (EBSCOhost platform).

37  
38 Grey literature will be sourced from the following databases: Database of African Theses and  
39 Dissertations (DATAD), ProQuest Dissertations and Theses, WorldCat Dissertations and Theses,  
40 International Association for the Prevention of Suicide conference proceedings, African Index Medicus,  
41 Eastern Mediterranean Index Medicus, Global Index Medicus, OpenDoar, OpenGrey, CGIAR  
42 repositories, and PapersFirst.

Finally, we will hand search the reference lists of included papers to identify further relevant articles not captured in the initial search and do forward citation tracking of reference lists using a citation index like Scopus, to identify further relevant papers.

## Search

The search strategy was developed using terms for the Population (suicide and pesticide) and the Context (the African continent) while search filters for the Concept (surveillance) were omitted to ensure that relevant studies on data collection or reporting of pesticide suicides would not be missed.

Search strategy for PubMed (to be adapted to other databases)

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Population: Suicide and Pesticide suicide search

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#1 MeSH term: Suicide

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#2 MeSH term: Poisoning  
Poisoning[subheading]

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#3 Text word: Overdose OR parasuicide OR poisoning OR self-destruction OR self-destructive OR self-destructing OR self-harm OR self-injurious OR self-poison OR self-poisoning OR self-inflicted OR self-mutilation OR suicide

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#4 #1 OR #2  
OR #3

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Pesticide search:

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#5 MeSH terms: Pesticides

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#6 MeSH terms: Pesticides [Pharmacological Action]

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#7 Text word: acaricides OR agricultural chemical OR agrochemical OR aluminium phosphide OR carbamate OR chemosterilant OR defoliant OR fungicide OR hazardous compounds OR hazardous substances OR herbicide OR Insect control OR Insect repellent OR insecticide OR miticide OR molluscicides OR organochlorine OR organophosphate OR organophosphorus OR paraquat OR

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pest control OR pesticide OR poisons OR rodent control OR rodenticide OR  
toxic substances OR toxins OR weedkiller

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#8 #5 OR #6  
OR #7

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#9 #4 AND #8

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Concept: Omitted filters for surveillance in order to keep search as broad as possible  
Surveillance

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Context: Geographic Filter:

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#10 MeSH Africa  
terms:

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#11 Text word: Africa OR African OR Algeria OR Angola OR Benin OR Botswana OR "Burkina  
Faso" OR Burundi OR "Cabo Verde" OR Cameroon OR Cameroun OR "Canary  
Islands" OR "Cape Verde" OR "Central African Republic" OR Chad OR  
Comoros OR Congo OR "Cote d'Ivoire" OR "Democratic Republic of Congo"  
OR Djibouti OR Egypt OR Eritrea OR eSwatini OR Ethiopia OR Gabon OR  
Gambia OR Ghana OR Guinea OR Guinea-Bissau OR "Ivory Coast" OR  
Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR  
Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR  
Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Reunion OR  
Rwanda OR "Saint Helena" OR "Sao Tome" OR Senegal OR Seychelles OR  
"Sierra Leone" OR Somalia OR "St Helena" OR Sudan OR Swaziland OR  
Tanzania OR Togo OR Tunisia OR Uganda OR "Western Sahara" OR Zaire  
OR Zambia OR Zimbabwe

---

#12 #10 OR #11

---

#13 #9 AND #12

---

Filter to Human Studies

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#14 MeSH Animals NOT Humans

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#15 #13 NOT #14

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### Stage 3: Study selection

#### Inclusion and exclusion criteria

The criteria for including and excluding studies in this scoping review are presented in Table 1.

**Table 1. Inclusion and exclusion criteria**

Inclusion criteria	Exclusion criteria
Articles in English only	Articles with no English translation
Articles that conducted research on the African continent	Studies outside the African continent
Peer-reviewed articles or articles from a specified grey literature database (listed above)	Articles not subject to a peer-review process
Articles on pesticide poisoning	Articles on poisoning using chemicals not classified as a pesticide
Articles on suicide	Articles on accidental pesticide poisoning
Articles on human studies	Animal studies
Articles that mention pesticide suicide surveillance systems	Articles that do not mention surveillance systems
Articles with data of any type (quantitative, qualitative, or mixed)	
Official government records	
No limits on publication date	

#### Selection of sources of evidence

Sources will be selected through a process of screening based on the eligibility criteria outlined in Table

1. A reviewer will conduct the search on the databases, with assistance from a University of Cape Town librarian, extract the results and export them into EndNote and then into Rayyan after removing any duplicates. The PRISMA flow diagram (Supplementary data 1) will be used to keep track of the screening process. To determine the eligibility of each source for this study, two of the authors will independently conduct the title and abstract screening, or a similar kind of screening in the absence of an abstract.. Any sources that could not be determined as eligible or not from the abstract will be subject to full-text review.

Following this, each reviewer will perform a full-text review on studies included from the title and abstract screening. Using Rayyan, each reviewer will indicate the sources to be included and the ones to be excluded and the reasons for exclusion. Any disagreements between the reviewers will be discussed and

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3 if a mutual decision is not reached, a third author will resolve the conflict. The final resulting sources will  
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5 then be used for the analysis of this review.  
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#### 10 **Stage 4: Data extraction**

##### 11 **Data charting process**

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13 Table 2 presents the extraction spreadsheet fields. It consists of categories used to assess the final  
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15 eligible articles retrieved from the systematic search. This framework might change as reviewers chart  
16  
17 the results of the articles. The framework will be updated continuously, as the reviewers increase their  
18  
19 awareness of the content of the included studies. The same two reviewers will oversee charting the data  
20  
21 independently. We ensure inter-rater reliability of the extraction fields by comparing a sample of the  
22  
23 eligible articles, independently rated by the two reviewers, and discuss any discrepancy.  
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30 **Table 2.** Data extraction items.

31 Category	32 Description
33 1. URL/ source	34 URL address of the publication
35 2. Authors	36 Names and institutions
37 3. Title	38 As per the database
39 4. Year of publication	40 Month and year
41 5. Objective	42 Objective of the study
43 6. Study design	44 Cohort/ cross-sectional/ ecological etc...
45 7. Country/ies	46 Country/ies the study took place in
47 8. Setting	48 Urban or rural 49 Area the study was based in 50 Hospital based or community based

8. Type of data	Primary data collected for the study Secondary data from an existing source
9. Source of data	E.g., Verbal autopsy, HMIS, census data, police records, or data collected for the specific study
10. Study duration	Time period over which the study took place or observed
11. Study population	The population of the study
12. Sample size	Size of the sample in the study
13. Type of pesticide	The type (group) of pesticide used for self-harm or poisoning
14. Number of deaths from each pesticide	The number of deaths that were related to each pesticide identified in the study
15. Results	Number of deaths reported / period Location of the results from multiple sights
16. Conclusions	Conclusions drawn from the study
17. Timeliness of the data	Gap between the data origin and publication
18. Coverage of the data	Does it provide data on both pesticides and suicides?
19. Depth of data	Does it give information on the type of pesticide

### Data items

The variables considered in this scoping review include the following:

- Number of suicides
- Number of pesticide poisonings
- Number of pesticide suicides

- Number of poisonings
- Number of deaths from pesticide poisonings
- Type of pesticide
- Number of deaths from each type of pesticide
- Age of individuals in each study
- Occupation of individuals
- Setting of each study (e.g., rural, urban, hospitals or clinics)
- Source of data (primary, secondary)

### **Critical appraisal of individual sources of evidence**

As this is a scoping study, we will provide a descriptive synthesis of the main findings of included studies, guided by the approach of Levac and colleagues(43) to demonstrate the current evidence for the different surveillance systems. Pesticide suicide rates for the African continent will be calculated based on each of the available surveillance system.

### **Stage 5: Collating, summarising, and reporting the results**

#### **Synthesis of results**

Data will be summarised according to the country/location, number of pesticide suicides and the time period. Data will be also summarised based on the different surveillance systems, number of pesticide suicides reported captured by each different surveillance system.

### **ETHICS AND DISSEMINATION**

This study will review the current literature and explore the scope of pesticide suicide research in Africa. As there are no human participants in this study, ethics is not required. The outcome of the scoping review will also be written up as a journal article and published.



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## AUTHOR CONTRIBUTIONS

MB and Ak are co-first authors of this protocol and led the design and development of this study, drafting and finalising this protocol. LU, ME, FK and HAR gave guidance to the study conceptualisation and protocol development. All authors provided input and commented on drafts, as well as approved the final manuscript.

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## COMPETING INTERESTS STATEMENT

Patient consent for publication not required.

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## PROVENANCE AND PEER REVIEW

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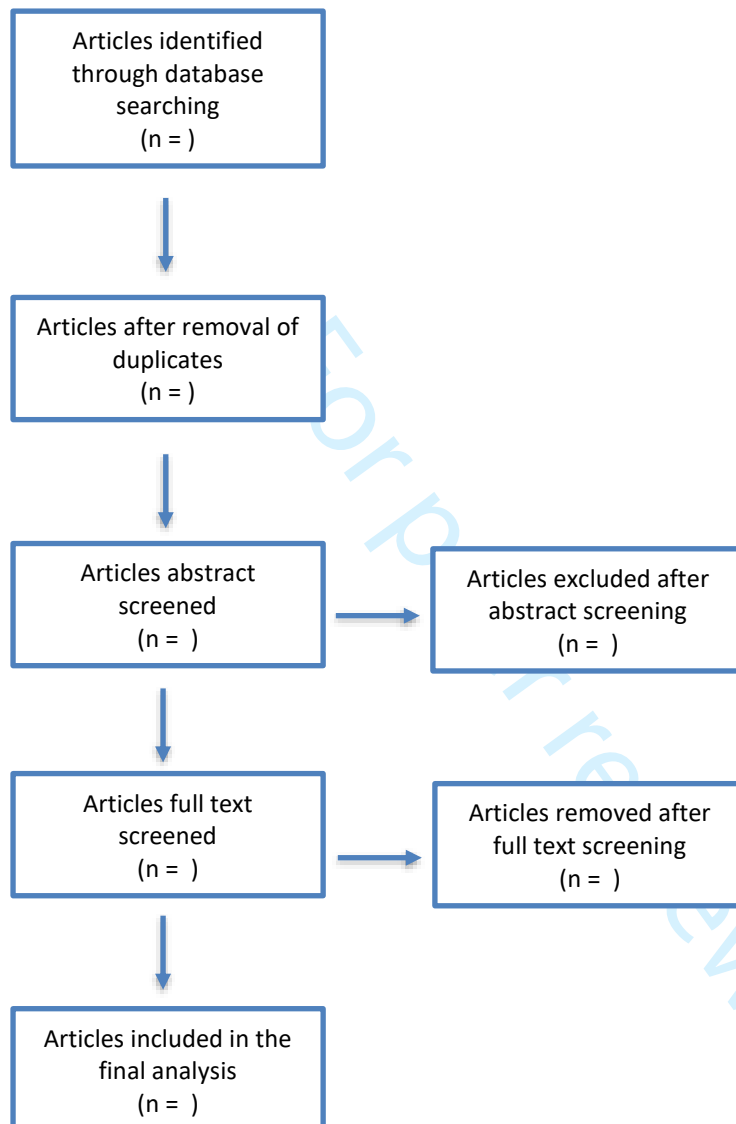
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## APPENDIX 1: Prisma flow diagram



## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
<b>TITLE</b>			
Title	1	Identify the report as a scoping review.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2&3
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2-10
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	10
<b>METHODS</b>			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	10
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	13&14
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	11
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12&13
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	14
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	15&16
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	16
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	17



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	17
<b>RESULTS</b>			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Click here to enter text.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Click here to enter text.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Click here to enter text.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Click here to enter text.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Click here to enter text.
<b>DISCUSSION</b>			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Click here to enter text.
Limitations	20	Discuss the limitations of the scoping review process.	Click here to enter text.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Click here to enter text.
<b>FUNDING</b>			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Click here to enter text.

JB1 = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

\* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

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