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# Investigating the epidemiology of medication errors and error-related adverse drug events (ADEs) in primary care, ambulatory care and home settings: a systematic review protocol

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## ABSTRACT

**Introduction:** There is a need to better understand the epidemiology of medication errors and error-related adverse events in community care contexts.

**Methods and analysis:** We will systematically search the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, Eastern Mediterranean Regional Office of the WHO (EMRO), MEDLINE, PsycINFO and Web of Science. In addition, we will search Google Scholar and contact an international panel of experts to search for unpublished and in progress work. The searches will cover the time period January 1990–December 2015 and will yield data on the incidence or prevalence of and risk factors for medication errors and error-related adverse drug events in adults living in community settings (ie, primary care, ambulatory and home). Study quality will be assessed using the Critical Appraisal Skills Program quality assessment tool for cohort and case–control studies, and cross-sectional studies will be assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Descriptive Studies. Meta-analyses will be undertaken using random-effects modelling using STATA (V.14) statistical software.

**Ethics and dissemination:** This protocol will be registered with PROSPERO, an international prospective register of systematic reviews, and the systematic review will be reported in the peer-reviewed literature using Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

## INTRODUCTION

Patient safety is a public concern in healthcare systems across the world.[1] The National Coordinating Council for Medication Error Reporting and Prevention defines a medication error as 'any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, patient or consumer'.[2] Medication errors are therefore any mistakes at any stage of medication management. Adverse drug event (ADE), on the other hand, is 'an injury resulting from medical intervention related to a drug', regardless of whether an error has occurred.[3] While almost all medication errors can be prevented, ADEs can be categorised as preventable and non-preventable.[1] Box 1 provides definitions of the key terms employed in this systematic review protocol.

Medication errors and error-related ADEs are common and are responsible for considerable patient harm.[1] More specifically, ADEs can lead to morbidity, hospitalisation, increased healthcare costs and, in some cases, death.[4] It has been estimated that 5–6% of all hospitalisations are drug-related.[5 6] With estimates suggesting that ADEs causing hospital admission occur in around 10% of inpatients; approximately half of these ADEs are believed to be preventable.[7]

The cost of drug-related morbidity and mortality was estimated to be $177.4 billion annually in 2001 in the USA alone.[8]

Medication errors and ADEs are a major problem in all care settings, including home, ambulatory and community settings.[1] Children and adults who suffer from multiple long-term conditions with associated complex drug regimens are particularly at risk.[9–11]

Systematic reviews focusing on the safety of primary care contexts only have identified studies with vastly different prevalence estimates of the rates of medication errors, these reflect differences in definitions, sampling strategy and populations studied; none of these have investigated the risk factors for medication errors.[12 13]

Since the release of *To Err is Human: Building a Safer Health System* by the Institute of Medicine,[14] which focused on acute care settings, most patient safety research has

**Box 1** Key definitions

- *Adverse drug event (ADE)*: Bates *et al*[3] define ADE as 'an injury resulting from medical intervention related to a drug'. Some ADEs are caused by underlying medication errors.
- *Medication error*: The National Coordinating Council for Medication Error Reporting and Prevention defines a medication error as: 'any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, patient, or consumer. Such events may be related to professional practice, healthcare products, procedures and systems, including prescribing; order communication; product labelling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use'.[2] Medication errors can result from any step of the medication-use process: selection and procurement, storage, ordering and transcribing, preparing and dispensing, administration or monitoring.[1]
- *Non-prescription drugs*: Medicines that can be sold legally without a drug prescription.
- *Over-the-counter (OTC) drug*: The Food and Drug Administration defines OTC drugs as 'drugs that have been found to be safe and appropriate for use without the supervision of a healthcare professional such as a physician, and they can be purchased by consumers without a prescription'.[24]
- *Prescription drug*: Drugs that cannot be sold legally without a prescription.

been carried out on hospitalised patients.[15 16] Given that patients are increasingly managed in primary, ambulatory and home settings, there is a need to also focus attention on community care contexts.

Prior to undertaking further primary work in this area, it is important to take stock of the current evidence base, reflect on the quality of the evidence, distil key findings that have the potential to provide both estimates on the frequency of medication errors and error-related ADEs, and understand the factors underpinning this important source of preventable harm. We will therefore undertake a systematic review investigating the incidence and prevalence of and risk factors for medication errors and error-related ADEs in community (ie, primary care, ambulatory and home) settings.

### Research question

What are the incidence and prevalence of and risk factors for medication errors and error-related ADEs in primary care, ambulatory care and home settings?

## METHODS

### Design

We will undertake a systematic review and, if possible, a meta-analysis.

### Inclusion criteria

#### Eligibility criteria

##### *Type of studies*

Population-based cross-sectional and cohort studies will be eligible to estimate the incidence and prevalence of medication errors and ADEs; these study designs and case–control studies will be eligible to study risk factors for the development of error-related ADEs.

##### *Population*

The population of interest will be adults (≥18 years) who are dwelling in the community and living in their own homes without home healthcare or nursing at home. These patients may be self-managing, receiving care in primary care and ambulatory settings or any combination of the above.

##### *Exposures*

The exposure of interest is prescribed and/or over-the-counter medications.

##### *Outcomes*

The outcomes of interest are the incidence and prevalence of medication errors and ADEs, and risk factors for the development of medication errors and error-related ADEs. These errors may have occurred anywhere in the medicines' management process.[1] We will work with the definitions of medication errors and error-related ADEs employed in individual studies.

#### Exclusion criteria

1. Studies on illegal substance abuse, herbal products, home healthcare (ie, continuous medical and/or nursing care provided to patients in their own homes), nursing home, hospitalised in-patients or those managed in emergency department settings.
2. Paediatrics (<18 years).
3. Randomised controlled trials since these cannot be used to reliably assess the incidence and/or prevalence of the outcomes of interest.
4. Existing reviews since the focus is on the primary literature.
5. Studies focusing on specific medication errors or subgroups of populations.
6. Incompletely reported studies, for example, in the form of abstracts.

### Search strategy

We will search the following biomedical databases for published research studies: Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, Eastern Mediterranean Regional Office of the WHO (EMRO), MEDLINE, PsycINFO and Web of Science. These databases will be searched from January 1990 to December 2015; the start date has been chosen to reflect the time when patient safety came into the consciousness of policymakers, professionals and the public.[17] In addition, we will search Google Scholar and contact an international panel of experts to search for unpublished and in progress work. The corresponding author of the eligible articles may be contacted if additional information is needed. The reference list of previous studies will be scrutinised for additional possible

eligible studies. No restriction on the language of publication will be employed.

Detailed search strategies are presented in online supplementary appendix 1.

### Study selection

GA will search the databases. GA and a second reviewer will then independently screen the titles and abstracts for eligible studies according to the above detailed selection criteria. Full-text articles will be retrieved from selected studies and will be reviewed according to the selection criteria. Disagreements will be resolved by discussion between the reviewers or arbitration by a third reviewer if a decision cannot be reached. Each copy of the selected studies will be retrieved and the reason for excluding other studies will be clearly noted.

### Quality assessment

The risk of bias assessments will be independently carried out on each study by two reviewers using the Critical Appraisal Skills Program quality assessment tool for cohort and case–control studies,[18] and cross-sectional studies will be assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Descriptive Studies.[19] Any disagreements will be resolved by consensus or arbitration by a third reviewer if a decision cannot be reached. Each study will be graded as being at high, medium or low risk of bias.

### Data extraction

Data will be extracted by two reviewers and recorded onto a customised data extraction sheet. Discrepancies will be resolved by discussion. The following information will be extracted:

1. Author, year;
2. Study design, study type (retrospective, prospective);
3. Population of interest;
4. Exposure of interest;
5. Outcomes of interest;
6. Main findings;
7. Conclusions;
8. Additional notes.

### Data analysis

Data will be summarised in detailed data tables, which will include information on the incidence, prevalence, and relative risk and ORs, together with 95% CIs, for each study (where available). STATA (V.14) statistical software will be used to pool study data if this is considered both clinically and statistically appropriate. Meta-analyses will be undertaken using random-effects modelling.[20]

Sensitivity analyses will be undertaken by excluding studies judged to be at the highest risk of bias.

Subgroup analyses will be undertaken comparing: adults (18–64 years) versus elderly (≥65 years) patients; and those who have recently been an inpatient or had a hospital visit (<30 days) versus those who have not had a recent hospital attendance (≥30 days).

If possible, funnel plots will be used to assess the presence of publication bias.[21]

### Registration and reporting

This systematic review will be registered with PROSPERO, an international prospective register of systematic reviews, and will be reported using Preferred Reporting Items for Systematic Reviews and Meta-Analyses[22] and Meta-analysis Of Observational Studies in Epidemiology guidelines.[23]

## DISCUSSION

This systematic review will provide a comprehensive assessment of the epidemiology of medication errors and error-related ADEs in community settings. We anticipate reporting the findings from this study in the autumn of 2016.

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**Contributors** GAA conceived the idea for this review. The protocol methods were developed in conjunction with AS and EG. GAA led the drafting of the manuscript and this was commented on critically by AS and EG.

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**Competing interests** None declared.

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# Correction: *Investigating the epidemiology of medication errors and error-related adverse drug events (ADEs) in primary care, ambulatory care and home settings: a systematic review protocol*

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The author, Ghadah Asaad Assiri would like to change the affiliation order in this article.

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