A scoping review of non-professional medication practices and medication safety outcomes during public health emergencies.

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Abstract

Objectives:

Public health emergencies (PHE) can disrupt personal medication practices and increase the risk of medication-related harm and other negative medication-related outcomes. Our aim was to examine the extent and nature of published research on this topic to guide future research and practice.

Study design: Scoping review.

Methods:

Standard electronic databases were searched. PRISMA-ScR guidelines were followed. Extracted data were organised in response to review questions and narrative accounts developed.

Results:

One-hundred-and-twenty-nine studies were included, conducted across 32 countries, mostly in the United States of America (n=42). Sixty-eight (53%) reported on infectious events, 49 (39%) climatological or ecological events and the remainder a mixture of terrorism, war or other disasters. The studies described several medication safety outcomes (medication-related harm, adherence, supply) and adaptive medication practices (self-altering prescribed medications, sharing medications and changing healthcare providers). Challenges to maintaining routine medication practices during a PHE included transport, finance, quarantine and knowledge-related issues. Twenty-eight studies (22%) examined health inequalities pertaining to adverse medication-related outcomes, with findings suggesting that gender, age, ethnicity, educational and socioeconomic status may be related to inequalities. Research gaps identified included carers', children's and minority communities' experiences and intervention studies.

Conclusions:

There is considerable evidence of disruptions to routine personal medication practices during PHEs and of medication-related harm and other negative outcomes. Maintaining medication supply for the management of chronic conditions is a universal problem across all emergency types. Research is needed to address these disruptions, particularly amongst people who experience health inequalities who may need additional support. 248 words

Keywords:

Medication safety, public health emergency, medication-related harm, medication adherence

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Introduction

Medications are the most common healthcare therapy and can cause unwanted medication-related problems[1]. These can significantly affect patients' lives. Medication related problems have been shown to cause significant morbidity, with most harm being avoidable[1-3].

Public health emergencies (PHEs) are defined as extraordinary events with associated health consequences that have the potential to overwhelm routine community capabilities to address them[4]. Recently, there have been several significant PHEs associated with infectious diseases, such as the COVID-19 pandemic, and climatological or ecological issues, such as flooding, hurricanes and earthquakes[5]. Potential issues associated with PHEs include reduced access to healthcare; supply chain interruption; changes in household mobility, personal wellbeing and routine support; and widening of health inequalities. These create additional challenges for medications safety, at times when preventing and mitigating medication-related harm and any associated healthcare utilisation are particularly important. Although previous studies have reported on the impact of PHEs and their implications for healthcare generally, the specific impact on medication management is less well known, particularly regarding lay people's medication practices and medication safety. Inappropriate changes in medication-related behaviour during a PHE may have adverse acute effects on individual health or necessitate the need for urgent healthcare intervention. They also have potential to worsen chronic ill-health leading to poor individual and population health outcomes and greater strain on health services during all stages of a PHE. As such there is an important need to optimise personal medication management / usage during and after PHEs.

Interest in medication-related harm and the lay burden of work associated with managing medication is rising[1, 6, 7]. We were keen to understand the impact of this in terms of personal medication safety. We are not aware of any systematic or scoping reviews of medication safety during PHEs. The aim of this scoping review is therefore to provide an overview of the extent and nature of the available research on laypeople's medication practices and medication safety outcomes at times of PHE. This review will assist in identifying medication safety issues during PHEs and responsive practices described in the literature, identify research gaps, and help guide future research and practice in this area.

Methods

Design

This scoping review was conducted in line with methodological guidance[8] and reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR; Supplementary Document 1)[9].

Review objective and questions

The aim was to provide an overview of the extent and nature of the available research on lay (non-professional) medication practices and medication safety outcomes at times of PHE. It was led by the following review questions (RQ), which were validated by discussion with informal carer and patient advocates:

RQ1. What study designs and characteristics have been used to examine medication safety vulnerabilities and non-professional medication practices before, during or after PHEs?

RQ2. What public and patient involvement occurred in the conduct of the research?

RQ3. What study populations and events were examined?

RQ4. What outcomes related to medication safety and non-professional medication practices/ behaviours were described?

RQ5. What were the main findings of these studies?

RQ6. What interventions have been evaluated to address these behaviours and outcomes during PHEs?

RQ7. What outcomes were measured to evaluate these interventions?

Search strategy

Based on our research questions, a preliminary Ovid Medline search was designed to combine the concepts of medication practices or behaviours, medication safety outcomes, and PHE. Subsequent searches were adapted and applied to CINAHL, PsychIfo, Embase, Global Health Cochrane Library, Prospero, Joanna Briggs Institute and Trip database. The search reviewed records from database inception to April 2021, with no limits to language or date range applied. Upon retrieval, results from all databases were deduplicated and exported for management into Covidence[10]. The study protocol and search strategy are provided in Supplementary Document 2.

Study selection

Title/abstract screening, followed by full text review, was performed independently by two reviewers; conflicts were resolved by discussion or with a third reviewer. Articles were then iteratively reviewed for their relevance until group consensus on inclusion was reached.

Eligibility criteria

The inclusion and exclusion criteria are described in detail in Supplementary Document 2. In brief we focused on studies conducted before, during or after a PHE; an unrestricted[4].Our study population included all individuals, regardless of demographic or clinical characteristics; any qualitative or quantitative outcome reporting on non-professional medication use, practices or behaviours or medication safety outcomes that met the criteria. We used the term medication-related harm to refer to changes in patient's health status associated with medication use such as adverse drug reactions and changes to clinical outcomes. We have classified changes to supply and adherence issues separately. We included published peer

reviewed journal articles with empirical data. We screened the bibliographies of identified systematic or literature reviews and included the original studies that matched our inclusion criteria, while excluding the review articles themselves.

Data extraction and charting

Data charting against each RQ, using a Microsoft Excel template, was undertaken mainly by one reviewer with 10% of data from studies extracted by a second reviewer. Accuracy and consistency between all extractions were assessed by a third reviewer to determine the validity of continued extraction by one team member. Non-English studies were translated by team members or a volunteer who were confident to translate the paper into English.

Summarizing and reporting the data

Data relating to RQs were synthesised from the charted data and reported as narrative accounts. Identified medication-related practices and outcomes were grouped into common themes. A PRISMA flow chart was prepared. We did not assess the methodological quality of the identified studies due to anticipated heterogeneity in study types and designs and in keeping with the standard practice for scoping reviews[11].

Results (1687 words)

One-hundred-and-twenty-nine studies were included in the review (Figure 1 and Supplementary Document 3), the majority reporting on infectious events (n=68, 53%), climatological or ecological events (n=50, 39%) and the remainder a variety of other disasters.

RQ1&2. Study characteristics and patient and public involvement

The earliest study identified was published in 1999, with the number of studies increasing substantially since 2020 (Figure 2). Most were reported in English (n=126). One study was published in each of Mandarin, German and Japanese. Most (n=105, 81%) collected only quantitative data. Five collected both quantitative and qualitative data, and 19 (15%) collected only qualitative data. All included studies were observational by design. Most were undertaken within the mitigation and preparedness phases during the PHE (n=62, 48%) or within the response and recovery phases afterward (n=60, 47%). A further seven studies that focussed on disaster preparedness were not temporally aligned to a single specific PHE, but rather to the participant's previous experience of one of several possible emergencies. Sixty-nine studies (53%) reported no specific funding source and the remainder reported funding from multiple sources. Seven (5%) studies reported patient and public involvement in conduct of the research[12-18].

RQ3. Public health emergency and participant characteristics

Study participants

Studies typically investigated an exclusively adult population (Figure 2). Participants were recruited from a variety of settings, mostly the general population affected by the PHE (Figure 2). Regarding healthcare condition, there was no restriction for the largest group of

studies (n=50, 39%); the remainder focussed on various disorders or body systems (Figure 2).

Several studies investigated populations that may be at greater risk of health inequalities[19] including those with physical disability [20-22], HIV [23-33], mental illness [15, 34-36] socioeconomic deprivation[14, 37-39], refuge or displacement [13, 25, 37, 40-42], opioid or other substance misuse or dependence [30, 43-46], people of black and minority ethnicity [38, 43, 47] and men who have sex with men[31, 48].

Country and type of public health emergency

More than half (n=68, 53%) of the studies covered infectious events, 57 (44%) of which were the COVID-19 pandemic (Figure 3). Most were conducted in the Americas, the European region and the Western Pacific (Figure 3) and in a single country (n=123). Based on The World Bank's world economies classification, most studies (n=83, 64%) were undertaken in high-income countries.

RQ4. Study outcomes measured

The identified medication safety outcomes were categorised into three themes: (1) medication-related harm, (2) medication adherence and (3) medication supply.

Concerning medication related harm, five studies reported adverse drug reactions (ADRs)[46, 49-51]. Other patient health outcomes associated with medication use or omission included asthma control[52], withdrawal from opioids[43, 44], uncontrolled hypertension [53], autoimmune hepatitis relapse[54], seizure frequency[21] , glycaemic control[55] and perceived and actual rheumatic disease activity[56] and long term health status following myocardial infarction[57]. Anxiety related to medication use was another common health outcome reported qualitatively and quantitatively via prompts in surveys and fears and concerns self-disclosed during interviews [58-62, 15, 28, 51, 63-67].

A quantitative outcome of "adherence" or "compliance", as termed by the study authors, was reported in 30 studies, using four distinct measurement types: (1) A discrete self-report at one time point using a variety of phrasing of questions (n=24)[24, 25, 32, 33, 36, 53, 56, 61, 68-79], (2) a discrete single time point measure comparing two study groups[54, 57, 80], (3) discrete measures at two times points[16, 23, 81-83] and (4) calculated based on days of tablets remaining[28].

Effects on lay medication practices, reported qualitatively and quantitatively, were categorised into four themes: (1) accessing medication supply, (2) altering prescribed medication regimens, (3) accessing professional or lay support or services or (4) storing, administering and monitoring the effects of medication. Quantitative measures included using disaster risk assessment tools[14, 84, 85] (n=3) and surveying experiences [17, 18, 35, 47, 48, 51, 56, 59, 62, 64, 66, 72, 74, 78, 81, 82, 86-91].

Twenty-eight studies examined outcomes by population groups at greater risk of health inequalities[19]: gender[12, 26, 29, 38, 43, 50, 52, 86, 92-95], age[26, 29, 38, 43, 50, 52, 60, 77, 93, 94, 96], race/ethnicity[38,

[40, 50, 52, 65, 93, 97, 98] socioeconomic[26, 29, 43, 50, 52, 96, 98, 99], educational[26, 43, 52, 60, 77, 95, 96], marital[26, 43, 95] or other[15, 23, 25, 29, 34, 43, 60, 93, 95, 98, 100] status.

RQ5. Study findings

Medication-related harm

Published reports of ADR during a PHE most frequently related to antiviral medicines administered during the 2009/2010 A/H1N1 influenza pandemic in the UK and USA,[46, 49, 50] and cancer chemotherapy[51]. One study reported an increase in perceived ADRs associated with self-medication during the COVID-19 pandemic, and more frequently in those taking chronic illness medication than others[95].

One study found epileptic seizures worsened for some patients immediately after an earthquake, attributed to lack of access to medication (5.6%)[21]. Two studies after hurricane Sandy reported an increased risk of relapse[43], and withdrawal[44], and changes in injection behaviours among opioid and intravenous drug using populations who were accessing substitution services pre-disaster[43 44]. Following the World Trade Centre disaster, an inverse relationship between adherence to long-term preventer medication and asthma control was identified amongst rescue workers with mental health viewed as a modifying factor[52]. Poor glycaemic control during COVID-19 was associated with medication non-adherence in type-2 diabetes, but not type-1 diabetes, with accounts of hyperglycaemia and diabetic ketoacidosis[55]. Altered adherence was associated with: uncontrolled hypertension following a hurricane[53]; perceived rheumatic disease activity[56] and exacerbation of rheumatic symptoms[58] during COVID-19; and index presentation to hospital with an acute myocardial infarction[57]. During COVID-19, telehealth was associated with a beneficial effect on medication compliance and lower rates of relapse of autoimmune hepatitis[54].

Several studies reported patient anxiety around medication use associated with an emergency. Patients experienced anxiety about general medication issues[101], and fear about maintaining access to medication supplies[60, 66, 67]. Anxiety reportedly contributed to both decreased [58-62, 15, 28, 51, 63, 64] and increased[60, 91] use of medication. A fear of accessing healthcare facilities was associated with changes in medication-related behaviours[33, 64, 67, 78, 89, 102], while fear of infection was reportedly associated with medication stockpiling[103] and decreased medication adherence[28, 62].

Medication adherence

Several studies reported non-adherence to prescribed medications after a PHE, but without comparison to pre-PHE adherence levels[15, 53, 56, 75, 76, 78, 79, 104] (Supplementary Document 5). Some studies reported little or no change to adherence during a PHE[29, 36, 71, 82, 91, 105, 106]. Notably this did not always mean similar health outcomes. For example, one study found most people reported remaining adherent to their epilepsy medications, while simultaneously observing an increase of >50% of seizure frequency, attributed to stress and lifestyle changes[71]. Both improved and worsened adherence was reported[36, 71, 72, 74]. For example, during one survey of 282 patients with cardiac disease during COVID-19, participants felt the pandemic had no effect on their medication compliance (73%), improved it (18%) and decreased it (10%)[74].

Medication supply

Twenty-seven studies quantified the prevalence of running out or having interruptions to medication supplies (Supplementary Table 5). The duration of medication shortages varied between studies, ranging from days to weeks[29, 42, 55, 69, 87]. Hydroxychloroquine was reported to be in short supply in three studies during COVID-19[64, 90, 107]. Being evacuated or displaced from home and forgetting to bring medicines[20, 45, 53, 97, 98, 101, 108] were reported as affecting adherence. Barriers to obtaining medications included transport/relocation [16, 25, 35, 45, 89, 109-112] and financial[20, 25, 27, 55, 89, 71, 80, 115] and regulatory[27] issues. Delays in prescription deliveries were reported[47].

Practices related to altering prescribed medication regimens

Use of long-term immunosuppressant therapy for chronic disease management reduced during COVID-19 due to perceived increased risk of infection, with medications stopped either temporarily or completely and sometimes without medical advice[18, 54, 56, 58, 59, 61-64, 88, 107, 113-116]. Patients requested to change their immunotherapy early into the COVID-19 pandemic but that requests to switch were no longer made later in the pandemic[18]. Patients made changes to their prescription medication regimen, without medical advice, including increased dosage[18, 56, 106], decreased dosage or frequency of administration[18, 56, 90, 106, 107, 115], rationing medication[117], interrupting or suspending medication[51, 61, 62, 64], stopping medication use[54, 59, 62, 63, 107, 113-115] and restarting previously used medication[61, 63].

Practices and barriers related to accessing medication supplies

People responded variably to the altered access to medication supplies. For example, attending a healthcare practitioner earlier than needed[67]; maintaining an extra supply of medication[21, 67, 109]; keeping medication separately in several places to support access[21]; bringing medications, medication lists and insurance cards with them when evacuated[27, 118]; sharing medications (insulin and buprenorphine) between friends or acquaintances [44, 119]; rationing medications[46, 117]. In the aftermath of a hurricane, people with substance dependence were reported to move from prescription supply to illicit supply[46], and increase risky behaviours such as sharing needles or drug preparation equipment due to lack access to methadone dispensing and closure of needle exchange centres [43, 44].

Lack of knowledge was reportedly associated with lack of preparation of medication supplies, and lack of recognition of the risk of adverse effects of running out of medications[14, 27, 70, 109]. Inadequate knowledge of one's medical history or records of medication names and dosages was identified as problematic for arranging a new supply of medications[27, 120]. Difficulty communicating with healthcare providers online or inability to contact them to order a prescription or access treatment was occasionally reported as a barrier to medication supply [47, 48, 78, 121].

Practices related to accessing support or services

People accessed alternatives to their regular healthcare providers during an emergency, for example doctors and hospitals[21, 79] and pharmacies[38, 53, 90] in a different location. The use of an online children's asthma action plan reportedly decreased medical expenses during COVID-19[83]. People accessed healthcare to support their coping with the PHE, for example, accessing counselling services was associated with a greater likelihood of medication use[93, 122] and commencing medication use as a coping mechanism[27, 93, 108, 122]. Having social support from other people ('social capital') was reportedly associated with increased adherence[23, 25, 122], the sharing of information and medication supplies[37],[25] and the purchase of medication for others[79].

Practices related to storing, administering and monitoring the effects of medication

Two studies described medication storage issues including medication being accidentally thrown out[25] and difficulty refrigerating medications during an evacuation[20]. Lack of assistance to administer medications[22, 45, 109, 112, 123] was reported to affect adherence. Lack of privacy in a communal refugee space resulted in covert medication self-administration and decreased adherence[25]. Lack of access to food was problematic for medications that should be taken with food[25]. Self-efficacy was an identified barrier to medications taking[24, 25, 76]. Financial issues were associated with (non-)adherence to medication monitoring recommendations[55].

Inequalities

Access to medicine supplies was associated with racial/ethnic[50, 97, 98], age [94], socioeconomic[50] , educational[26], health[25] and displacement[34] status: Black and minority ethnic groups, older, less educated, socially deprived and those who were displaced experienced greater challenges accessing medication. Existing social inequalities were reportedly widened through favouritism of selected communities for distribution of medication supplies[25]. Medication non-adherence and treatment failure was associated with religious status and stigma amongst people living with HIV who attended a treatment centre daily following an earthquake[23]. Women were identified as more likely to administer medication to infected patients during a pandemic, thereby exposing them to greater risk than men of contracting the infection through caring duties[12]. Drug misuse or illicit drug use in those experiencing dependence was associated with age[29, 60], social support[29], educational[60], occupational[99], health[60] and socioeconomic status[99]. Females had greater medication use needs than males following a PHE, for example, needing medication refills or commencing hypnotic use[14, 86, 92, 93, 95]. Inferior glycaemic control in people with diabetes who were home quarantining during

COVID-19 was reportedly more common in younger people and those with a greater number of years' education.

RQ6&7. Interventions evaluated and outcomes measured

Five studies described interventions that were implemented during PHEs; these were an action research study[13], a mixed-methods study[42] and three cross-sectional studies[26, 83, 110]. Provision of extra take-home medication doses was associated with sustained access[13, 26]. Provision of information about anticipated clinic closures and access to alternative clinics were considered as modifiable factors that can potentially help sustain medication access[26]. Implementation of a multicomponent intervention for the management of hypertension and diabetes in a humanitarian situation identified the challenge of large-scale implementation in the field and the limited impact of the programme on continuity of medication supply[42]. A study observed the feasibility and acceptability of administration of medications for headache, reported to be a common health issue during a natural disaster[13]. Provision of an online platform for children with asthma was associated with improved medication adherence and reduced medical expenses[83]. Finally, provision of an information kit about preparing for an emergency to a cohort of dialysis patients resulted in a self-perceived improvement in disaster preparedness in a subsequent follow-up survey[110].

Discussion

This scoping review provides the first systematic overview of studies exploring lay, non-professional medication practices and medication safety outcomes during events of major public health concern. The review identified medication-related harm, adherence, supply, alteration of prescribed regimen and issues with the storage, administration and monitoring of medication as outcomes that have been assessed, both quantitatively and qualitatively. People's practices related to accessing medicines, support or services were commonly reported. The associations between health inequalities and medication-related outcomes and practices were frequently explored. The evidence suggests that medication-related problems are common during PHEs, that people adapt their medication use behaviours to respond to these challenges and that pre-existing inequalities may be widening during PHEs and affecting medication outcomes. The coming section summarises the evidence for each research question and the implications for future research.

RQ1 Study design and characteristics

Included studies employed mostly observational designs with limited potential to inform whether the medication management issues identified were associated with the emergency or whether they occurred routinely during "normal" times. Few studies were published in non-English languages, possibly reflecting the databases searched, or the dominance of the English language in science and social science[124]. Other methodological challenges identified were the lack of pre- and post- reporting of medication adherence rates, and limited follow-up to assess long-term clinical impact. We acknowledge that comparative or prospective studies are challenging due to the unplanned and unpredictable nature of PHEs. Future research should employ comparative and experimental designs if possible and explore the long-term impact of PHEs.

RQ2 patient and public involvement

The absence of community engagement in this review is a clear research gap. Involving patients and the public in research has been widely recognized as a useful method to increase the relevance, use of research findings[125, 126] and sustainability of new interventions in humanitarian settings[127].

RQ3 study population and emergency characteristics

The relative absence of studies conducted in low-income countries supports the recent call to prioritise global medication safety research efforts in low- and middle-income countries[125]. Several studies focused on marginalised groups and many studies considered disadvantaged groups or specific clinical groups more vulnerable to certain medication-related harm during PHEs. The current literature extensively explores multiple clinical conditions and disease states but provides limited insight into the experiences and perspectives of children or informal caregivers. Given the increasing prevalence of vulnerabilities associated with informal caregivers' medication management, it is a potential area for future study[128]. Few studies included complementary and herbal medications[12, 107, 129, 130], and this may also be worthy of future exploration[131]. COVID-19 accounted for almost half of the studies included in this review, likely reflecting its scale and impact worldwide. The review also included numerous studies set in the aftermath of climate disasters, mainly in the USA, and information about the experiences in other jurisdictions is relatively lacking.

RQ4 Outcomes measured

The key outcomes reported in this review were medication-related harm, adherence and supply, although few studies reported on the long-term health consequences these. There was an absence of exploration about how education on new and routine medication, and altered medication monitoring, affected long-term health outcomes. The inconsistent use of definitions, terminology or validated measures jeopardised the potential quality of the included research. For example, several studies reported challenges with obtaining medication supply in the short term as non-adherence or non-compliance, despite the outcome reflecting a discrete event rather than a behaviour over time. Therefore, ostensible findings regarding "adherence" potentially misidentify an organisational problem related to lack of continuity of medication supply with a personal pattern of medication use. This could affect development of effective solutions to improve patient outcomes during a future emergency[132]. Several studies measured doses missed during an emergency but failed to assess their clinical significance, a missed opportunity to differentiate more critical issues that should be addressed to mitigate harm[133].

RQ5 Findings

The review provided considerable evidence of disruptions to routine medication practices but less evidence about the impact of these disruptions on short- or long-term health outcomes. There is some evidence that these disruptions may contribute to stress, anxiety and other negative outcomes.

Self-alteration of medication was commonly described in studies. This is a new concept that typically involved medication discontinuation, reduction of immunosuppressant use or increased medication taking. During COVID-19, there was unprecedented sharing of information online[134]. We hypothesise that self-alteration of prescribed medications could arise in response to: (1) health anxiety, (2) changing routines, (3) interrupted medication supply, and (4) uncertainties about the (side) effects or efficacy of medication when a new infectious disease is not well understood. The appropriateness of self-alteration and its impact on clinical or humanistic outcomes may support understanding of whether health behaviour modification techniques are merited.

The review identified that disadvantaged population groups are more vulnerable to negative medication-related outcomes during PHEs, and that PHEs may indeed exacerbate and widen pre-existing health inequalities, both directly and indirectly. Research is needed to determine the actions required to mitigate this.

RQ6-7 interventions to address identified problems during PHEs

The review identified few interventions to address medication safety outcomes during PHEs. There is an opportunity to address this by prioritising the identified medication-related challenges: medication adherence, supply and self-alteration. Our findings suggest that the public may not perceive medication-related hazards as a threat during PHEs despite evidence of them resulting in negative patient outcomes. Improving preparedness may mitigate medication-related harm. Emphasizing the importance of household-based preparedness such as keeping a written/printed record of medications in a safe and accessible place(s), and providing basic resources to affected communities may also be protective[128]. Further exploration of system level changes to medication supply that have proven helpful in emergencies may support lay medication practices in future emergencies. This echoes calls for targeting systemic and organisational issues which contribute to medication risk[125].

Strengths and Limitations of this review

The main strengths of this scoping review are that it provides a comprehensive overview of the available published literature on this topic, with no restriction on language and inclusive of a wide range of databases. The review followed a rigorous methodological framework for scoping reviews, which assures consistency and structure of the search process and confidence in the reporting of findings. We did not assess the quality of the studies, as is typical for a scoping review. Regarding patient and public involvement, whilst we did validate the research questions with informal carer advocates, there were opportunities for deeper engagement, potentially following published guidance on stakeholder involvement in systematic reviews[135]. Heterogeneity was introduced into the review by including different types of PHEs; future research should synthesise the issues and outcomes specific to certain PHE types. The review includes only studies published prior to April 2021 and therefore more recent evidence may be missing. However, the high volume of studies provided adequate data to respond to the research questions. The findings and discussion points regarding gaps in research should help to define an agenda for future research.

Conclusions

There is a considerable level of research evidence suggesting that medication supply and patient adherence are impaired during PHEs, that medication-related harm occurs commonly, and people adapt their medication regimen, without healthcare advice, in response to challenges experienced. The review identified that PHEs can widen pre-existing inequalities resulting in a disproportionate effect on medication outcomes for marginalised and minority groups. Despite this, we found very few interventions targeting lay, non-professional medication practices.

Author statements

Ethical approval

Not applicable.

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Competing interests

The authors have nothing to declare.

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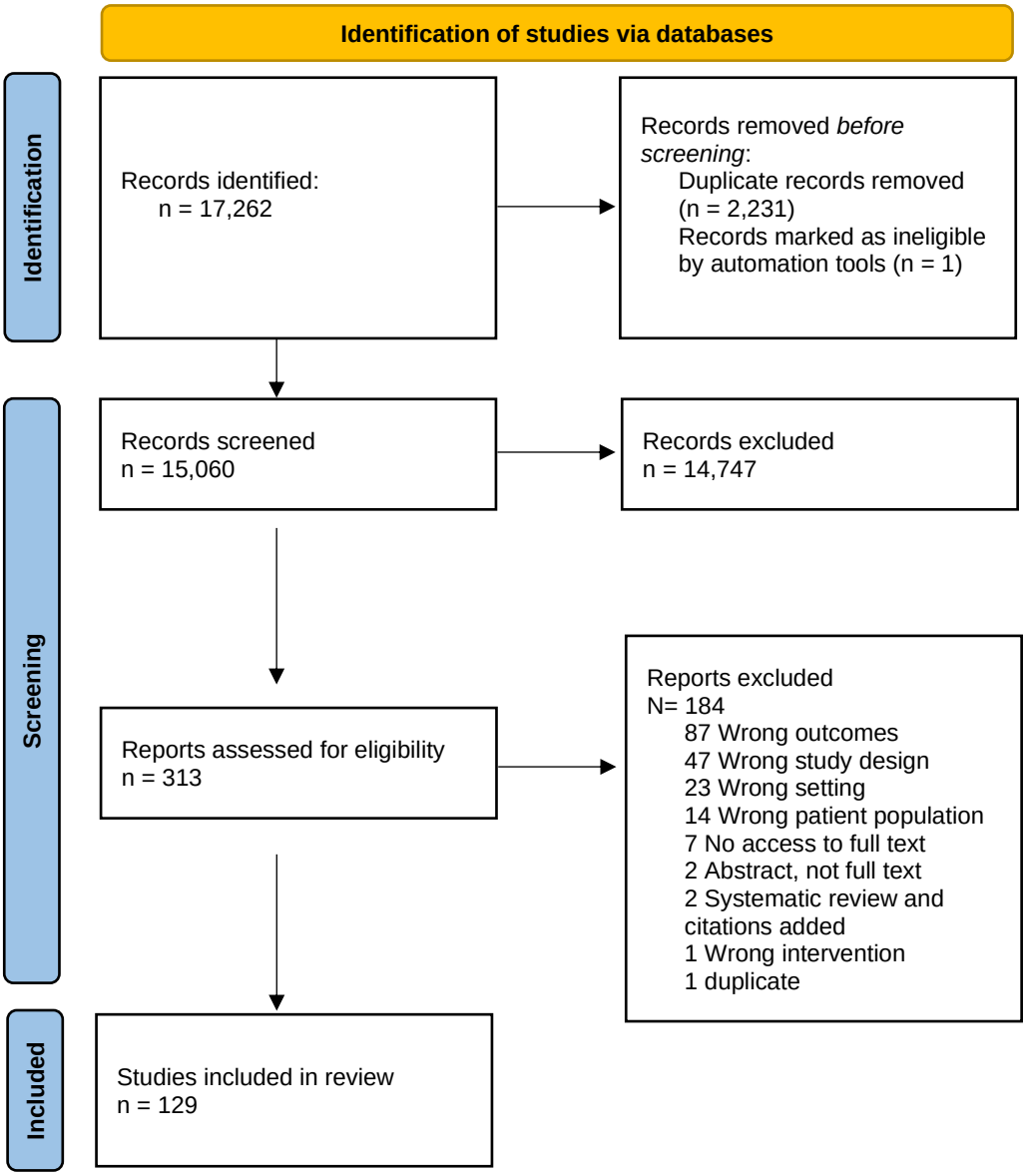
Figure 1: PRISMA Flow Diagram



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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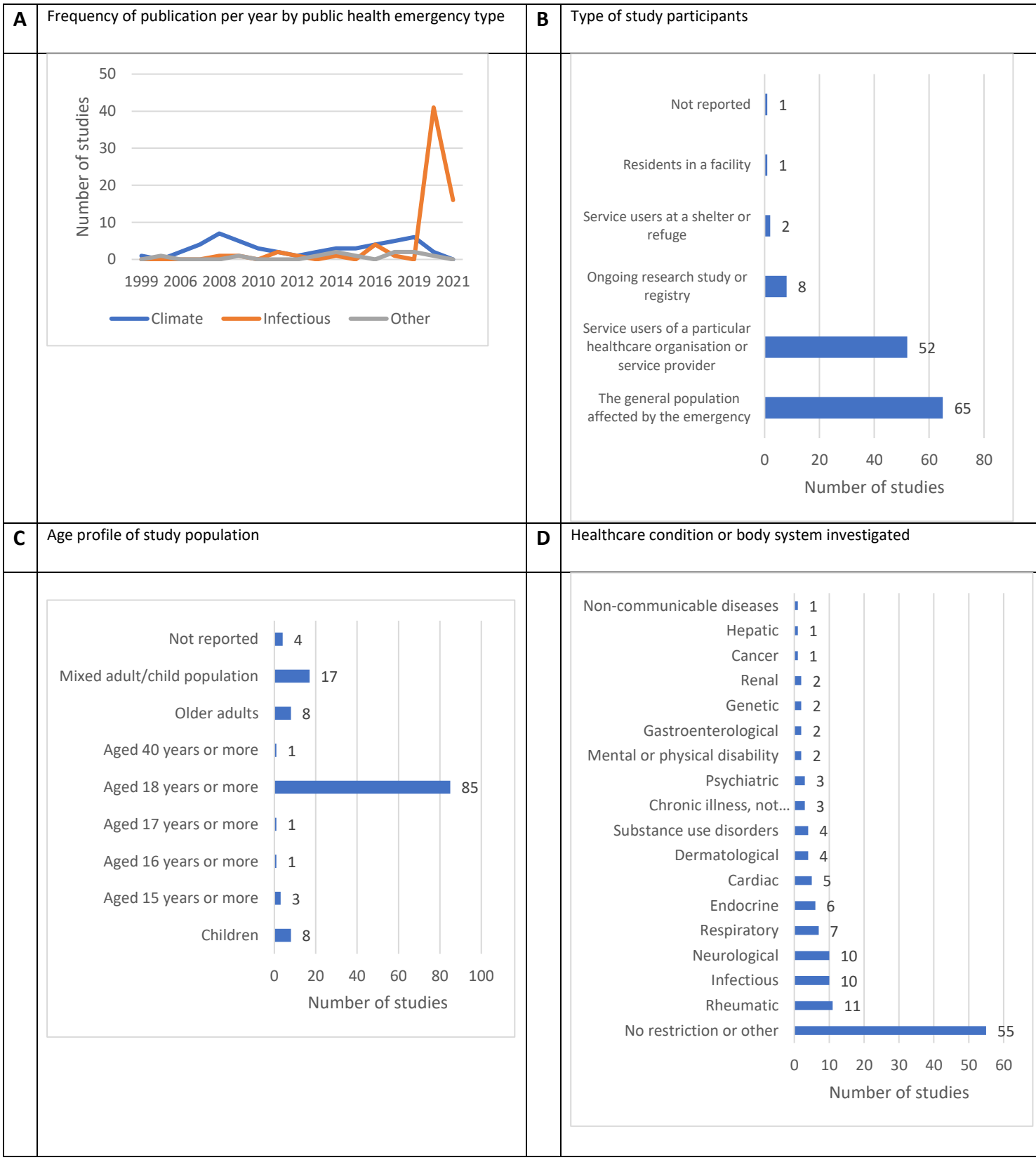


Figure 2: A visual representation of the included studies.

Figure A) Frequency of publication per year by public health emergency type (presenting 2021 data to April). Figure B) Type of study participants. Figure C) Age profile of study population. Figure D) Healthcare condition or body system investigated.

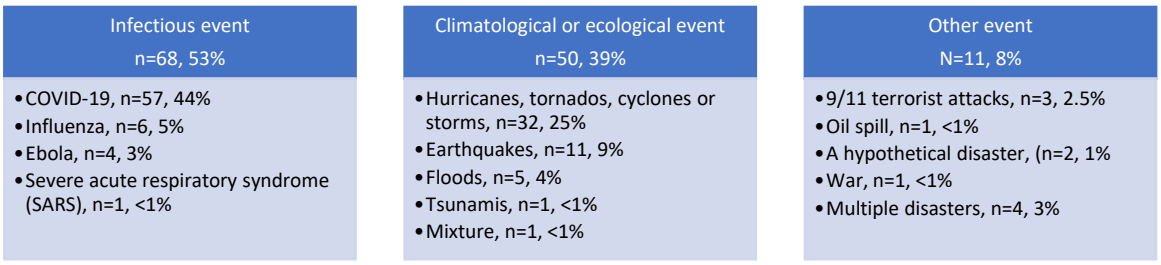
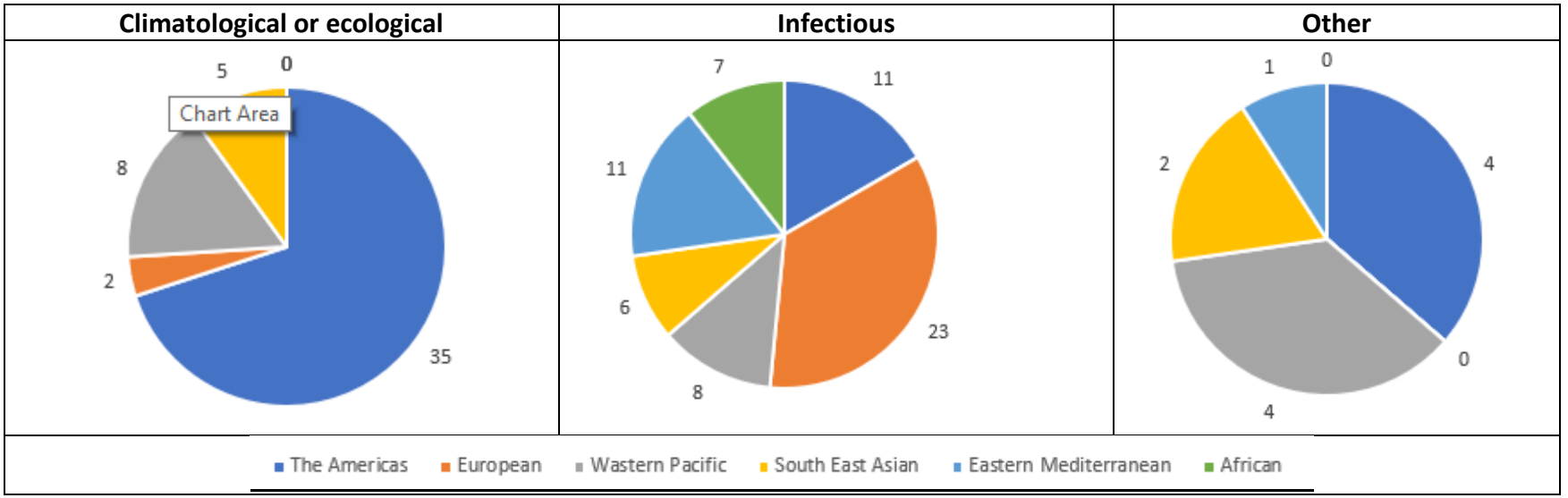


Figure 3. Type of public health emergency studied

The Americas n=51, 39.5%	European n=25, 19.4%	Western Pacific n=20, 15.5%	South East Asian n=13, 10.1%	Eastern Mediterranean n=12, 9.3%	Africa n=7, 5.4%
•USA n=42 •Canada n=4 •Argentina n=1 •Chile n=1 •Haiti n=1 •USA & Canda n=1 •USA (& Sri Lanka) n=1	•UK n=6 •Turkey n=6 •Italy n=4 •Spain n=3 •Switzerland n=2 •Denmark n=1 •France n=1 •Germany n=1 •Israel n=1	•China n=8 •Japan n=7 •Australia n=4 •Hong Kong n=1	•India n=8 •Thailand n=2 •Nepal n=2 •Sri Lanka (&USA) n=1	•Saudi Arabia n=5 •Egypt n=1 •Iran n=1 •Kuwait n=1 •Lebanon n=1 •Pakistan n=1 •Arab States n=1 •Gulf states n=1	•Nigeria n=2 •Ghana n=1 •Kenya n=1 •Liberia n=1 •Sierra Leone n=1 •Uganda n=1



*2 studies of infectious events were undertaken across multiple regions

Figure 4. Public health emergencies studied by geographic region and type