**Supplementary materials**

**Overview**

Supplementary Document 1: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

Supplementary Document 2: Study Protocol and Search Strategy

### Supplementary Document 3: Overview of included studies

### Supplementary Document 4: A summary of findings of studies reporting difficulty accessing medications during PHE

### Supplementary Document 5: A summary of studies describing adherence or compliance to medications during PHE

**Supplementary** Document **1: 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 #** |
| --- | --- | --- | --- |
| **TITLE** | | | |
| Title | 1 | Identify the report as a scoping review. | Title page 1,2 |
| **ABSTRACT** | | | |
| 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 |
| **INTRODUCTION** | | | |
| 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. | 3 |
| 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. | 3 |
| **METHODS** | | | |
| 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. | 4 |
| 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. | 4,5 |
| 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. | 4 |
| Search | 8 | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated. | 4, 31-33 |
| Selection of sources of evidence† | 9 | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review. | 4 |
| 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. | 5-6, 37-56 |
| Data items | 11 | List and define all variables for which data were sought and any assumptions and simplifications made. | 5 |
| 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). | Not done |
| Synthesis of results | 13 | Describe the methods of handling and summarizing the data that were charted. | 5, 6 |
| **RESULTS** | | | |
| 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. | 34, 6 |
| Characteristics of sources of evidence | 15 | For each source of evidence, present characteristics for which data were charted and provide the citations. | 6, 7, 37 |
| Critical appraisal within sources of evidence | 16 | If done, present data on critical appraisal of included sources of evidence (see item 12). | Not done |
| 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. | 6-12 |
| Synthesis of results | 18 | Summarize and/or present the charting results as they relate to the review questions and objectives. | 6-12 |
| **DISCUSSION** | | | |
| 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. | 12-14 |
| Limitations | 20 | Discuss the limitations of the scoping review process. | 14-15 |
| 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. | 15 |
| **FUNDING** | | | |
| 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. | 16 |

JBI = 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](http://annals.org/aim/fullarticle/2700389/prisma-extension-scoping-reviews-prisma-scr-checklist-explanation).

**Supplementary Document** **2: Study Protocol and Search Strategy**

**Study protocol**

**Design:** Systematic scoping review.

**Rigour:** The review was conducted in line with methodological guidance1 and reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)2.

**Concept:** Non-professional medication practices and medication safety vulnerabilities.

**Context:** Events of major public health concern, including ecological, climate, infectious, disaster or conflict.  For the purpose of this study, such an event is defined as “An event, condition or agent which has the potential to rapidly harm an exposed population sufficiently to lead to a crisis and which may involve the government to declare a state of emergency, suspend state regulations and change the function of stage agencies.”

**Objective and review questions:**

The objective of this scoping review is to provide an overview of the extent, range and nature of the available research on non-professional medication practices and medication safety vulnerabilities at times of events of major public health concern.  It is led by the following review questions (RQ):

1. What study designs and characteristics have been used to examine medication safety vulnerabilities and non-professional medication practices before, during or after PHEs?
2. What public and patient involvement in conduct of research occurred?
3. What study populations and events were examined?
4. What outcomes related to medication safety outcomes and non-professional medication practices/ behaviours were described?
5. What were the main findings of these studies?

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

RQ7 What outcomes were measured to assess these interventions?

**Inclusion criteria:**

Published articles will be eligible for inclusion in this review if they satisfy all of the following:

* Article type: Published manuscript or journal article.
* Study design: All research designs.
* Study population: All people, regardless of demographic or clinical characteristics.
* Study setting: Before, during or after an event of major public health concern. All event types, including ecological, climate, infectious or conflict (see definition).
* Outcomes:
* Any qualitative or quantitative outcome reporting on non-professional medication use, practices or behaviours.  Medication includes prescribed or otherwise (including herbals, supplements, over-the-counter medicines, complementary and alternative medicines).    
  **or**
* Any qualitative or quantitative outcome reporting on medication safety measures (adverse drug event, adverse drug reaction, medication error, adherence, compliance, consumption, drug-related problems).
* Language: no restriction.

**Exclusion criteria**

* Article types:
* Commentaries, editorials, opinion pieces, non-systematic literature reviews
* Clinical trials of medicinal products, including vaccines
* Published abstracts
* Population and setting:
* Studies reporting on opioid, obesity, tobacco, diabetes or antimicrobial resistance related epidemics or emergencies, in the absence of exposure to an event of major public health concern, as defined for the purpose of this study.
* Outcomes:
* Vaccination coverage or adherence.

**Search strategy:**

* The search string will explore subject headings, keywords and synonyms for the concepts:
* medication practices or behaviours;
* medication safety outcomes;
* public health emergency.
* Preliminary search has been undertaken in Ovid Medline.
* A second search will be carried out using the preferred search string, adapted to each database syntax, in CINAHL, PsychInfo, Embase, Global Health and in the systematic review or evidence synthesis databases: the Cochrane Library, Prospero, Joanna Briggs Institute and TRIP database.
* Depending on the yield from the above searches, forward and backward citation chasing of identified studies may be performed.

**Study selection:**

Title/abstract screening, followed by full text review, independently by two reviewers, conflicts resolved by discussion or with a third reviewer.

**Data abstraction / extraction:**

Create an extraction template.

Data abstraction, or charting, will be undertaken independently by two reviewers, with conflicts resolved by consensus or discussion with third reviewer.  This will use a purposefully developed data abstraction form.

Data fields to be extracted include:

* study characteristics (e.g., country, funder, design, extent of public or patient involvement, defined as 'research carried out 'with' or 'by' members of the public rather than 'to', 'about' or 'for' them’136,
* PHE characteristics (e.g., emergency type, region, impact on healthcare system, region, timing of study with respect to emergency),
* study participant characteristics (e.g., focus on disease or drug class),
* non-professional medication practice or behaviour outcomes,
* medication safety outcomes (e.g., adherence, harm, error),
* key findings relevant to medication use or medication safety outcomes,
* recommendations for policy, practice, education, research and Interventions implemented to address the issues and associated outcomes.

Charting this abstracted data will enable a logical and organised summary of the data to answer the review questions.

A PRISMA flow chart, demonstrating study eligibility, screening, selection and inclusion will be reported.

References

1. Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil, H. Chapter 11: Scoping Reviews (2020 version). In: Aromataris E, Munn Z (Editors). JBI Reviewer's Manual, JBI, 2020. Available from https://reviewersmanual.joannabriggs.org/.  https://doi.org/10.46658/JBIRM-20-01
2. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MD, Horsley T, Weeks L, Hempel S. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Annals of internal medicine. 2018 Oct 2;169(7):467-73.

**Search strategy**

|  |  |
| --- | --- |
| Preliminary search OVID MEDLINE | Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) <1946 to April 22, 2020>  Search Strategy:  --------------------------------------------------------------------------------  1 Medication Errors/ or Medication Adherence/ or Medication Reconciliation/ (32270)  2 "Drug-Related Side Effects and Adverse Reactions"/ (31657)  3 medication\*.mp. (341073)  4 medicine\*.mp. (873572)  5 drug\*.mp. (5839065)  6 pharmac\*.mp. (3859868)  7 3 or 4 or 5 or 6 (7654648)  8 error\*.mp. (374690)  9 Patient Harm/ or harm\*.mp. (180513)  10 adverse\*.mp. (2104667)  11 adhere\*.mp. (216098)  12 complian\*.mp. (174203)  13 8 or 9 or 10 or 11 or 12 (2907937)  14 7 and 13 (1208707)  15 pandemic.mp. or Pandemics/ (25953)  16 epidemic\*.mp. (107444)  17 Natural Disasters/ or Disasters/ (19156)  18 disaster\*.mp. (41966)  19 war.mp. or Armed Conflicts/ (45872)  20 hurricane.mp. or Cyclonic Storms/ (3943)  21 Floods/ (2659)  22 Nuclear Warfare/ or Fukushima Nuclear Accident/ or Radioactive Hazard Release/ (10306)  23 public health crisis.mp. (962)  24 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (225470)  25 1 or 2 or 14 (1209112)  26 24 and 25 (7276)  27 limit 26 to english language (6691) |
| Embase | ('adverse drug reaction'/de OR 'side effect'/de  OR 'medication compliance'/de OR 'attitude to  health'/de OR 'patient safety'/de OR ((error\* OR  harm\* OR adverse\* OR adhere\* OR complian\*) AND  (medication\* OR medicine\* OR drug\* OR pharmac\* OR  'drug therapy'/de))) AND ('pandemic'/de OR  'epidemic'/de OR 'disaster planning'/de OR  'disaster medicine'/de OR 'relief work'/de OR  'public health crisis' OR 'public health  emergency') AND 'article'/it AND [embase]/lim AND  ([article]/lim OR [article in press]/lim) AND  [abstracts]/lim |
| Psychinfo | (DE "Health Knowledge" OR DE "Health Attitudes" OR DE "Health Behavior") OR (error\* OR harm\* OR adverse\* OR adhere\* OR  complian\*) OR (DE "Errors" OR DE "Patient Safety" OR DE "Side Effects (Drug)" OR DE "Treatment Compliance")  AND  (DE "Drug Therapy" OR medication\* OR medicine\* OR drug\* OR pharmac\*)  AND  (DE "Pandemics" OR DE "Epidemics" OR ( DE "EmergencyPreparedness" OR DE "Natural Disasters" OR DE "Disasters" ) OR ''public health emergency'' OR ''public health crisis'') |
| Cinahl | (MH "Medication Compliance") OR (MH "Medication History") OR (MH  "Medication Reconciliation") OR (MH "Medication Side Effects (Saba CCC)") OR (MH "Medication Management") OR (MH "Noncompliance of Medication Regimen (Saba CCC)") OR (MH "Medication Risk (Saba CCC)") OR (MH "Medication Errors") OR (MH "Knowledge Deficit of Medication Regimen (Saba CCC)") OR (MH "Compliance with Medication Regimen (Saba CCC)") OR (medication\* OR medicine\* OR drug\* OR pharmac\*) OR (error\* OR harm\* OR adverse\* OR adhere\* OR complian\*)  AND  ((MH "Influenza, Pandemic (H1N1) 2009") OR (MH "DiseaseOutbreaks") OR (MH "Influenza, Swine") OR (MH "Disaster  Planning") OR (MH "Natural Disasters") OR (MH "Disasters") OR (MH "Humanitarian Aid") OR ''public health emergency'' OR ''public health crisis'') |
| Global Health | Database: Global Health <1973 to 2020 Week 17>  Search Strategy:  --------------------------------------------------------------------------------  1 pharmaceutical products/ (10932)  2 (multiple drug therapy or drug therapy).sh. (196690)  3 prescriptions/ (8880)  4 nonprescription drugs.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes] (79)  5 drug interactions/ (1441)  6 (medication\* or medicine\* or drug\* or pharmac\* or polypharm\* or remedy or remedies or ''self-medic\*'' or prescri\*).mp. (821136)  7 1 or 2 or 3 or 4 or 5 or 6 (821136)  8 health behaviour.sh. (12328)  9 health beliefs.sh. (4552)  10 (knowledge and health).sh. (1165)  11 (safety and patients).sh. (825)  12 (adverse\* or error\* or harm\* or adhere\* or complian\* or knowledge or attitude\* or practice\* or behavio\* or safe\* or "adverse reaction" or "side effect" or reconcil\*).mp. (778928)  13 8 or 9 or 10 or 11 or 12 (779271)  14 7 and 13 (211658)  15 (errors and drug therapy).sh. (46)  16 patient compliance.sh. (4856)  17 adverse effects/ (51482)  18 'self medication'.mp. (1315)  19 16 or 17 or 18 (57111)  20 14 or 19 (230181)  21 natural disasters/ (3653)  22 disasters/ (1767)  23 pandemics/ (2697)  24 floods/ (1457)  25 emergencies.sh. (4126)  26 outbreaks.sh. (36359)  27 emergency relief.sh. (369)  28 (emergencies and public health).sh. (1116)  29 ''public health cris\*''.mp. (399)  30 ''public health emergenc\*''.mp. (1406)  31 (Disaster\* or pandemic\* or epidemic\* or flood\* or outbreak\* or cyclon\* or hurricane\*).hw. (60304)  32 (''emergency prepar\*'' or "relief work").mp. (829)  33 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 (64538)  34 20 and 33 (3841)  35 limit 34 to journal article (3541)  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

### **Supplementary Document 3: Overview of included studies**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Study ID** | **Country** | **Study population** | **Types of public health emergency** | **Disease area** | **Study design or data type** | **Sample size** |
| Abualfadl 2020 | Egypt | RA cases aged 18 years and older diagnosed according to the 2010 American College of Rheuma-tology/European League Against Rheumatism classification criteria | COVID-19 Pandemic | Rheumatoid arthritis | Cross sectional study | 1037 |
| Adong 2016 | Ghana | Adults 18 years or older | Ebola outbreak | Public health: prevention and containment | Qualitative | 235 in focus groups, 40 interviews. |
| Ahmad 2018 | Thailand | adults | earthquake | access; health seeking behaviour, including medication use | retrospective secondary data analyses | 1998 |
| Al-Hashel 2020 | Kuwait | We recruited a sample of patients with migraine from headache clinic registry and via social media to complete an anonymous survey | COVID-19 | Migraines | Cross sectional study | 1018 |
| Alkhotani 2020 | Saudi Arabia | People with epilepsy in Saudi Arabia | COVID-19 Pandemic | Epilepsy | Cross sectional study | 156 |
| Alshareef 2020 | Saudi Arabia | Type 2 diabetes | COVID-19 pandemic | Type 2 diabetes | Cross sectional study | 394 |
| Anderson 2020 | Australia | Asthmatics | Hurricane; thunderstorm | Asthma | Retrospective audit | 318 |
| Andrade-Campos 2020 | Spain | Spanish Gaucher Disease | COVID-19 Pandemic | Spanish Gaucher Disease | cross sectional study, quant survey | 113 |
| Antony 2020 | Australia | Patients with rheumatic disease | COVID-19 Pandemic | Patients with rheumatic disease | Cross sectional study, quant | 550 |
| Appavoo 2016 | Canada | Adults and children presented to study site ED | Hurricane or tornado | Access; community ED utilization | Retrospective secondary data analyses | 1310 |
| Arrieta 2009 | USA | Adults with chronic illness | Hurricane | Medication: Chronic disease continuity of care in disasters | Qualitative | 28 |
| Bali 2016 | Nigeria | adults | Ebola outbreak | access private healthcare | Mixed methods | 119 |
| Ballivian 2020 | Argentina | HIV population | COVID-19 Pandemic | Mental Health | Combined Cohort Study | 1336 |
| Banerjee 2021 | USA and Canada | Vasculitis patients | COVID-19 Pandemic | Vasculitis | Cross sectional study | 662 |
| Bayleyegn 2006 | USA | Adults | Hurricane | Access to basic utilities, access to health services, health status, and immediate needs | Mixed methods | 420 |
| Beaudoin 2009 | USA | Adults who were hurricane shelter residents  in the state of Louisiana | Hurricane | Media and public health | Qualitative | 57 |
| Boehnke 2020 | USA | People using cannabis medically | COVID-19 Pandemic | Medicinal cannabis users | Cross sectional study | 353 |
| Boscarino 2004 | USA | Adults (18 years or older) who reported receiving mental health treatment | 9/11 terrorist attack | Mental health | Cross Sectional | 2368 |
| Boscarino 2014 | USA | Adults, 18 years old or older, who were permanent residents in a shore community in Monmouth County, | Hurricane | mental health services | Cross sectional | 200 |
| Brite 2019 | USA | adults | 9/11 terrorist attack | mental health, asthma | Cross Sectional | 1293 |
| Burger 2019 | USA | Adults | Hurricane | Access; medical needs and access to care, concerns, evacuation status, | Cross sectional study | 584 |
| Burger 2019 | USA | Adults | Hurricane | Access; medical needs and access to care, concerns, evacuation status, | cross sectional interviewer administered survey | 599 |
| ChaguÃ© 2020 | France | CHF patients | COVID-19 Pandemic | Congestive heart failure | Cross sectional study | 124 |
| Chan 2014 | China | Adults | Hypothetical disaster | Disaster preparedness, access to materials and health services | Qualitative | 133 |
| Cherniack 2008 | USA | older adults | Hurricane | Disaster preparedness | Cross Sectional | 547 |
| Ciurea 2021 | Switzerland | Inflammatory Rheumatic Patients | COVID-19 | Inflammatory rheumatic diseases: | Cohort study | 666 |
| Clay 2020 | USA | General Household | Hurricane category: SuperStorm | Household Preparedness to Disaster & medical services use | Retrospective study | 1114 households |
| Cousino 2020 | Multiple | Coronary heart disease | COVID-19 Pandemic | Heart disease | Cross-sectional | 1220 |
| Datar 2013 | India | Children under 5 years old | Various: T | Access: paediatric; immunization disruptions and acute illness med availability | Retrospective secondary data analyses | 80000 |
| Davidow 2016 | USA | Adults | Hurricane | Access to medical care, including medication interruption | Cross sectional | Estimates 2.7 million represented in database |
| Dorfman 2021 | Israel | Children with inflammatory bowel disease | COVID-19 Pandemic | Inflammatory bowel disease | Cross-sectional telephone interview | 244 |
| Duggan 2010 | USA and Sri-Lanka | older adults | Various disasters included tsunamis, floods, wind storms and earthquakes | Disaster preparedness including access to medications | Qualitative | 17 |
| Efe 2020 | Turkey | Autoimmune hepatitis | COVID-19 Pandemic | Autoimmune hepatitis | Cohort study | 46 |
| Erdem 2020 | Turkey | Patients with chronic urticaria (CU) in the allergy units of two dermatology departments. | COVID-19 pandemic | Dermatology | Other: prospective, observational study | 194 |
| Ferraro 1999 | USA | Older adults | Flood | Access and needs, including medication use | Cross sectional | 68 |
| Fiumara 2020 | Italy | lysosomal disease | COVID-19 Pandemic | Lysosomal storage diseases | Qualitative | 15 |
| Garfin 2014 | Chile | Ages 15-90 | Earthquake | Dependence: substance abuse & healthcare service use | Cross sectional study | 2108 |
| Gasink 2009 | USA | People who obtained oseltamivir and control subjects, | Influenza Outbreak | Stockpiling of antiviral medications | Cross Sectional | 68 |
| Georgakopoulos 2020 | Canada | Moderate to severe psoriasis | COVID-19 Pandemic | Psoriasis | Cross sectional study | 2095 |
| Ghose 2013 | Haiti | Adults with HIV | Earthquake | Medication: antiviral adherence (HIV/AIDS) | Qualitative | 33 |
| Ghosh 2007 | USA | Head of household | Hurricane | Access; needs assessment | Cross sectional | 106 |
| Glintborg 2021 | Denmark | Inflammatory rheumatic diseases | COVID-19 Pandemic | Rheumatic diseases | Cross sectional study | 12789 |
| Guetti 2011 | Italy | Resident in 4 tent cities | Earthquake | Medication: headaches and painkiller use | Cross sectional | 53 |
| Gul 2021 | Turkey | Epilepsy | COVID-19 Pandemic | Epilepsy | Cross sectional study, quant | 110 |
| Haroon 2011 | UK | Adults who sought and collected an antiviral drug between 23 July 2009 and 7 February 2010. | Influenza pandemic 2009/2010 A/H1N1 | Medication: antiviral drug accessibility | Retrospective secondary data analyses | 10655 |
| Hassen 2020 | Saudi Arabia | Rheumatic diseases | COVID-19 Pandemic | Rheumatic diseases | Cross sectional study, quant | 637 |
| He 2018 | Nepal | Adults | Earthquake | Accessibility and services | Qualitative | 82 |
| Hochstatter 2021 | USA | HIV & Substance abuse Users | COVID-19 Pandemic | Substance misuse | Retrospective chart review | 112 |
| Howe 2008 | USA | Adults and children who visited the site clinic | Hurricane | Access; disaster relief care | Retrospective secondary data analyses | 465 |
| Islam 2008 | USA | Older adults taking medication | Hurricane | Medication: Anti-hypertensive medication adherence | Cross sectional | 2194 |
| Jhung 2007 | USA | Evacuees attending clinic | Hurricane | Medicine dispensing during hurricane | Retrospective secondary data analyses | 4229 |
| Jiao 2012 | USA | Adults with AMI | Hurricane | Access; outcomes cardiovascular effects on natural disaster | Retrospective secondary data analyses | 418 |
| Kalichman 2020 | USA | Men and women living with HIV (N = 162) aged 20â€“37years | COVID-19 pandemic | COVID-19 | Other: Longitudinal study | 162 |
| Kamoi 2006 | Japan | Adults with endocrine disorders | Earthquake | Access; needs endocrine disorder management | Prospective, uncontrolled study | 229 |
| Karacin 2020 | Turkey | Cancer patients | COVID-19 Pandemic | Cancer patients | Cross sectional study, quant retrospective | 3661 |
| Kaye 2020 | USA | People with asthma and COPD | COVID-19 Pandemic | Asthma and COPD | retrospective study observational | 7578 |
| Khabbazi 2020 | Iran | Adults with rheumatic diseases, treated with non- steroidal anti-inflammatory drugs, colchicine, glucocorticoids, synthetic disease-modifying antirheumatic drugs and biologic DMARDs | COVID-19 Pandemic | Rheumatic diseases | Cross sectional study | 858 |
| Khawcharoenporn 2013 | Thailand | Adults with HIV-infected adults (aged ]15 years old) | Flood | Medication: antiviral adherence (HIV/AIDS) | Qualitative | 217 |
| Kobayashi 2016 | Japan | Children and adults with epilepsy and physical and intellectual disabilities | Earthquake | Medication availability epilepsy | Cross sectional | 161 |
| Koker 2020 | Turkey | Children with rheumatic diseases | COVID-19 Pandemic | Children with rheumatic diseases | Cross sectional study, quant survey | 414 |
| Krousel-Wood 2008 | USA | Adults with hypertension | Hurricane | Medication non-adherence in anti-hypertensive meds | Cross sectional | 210 |
| Kyota 2018 | Japan | Carers of older adults | Various | Medication: carers medication storage preparedness | Cross sectional | 58 |
| Leyser-Whalen 2011 | USA | Women reproductive health | Hurricane | Access; reproductive health | Cross sectional | 3181 |
| Li 2018 | China | Adults | Various | Disaster preparedness, materials and medications prep | Qualitative | 133 |
| Li 2021 | China | Psychiatric disorders | COVID-19 Pandemic | Psychiatric illnesses | Cross sectional | 1063 |
| Linnemayr 2021 | Uganda | HIV | COVID-19 Pandemic | HIV | Cross sectional | 100 |
| Lovegrove 2011 | USA | Adults and children who attended 25 participating EDs | Influenza pandemic 2009 H1N1 | Medication: adverse events for drugs | Retrospective secondary data analyses | 2006-2007: n=77  2007-2008: n=130  2008-2009: n=261  2009-2010: n=411 |
| Lowe 2015 | USA | Adults aged 21 or over and capable of completing an interview in English, Spanish, or Vietnamese) and had reasonably good contact information were identified. | Oil spill | Mental health services | Cross Sectional | 8931 |
| Magliah 2021 | Saudi Arabia | Adults (>18 years old) with T1DM on insulin pump therapy | COVID-19 pandemic | COVID-19 | Cross sectional study | 65 |
| Mahmud 2014 | India | Adults with disabilities | Various | Access and needs, concern and coping; people with disabilities | Cross sectional | 50 |
| Mandelkorn 2021 | Multiple | Adults | COVID-19 Pandemic | N/A | Cross sectional study | 2562 +971 |
| Marbaniang 2020 | India | People living with HIV (PLHIV) registered for care at a publicly funded antiretroviral therapy (ART) center in Pune, India | COVID-19 | HIV patients | Cohort study; interview | 167 |
| Matusow 2018 | USA | Adults who use opioid drugs | Hurricane | Dependence opioid treatment medication access | Qualitative | 82 |
| McAuley 2021 | UK | COPD | COVID-19 Pandemic | COPD | Cross sectional study, quant | 160 |
| McLean 2018 | Liberia | Adults poor and middle class | Ebola outbreak | access to basic utilities, access to health services, health status, and immediate needs | Qualitative | 505 |
| Meng 2016 | Hong Kong | Adults >18 years | Influenza epidemics | Access; health seeking behaviour, including medication use | Cross sectional | 516 |
| Mir 2020 | UK | Inflammatory bowel disease | COVID-19 Pandemic | Inflammatory bowel disease | Cross sectional study, quant | 228 |
| Missildine 2009 | USA | Adults >17 years | Hurricane | Access meds and overall experience; shelter experience of evacuees with special medical needs | Cross sectional | 2269 |
| Mori 2007 | Japan | Adults with chronic illness | Earthquake | Medication: chronic disease medication interruption | Qualitative | 29 |
| Moscona 2019 | USA | Adults registered with hospital site | Hurricane | Access to medical care, including medication interruption | Retrospective secondary data analyses | 2341 |
| Murakami 2015 | USA | Adults receiving dialysis | Hurricane | Access; dialysis patients (service interruption) | Cross sectional systematic | 357 |
| Muruganandam 2020 | India | Patients with severe mental illness | COVID-19 Pandemic | Severe mental illness | Cross sectional study, quant | 132 |
| Negi 2018 | Nepal | Aged 18 years and older HIV positive | Earthquake | Mental health and med adherence | Cross sectional study | 305 |
| Okumura 2008 | Japan | Older adults | Earthquake | Medication; chronic disease; medication availability and use | Mixed methods | 110 |
| Onchonga 2020 | Kenya | Healthcare workers | COVID-19 Pandemic | General population | Cross sectional study | 379 |
| Oyeyemi 2021 | Nigeria | Adults living in Nigeria | COVID-19 Pandemic | General population | Cross sectional study | 1022 |
| Peters 2010 | USA | 9 and 19 years old. | Hurricane | Mental health PTSD & substance abuse | Cross sectional | 170 |
| PolatEkinci 2020 | turkey | Psoriasis | COVID-19 Pandemic | Dermatology | Cross sectional study | 133 |
| Potash 2009 | USA | Older adults; veterans enrolled in a chronic pain program | Hurricane | Mental health services | Qualitative | 42 |
| Pouget 2015 | USA | Adults who use IV drugs | Hurricane | Dependence IV drug addiction | Cross sectional study | 300 |
| Quaill 2019 | Australia | Adults with physical disabilities | Hurricane or Cyclone | Mental health and public health | Qualitative | 20 |
| Quast 2018 | USA | Children who were ages 18 or younger at the time Hurricane Katrina struck with a diagnosis for psychiatric conditions that are relatively chronic, require long-term treatment | Hurricane | Mental health services - Paediatric - (psychotropic medications prescription fills) | Retrospective secondary data analyses | 101950 |
| Rath 2007 | USA | 0 to 24 years of age ID attending clinic | Hurricane | Medication: asthma med shortage | Cross sectional | 531 |
| Rathi 2021 | India | Systemic lupus erythematosus | COVID-19 Pandemic | Systemic lupus erythematosus | Cross sectional study, quant | 1040 |
| Reilly 2009 | USA | Adults with HIV/AIDS in the New Orleans metropolitan area | Hurricane | Access HIV care | Qualitative | 145 |
| Rhodes 2021 | USA | HIV and men who have sex with men | COVID-19 Pandemic | HIV | Cross sectional study | 15 |
| Rojano 2019 | USA | Asthmatics | September 2011 World Trade Centre attack | Asthma | Cross sectional study | 381 |
| Rutter 2014 | UK | Children or adults who received telephone or internet consultation | Influenza pandemic | Medication: antiviral medication collection | Retrospective secondary data analyses | 2.73 million unique patient contact; 429 000 GP consultations |
| Sahni 2016 | Canada | Adults and children who had medication dispensed at study site | Flood | Access; needs assessment including medical | Retrospective secondary data analyses | N/A (“per 100 000 population” calculations) |
| Salas-NicÃ¡s 2021 | Spain | All wage-earners residing in Spain who had a job on 14 March 2020 (the day the state of alert began), including people who were subsequently fired, or affected by a temporary lay-off procedure | COVID-19 Pandemic | General population | Cross sectional study | 20328 |
| Saleem 2020 | Pakistan | Epilepsy | COVID-19 Pandemic | Epilepsy | Cross sectional study, quantitative | 213 |
| Samargandy 2020 | Saudi Arabia | Cardiac outpatients | COVID-19 Pandemic | Cardiac disease | Cross sectional study | 388 |
| Sanchez 2020 | UK | Men who have Sex with men | COVID-19 Pandemic | Sexual health | Cross-sectional | 1051 |
| Sanchez-Larsen 2020 | Spain | People with epilepsy | COVID-19 Pandemic | Epilepsy | Retrospective observational study | 100 |
| Sankar 2020 | India | Type 2 diabetes | COVID-19 Pandemic | Type 2 diabetes | Cross sectional study, quantitative | 110 |
| Schmeiser 2020 | Germany | Patients with inflammatory rheumatic disease | COVID-19 Pandemic | Patients with inflammatory rheumatic disease | Cross sectional study | 656 |
| Sharawat 2020 | India | Children and adolescents with migraine | COVID-19 Pandemic | Migraine | Cross sectional study, quant | 51 |
| Sibai 2020 | Lebanon | Adults aged 40 years and above were screened by the nurse or social worker. The majority were Syrian refugees (77%), females (72.2%), with equal distribution across age bands. | The Syrian war | Not specified | Mixed method approach, with qualitative and quantitative data | 1876 |
| Subaiya 2019 | USA | Adults | Hurricane | Access to medical care, including medication interruption | Cross sectional | 87 |
| Tao 2020 | China | Patients with type 1 diabetes mellitus and type 2 diabetes mellitus | COVID-19 | Diabetes mellitus (endocrine) | Cross sectional study | 1253 |
| Teh 2012 | Australia | Adults who tested positive by RT-PCR for seasonal influenza A (265 pH1N1 and 53 non-H1N1) and 500 controls | Influenza H1N1 | Public health containment measures and access to medical treatments including antivirals | Cross sectional | 265 pH1N1 and 53 non-H1N1) and 500 controls |
| Teramoto 2015 | Japan | Adults | Earthquake | Access; needs healthcare assistance | Qualitative | 296 |
| Thorpe 2020 | UK | Epilepsy | COVID-19 Pandemic | Epilepsy | Cross sectional study | 463 |
| Tofighi 2014 | USA | Adults who use opioid drugs | Hurricane | Dependence on opioid use | Mixed methods | 91 |
| Tomio 2010 | Japan | Outpatients in a flood-affected area | Flood | Medication: chronic disease medication interruption | Cross Sectional | 309 |
| Trivisano 2020 | Italy | Children with epilepsy | COVID-19 Pandemic | Epilepsy | Cross sectional study | 3321 |
| Verma 2020 | India | T1DM who were on regular follow up in Endocrinology Outpatient department (adult and child) | COVID-19 Pandemic | Type 1 diabetes | Cross sectional study | 52 |
| Vetter 2008 | Switzerland | Adults | Tsunami | Mental health substance use | Cross sectional | 2921 |
| Wang 2008 | USA | Adults (?18 years of age) | Hurricane | Mental health | Cross sectional study | 1043 |
| Wang 2020 | China | Chinese patients with psoriasis who were diagnosed by one or more experienced dermatologists. | COVID-19 Pandemic | Dermatology | Cross sectional study | 926 |
| Wills 2008 | Canada | Older adults in residential care setting | SARS outbreak | Disaster preparedness | Qualitative | 19 |
| Yadav 2019 | USA | Adults | Flood | Access; needs assessment | Cross sectional | 210 |
| Yamanis 2016 | Sierra Leone | Adults | Ebola outbreak | Disease Perception | Qualitative | 16 |
| Yuan 2009 | China | Person aged >15 years | Hypothetical pandemic | Disaster preparedness | Cross sectional | 256 |
| Zakaria 2020 | Multiple | Chronic disease | COVID-19 Pandemic | Chronic disease | Cross sectional study, quant | 1066 |
| Zen 2020 | Italy | Rheumatic diseases | COVID-19 Pandemic | Rheumatic diseases | Cohort study | 916 |
| Zhang 2020 | China | Chronic obstructive pulmonary disease (COPD) | COVID-19 Pandemic | COPD | Cross sectional study | 84 |
| Zhang 2020 | China | Asthmatics | cOVID-19 Pandemic | Asthma | Cross sectional study | 422 |
| ZiadÃ© 2020 | Multiple | Adults with chronic rheumatic diseases | COVID-19 Pandemic | Chronic rheumatic diseases | Cross sectional study | 2163 |

### **Supplementary Document 4: A summary of findings of studies reporting difficulty accessing medications during PHE**

|  |  |  |  |
| --- | --- | --- | --- |
| **Study author, year** | **Emergency type** | **Participants** | **Reported rate** |
| Abualfadl 2020107 | COVID-19 | Adults with RA | Difficulty to obtain the drug 608 (58.6%) |
| Al-Hashel 202069 | COVID-19 | Adults with migraine | difficulty in getting medications (179 patients (29.5%) |
| Andrade-Campos 202091 | COVID-19 | Spanish Gaucher Disease | Missed several doses due to rescheduling and reorganization of their hospital infusion center |
| Ballivian 202029 | COVID-19 | HIV population | a few (n = 52, 3.9%) reported having problems obtaining HIV medication, and 122 (9.1%) reported difficulty obtaining other medication |
| Bayleyegn 2006118 | Hurricane | Adults | 9-10% of households had problems obtaining medication. [19040] |
| Gul 202181 | COVID-19 | Epilepsy | 2 patients (1.8%) experienced difficulty obtaining drugs during the pandemic. |
| Hassen 202056 | COVID-19 | Adults with rheumatic disease | 48% of patients experienced difficulty obtaining medications |
| He 2018 | Earthquake | Adults | Qualitative report of delayed treatment [5007] |
| Kobayashi 2016 | Earthquake | Children and adults with epilepsy and physical and intellectual disabilities | 29% respondents experienced a lack of medication or near-lack during the acute phase of the disaster. Six patients were forced to stop taking medication. |
| Koker 202064 | COVID-19 | Children with rheumatic disease | Fourteen patients particularly using hydroxy-chloroquine |
| Leyser-Whalen 201197 | Hurricane | Adult females | 13% women reported an inability to access their birth control method due to the hurricane [13380] |
| Magliah 2021127 | COVID-19 | T1DM | difficulty obtaining medical supplies was re-ported in 24 patients (36.9%) for insulin, 26 patients (40%) for insulin reservoir, 26 patients (40%) for infusion set,11 patients (16.9%) for lancets, test strips, and/or alcohol swabs, and 5 patients (7.7%) for glucometer device |
| Matusow 201843 | Hurricane | Adults who use opioid drugs | 10% reported they could not obtain their medication the week immediately following the storm [14932] |
| Missildine 2009123 | Hurricane | adults >17 years | 63% respondents required assistance with medication [19741] |
| Mori 2017 | Earthquake | Adults | Qualitative report of running out of medication [11878] |
| Muruganandam 202035 | COVID-19 | Patients with severe mental illness | Non availability of meds (6%) |
| Potash 2009117 | Hurricane | older adults; veterans enrolled in a chronic pain program | 4.8% (2/42) respondents ran out of pain medication briefly [13599] |
| Rath 2007126 | Hurricane | 0-24 years of age attending an infectious disease clinic | Nearly half (43.9%) of the participants had experienced one or more disruptions in medical care (including but not only missed medications) [19289] |
| Rathi 202190 | COVID-19 | Systemic lupus erythematosus | hydroxychloroquine, and 190 patients (21.9%) responded that they had faced difficult in the availability of the drug, and 69 patients (6.6%) had been forced to miss several doses |
| Reilly 200924 | Hurricane | adults with HIV/AIDS | 38.5% ran out of medication [13926] |
| Saleem 202089 | COVID-19 | Adults with epilepsy | 17.4% had medication disruptions |
| Sharawat 202087 | COVID-19 | Children with migraine | Significantly reduced across both drug classes, requesting change to Rx. 7.8% requested a Rx change due to unavailability of medication |
| Sibai 202042 | Syrian war | Adults who were refugees | Shortage in a variety of medications for extended periods of time ranging from days to weeks; this was attributed to the increase in patient load and the rise in demand |
| Subaiya 201945 | Hurricane | Adults | 24.7% respondents experiencing difficulty in acquiring prescription medications in the 4 months’ post disaster [16758] |
| Teramoto 2015112 | Earthquake | Adults | interruption of treatment affecting 36.5% respondents (n=19) [14658] |
| Tomio 2010108 | Flood | People with chronic conditions | Only 52% brought medications of evacuees brought their medicines with them during evacuation [18335] |
| Trivisano 2020105 | COVID-19 | Children with epilepsy | 12.6% of responders reported difficulties in obtaining ASMs, 7.9% because ASMs were not available in pharmacy, 2.7% for problems in reaching the pharmacy, and 2.0% for lack of prescription. |
| Verma 202055 | COVID-19 | T1DM | 8/19 patients having hyperglycemia were not getting insulin injections due to non-availability during lockdown; not monitoring blood glucose were non availability of glucostrips (13 out of 20) |
| Yadav 2019137 | Flood | Adults | 40% did not have a 1 week supply of medicines with them at the time of interview [16891] |
| Ziadé 202073 | COVID-19 | Rheumatology patients | negative impact on access to hydroxychloroquine (47%)  Shortage of HCQ n=297, 18%  Difficulty to access HCQ n=481 29. 2% |

### **Supplementary Document 5: A summary of studies describing adherence or compliance to medications during PHE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study author, year** | **Emergency type** | **Participants** | **Measure used** | **Timing of measurement** | **Reported rate of non-adherence** |
| Abualfadl 2020107 | COVID-19 | Adults with RA | Self-report | During | Stopped or reduced taking NSAIDs n= 171 (16.5%) |
| Ahmad 2018 | Earthquake | Adults with tuberculosis | Direct Observation of Treatment data | Before and after | During the intensive phase of the disaster, TB-DOTS remained stable in those in areas less affected by the earthquake and deteriorated in highly affected areas. |
| Al-Hashel 202069 | COVID-19 | Adults taking migraine treatment | Self-report | During | 54.4% non-compliant, 59% reported overuse |
| Alkhotani 2020 | COVID-19 | People with epilepsy | Self-report | During | Self-reported change to adherence for 5% but remaining 95% remained unchanged. |
| Alshareef 2020 | COVID-19 | People experiencing T2DM | Self-report | Before and after lockdown | 89.6% and 88.3% took medications regularly and on time before the lockdown, respectively |
| Ciurea 202116 | COVID-19 | Adults with axial spondyloarthritis (axSpA), rheumatoid arthritis (RA) or psoriatic arthritis (PsA) | Self-report | Before and during | The pre-pandemic proportion of patients with non-compliance to the prescribed medication was around 15%. Non-compliance increased slightly during the pandemic reaching statistical significance in people with axial spondyloarthritis (19.9% vs 13.2% p=0.003). |
| Efe 2020 | COVID-19 | People experiencing autoimmune hepatitis | Self-report | Before and during | Those in the telehealth group had better adherence and less relapse than standard care |
| Ghose 2013 | Earthquake | Adults with HIV | Qualitative reports | After | Reports from encampment residents who were living with HIV/AIDS about difficulties accessing medicines and remaining adherent while in the camps. |
| Gul 2021 | COVID-19 | Patients aged 18–65 with epilepsy | Modified Morisky Scale | Before and during | Increases in the subscales of motivation and knowledge during compared to before the PHE were reported. Total MMS score not reported. |
| Hassen 202056 | COVID-19 | Adults with rheumatic disease | Self-report | During | 14% were non-adherent |
| Hochstatter 202130 | COVID-19 | Adults with HIV and substance abuse users | Self-report | Before and during | Proportion of participants missing their HIV medications 2 or more days per week significantly increased from 5% to 12% |
| Islam 2008 | Hurricane | Older adults | Self-report | After | Prevalence of low adherence was reported but no comparison with baseline pre-PHE. Low medication adherence was associated with lower scores on the hurricane coping self-efficacy scale. |
| Jiao 2012 | Hurricane | Adults | Healthcare recorded history data | Before and after | post-PHE patients were more likely to be non-adherent and to present to hospital with an AMI than before the PHE. |
| Kalichman 2020 | COVID-19 | People living with HIV | Self-report | During | Practicing protective behaviours was related to an inability to access medications but not to ART adherence in the month before, or the month during, the COVID-19 assessment. Adherence improved in the month since the onset protective actions. |
| Kaye 2020 | COVID-19 | People experiencing asthma or COPD | Electronic inhaler use monitoring data | During | 14.5% relative increase (53.7% to 61.5%) in mean daily controller medication adherence |
| Krousel-Wood 200853 | Hurricane | Adults taking antihypertensive medications | Self-report, the Hill Bone medication-taking subscale | During | 46% of the patients had less-than-perfect adherence |
| Li 2020 | COVID-19 | Older people experiencing psychiatric disorders | Self-report | During | Poor adherence to treatment was associated with anxiety and depression symptoms |
| Linnemayr 202132 | COVID-19 | HIV | Self-report | During | 14% said decreased compliance (due to stay at home orders, restrictions) |
| Marbaniang 2020 | COVID-19 | People living with HIV | Remaining days’ medication supply | During | Evidence that adherence is related to anxiety and access to mental health treatments |
| Muruganandam 202035 | COVID-19 | Patients with severe mental illness | Self-report | During | 22% of patients missed psychiatric medicines during lockdown. 18% of patients missed medication for comorbid illness |
| McAuley 2021 | COVID-19 | People with COPD | Self-report of use of maintenance inhalers | Prior to and during lockdown compared to stable state | Prior to lockdown 83% reported the same frequency, 14% increased use and 2.5% less frequent use than normal. During lockdown 26% reported increased, 71% the same and 2.5% less regular use than baseline (p<0.001) |
| Negi 2018 | Earthquake | People living with HIV | Adapted from the Adult AIDS Clinical Trials Group, self-report measure, based on previous 4 days | 6 and 12 months after the earthquake | Adherence rates declined after the earthquake and this may have resulted in treatment failure and emergence of resistance strains for some. |
| PolatEkinci 2020 | COVID-19 | patients with moderate-to severe psoriasis receiving maintenance biological treatment | Self-report | During | 39% suspended biological treatment. |
| Reilly 2009 | Hurricane | People living with HIV | Medication supply interruptions and missed doses | After | No association identified between medication “adherence” and PTSD. 39% ran out of medication within one month of the hurricane. |
| Rojano 2019 | Disaster | Rescue and recovery workers with asthma | Medication Adherence Rating Scale (MARS) | After | 44% non-adherent |
| Samargandy 2020 | COVID-19 | Cardiac patients | Self-report | Perceived change from before to during | No change (72.7%), improved compliance (17.8%), disimproved compliance (9.5%). |
| Sanchez-Larsen 2020 | COVID-19 | People with epilepsy | Self-report | During | No change 98%, improved 2% |
| Tao 202077 | COVID-19 | T1DM and T2DM | Self-report and hospital records | During | 22.3% of T2 and 75% of T1DM reported being non-compliant. |
| Thorpe 202047 | COVID-19 | Epilepsy | Self-report | During | 13% reported greater difficulties in adherence |
| Wang 2020115 | COVID-19 | Adults with psoriasis | Self-report | During | The prevalence of nonadherence was 37.3%, 63.7%, and 71.2% for biological, systemic, and topical treatment, respectively |
| Zakaria 202078 | COVID-19 | Adults with chronic disease | Self-report | During | 29.2% were not adherent during pandemic, |
| Zhang 2020 (#25596) | COVID-19 | People experiencing COPD | Dispensed medication data | Before and during | No change in adherence rates between the two periods. |
| Zhang 2020 (#25925) | COVID-19 | Asthma | Scale unclear | During | Average score 4.56 reported. |
| Ziade 2020 | COVID-19 | People with chronic rheumatoid disease | Medication persistency | During | The pandemic had a negative association with medication persistence. |