Systematic review examining the benefits of professional, organisational and structural interventions to reduce preventable medications adverse events in primary care

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Background: Medication related adverse events in primary care are a leading cause of hospital admissions and mortality, commonly resulting from medication errors. Previous reviews have assessed interventions broadly across healthcare settings, but few have focused specifically on interventions targeting medication errors in primary care. A systematic review was conducted including literature up to December 2016, but a more up to date review was required.

Objectives: To evaluate the effectiveness of professional, organisational, and structural interventions in reducing preventable medication-related hospital admissions, emergency department (ED) visits, and mortality in primary care settings.

Methods: We conducted a systematic review using comprehensive searches of CENTRAL, MEDLINE, Embase, CINAHL, grey literature and trial registries from Jan 2016 to Oct 2024. Two reviewers independently screened each title, abstract, and full text for inclusion, resolving disagreements by consensus. We included randomised controlled trials conducted in primary care that assessed the impact of interventions on medication-related hospital admissions, ED visits, and mortality. Two review authors extracted data using a customised EPOC checklist and grouped studies by similar interventions and outcomes. Risk of bias assessments and random-effects meta-analyses were performed.

Results: Sixty-two studies met the inclusion criteria (33 new studies). Ten studies (16.1%) were categorised as professional interventions, two (3.2%) as structural interventions, and 50 (80.6%) as organisational interventions. Organisational interventions reduced the number of hospital admissions (RR 0.81, low-certainty). Professional interventions showed little to no effect on primary outcomes. Structural interventions, such as system-level support and quality monitoring, showed a reduction in hospital admissions (RR 0.90, moderate-certainty). Evidence for effects on ED visits and mortality was limited or very low in certainty.

Conclusion: Organisational and structural interventions may reduce medication-related hospital admissions in primary care. The overall certainty of evidence is low to very low, highlighting the need for high-quality trials, over a longer timeframe and including patient specific outcomes related to error rates and adverse events. Given the modest effect sizes and variability in outcomes, future policies should focus on targeting interventions to high-risk populations.

Systematic review examining the benefits of professional, organisational and structural interventions to reduce preventable medications adverse events in primary care

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Objective:
To evaluate the effectiveness of professional, organisational, and structural interventions in reducing preventable medication-related hospital admissions, emergency department (ED) visits, and mortality in primary care settings.

Methods:

Search strategy
- We conducted a systematic review using comprehensive searches of CENTRAL, MEDLINE, Embase, CINAHL, grey literature and trial registries from Jan 2016 to Oct 2024.
- Two reviewers independently screened each title, abstract, and full text for inclusion, resolving disagreements by consensus with a third reviewer (Table 1).
- Two review authors extracted data using a customised EPOC checklist and grouped studies by similar interventions and outcomes.

Quality Assessment
- For RCTs, risk of bias was assessed across standard domains using Higgins 2011 criteria.(1) Cluster-RCTs were also assessed for recruitment bias, baseline imbalances, and analytical appropriateness. Studies with any high-risk domain were considered high risk overall.

Measures of Treatment Effect
- Outcomes were reported in natural units (e.g. number of events per total participants). Dichotomous outcomes were analysed using risk ratios (RRs) with 95% confidence intervals (CIs). Funnel plots were used to assess publication bias.

Data Analysis
- Random-effects meta-analyses were used due to expected heterogeneity. Studies were grouped by intervention type (professional, organisational, structural). Cluster RCTs were adjusted using design effect calculations as per the Cochrane handbook.(2)

Assessment of Heterogeneity
- Heterogeneity was evaluated using the I^2 statistic and visually via forest plots. Thresholds followed Higgins 2003 guidelines.(3, 4)

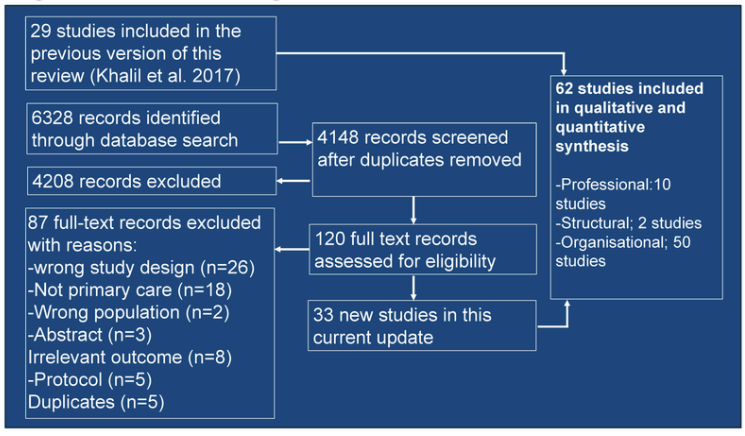
Reporting Bias
- Funnel plots and Egger's test were planned if ≥10 studies were available. Due to insufficient trials, this was not performed for professional and structural interventions.(2)

Summary of Findings and Certainty of Evidence
- GRADE was used to assess evidence certainty. Three 'Summary of findings' tables were developed for comparisons between each intervention type and usual care, including justifications for any downgrading/upgrading of evidence, as per the GRADE handbook.(5, 6)

Table 1. Eligibility criteria- inclusion criteria

Participants	Studies conducted within primary care, including general practitioners (GPs), family doctors, family physicians, family practitioners, dental practitioners, community nurses, nurse practitioners, community pharmacists, dispensers in community pharmacies and any other relevant healthcare providers. Adult patients only
Intervention	Interventions that improved patient safety by reducing hospital admissions, emergency department visits, and mortality. We divided interventions into the following three categories: **Professional interventions-** the use of health information technology to identify people at risk of medication problems, computer-generated care suggested and actioned by a physician, electronic notification systems about dose changes, drug interventions and follow-up, educational interventions on drug use aimed at physicians to improve prescriptions. **Organisational interventions**- medication reviews by pharmacists, nurses or physicians, clinician-led clinics, and home visits by clinicians. **Structural interventions-** social, economic, and political interventions that could improve public health outcomes by increasing the willingness and ability of individuals to practice prevention. E.g. The introduction of financial incentives to healthcare workers to reduce medication errors.
Studies	Randomised trials. Included cluster randomised trials where the unit of analysis was the site rather than the individuals (Higgins 2017) No restriction on the language or country or status of publication.
Primary Outcomes	1. Number of all-cause hospital admissions. 2. Number of people admitted to hospital
Secondary outcomes	1. Number of all cause visits to emergency departments. 2. Mortality (all-cause)

Figure 1 PRISMA flow diagram



Results:
- See Figure 1 for the PRISMA flow diagram
- Ten studies (16.1%) were categorised as professional interventions, two (3.2%) as structural interventions, and 50 (80.6%) as organisational interventions.
  - Organisational interventions, reduced the number of hospital admissions (RR 0.81, 95% CI 0.70–0.95; low-certainty evidence)
  - Professional interventions, showed little to no effect on primary outcomes.
  - Structural interventions, showed a reduction in hospital admissions (RR 0.90, 95% CI 0.83–0.97; moderate-certainty evidence)
- Evidence for effects on ED visits and mortality was limited or very low in certainty.

Conclusions:
- Organisational and structural interventions may reduce medication-related hospital admissions in primary care.
- Overall certainty of evidence is low to very low, highlighting the need for high-quality trials, over a longer timeframe and including patient specific outcomes related to error rates and adverse events.
- Given the modest effect sizes and variability in outcomes, future policies should focus on targeting interventions to high-risk populations.

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