



Evidence Briefings on Interventions  
to Improve Medication Safety

**Reducing interruptions  
during medication  
prescribing, preparation and  
administration**

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# Reducing interruptions during medication prescribing, preparation and administration

## Policy question

Are interventions effective at reducing interruptions during medication prescribing, preparation, and administration?

## Current evidence shows

Interruptions have been implicated as a source of error during the preparation and administration of medications, and more recently interruptions have been shown to be associated with prescribing errors. Eleven studies found interventions to be effective resulting in a statistically significant reduction in interruptions during medication administration. Five studies showed a significant reduction in medication administration errors (MAEs). However, only two of those studies were randomised controlled studies, one of which found no significant differences in interruption and medication error rates after implementation of an intervention. The lack of robust study designs applied to evaluate these interventions limits the generalisability of the findings regarding effectiveness. While several interventions have been associated with reduced rates of interruptions, evidence of impact on reduced medication errors is limited. Hospitals should be cautious about adopting these interventions until controlled trials of their effectiveness have been undertaken.

## Background

MAEs are estimated to occur in approximately one in five medication administrations,<sup>1</sup> and are more likely to result in serious harm and death compared to other medication errors.<sup>2,3</sup> There is growing evidence that interruptions are a contributory factor to MAEs in hospitals.<sup>1,4-7</sup> A large study in two Australian teaching hospitals found that interruptions to nurses during medication administration were significantly associated with more medication errors and more severe errors.<sup>7</sup> While there is emerging evidence of the impact of interruptions during medication administration, there is less evidence in other areas such as prescribing. One direct observational study of emergency department

physicians in an Australian teaching hospital found that physicians were significantly more likely to make prescribing errors when interrupted during the process.<sup>8</sup>

Interruptions have also been identified as a risk factor for task errors in other industries and have consequently been the target of interventions.<sup>9-12</sup> For example, the aviation industry implemented the “sterile cockpit” as standard operating practice to remove non-essential conversations during safety critical tasks such as taking off and landing.<sup>13</sup> This same concept has been applied by some hospitals in the form of ‘no interruption zones’ for the preparation of medications and the use of ‘do not disturb’ vests for the administration of medications.<sup>14-18</sup> Two systematic reviews concluded that there is limited evidence of the effectiveness of such interventions to reduce interruption rates and MAEs in hospitals.<sup>19,20</sup>

In 2013, the Australian Commission on Safety and Quality in Health Care published an evidence briefing on interventions to reduce interruptions during medication preparation and administration.<sup>21</sup> This briefing provides an update incorporating literature published since 2013 to identify further evidence of the effectiveness of interventions to reduce interruptions during prescribing as well as during the preparation and administration of medications.

## Methods

A literature search was performed to identify studies using search terms related to nursing, medication administration, prescribing, interruptions, and intervention studies. Searches were performed in MEDLINE, MEDLINE In-Process & Other Non-Indexed Citations, Embase, CINAHL and PsycINFO. Google Scholar and the Cochrane Effective Practice and Organisation of Care Group reviews were also searched. Studies that relied only on self-report for outcome measurement were excluded,<sup>22-29</sup> as were conference abstracts, review articles, duplicates, dissertations, commentaries, and letters.

## Results

The literature search retrieved 866 articles. Twenty-nine articles met inclusion criteria.<sup>14,18,30-55</sup> However, two of these articles reported results from the same study.<sup>34,35</sup> Therefore, in total, 28 studies were included.<sup>14,18,30-33,35-55</sup>

### Study characteristics

Fourteen studies were conducted in the USA,<sup>14,18,30-33,35,39-41,43,50,54</sup> eight in Europe,<sup>36,37,42,44,45,47,49,52</sup> three in Australia,<sup>46,53,55</sup> two in Canada,<sup>38,51</sup> and one in Egypt.<sup>48</sup> Studies were predominately undertaken in one ward in one hospital,<sup>18,30,31,35,36,38,39,44,47,49,50,54</sup> but the type of wards varied from general medical wards to intensive care wards. Of the studies on multiple wards,<sup>14,32,33,37,40-43,45,46,48,52,53</sup> only one controlled for clustering in the analysis,<sup>53</sup> which takes into account similarities in nurses' behaviours on any one ward.<sup>56</sup> Eighteen studies used more than one observer,<sup>18,22,30-33,35,37,38,40-42,45,46,49,51-53</sup> but only six studies reported a measure of inter-rater reliability.<sup>18,37,41,46,52,53</sup> Twenty-four studies used a before-and-after design without a control group,<sup>14,30-33,35-45,47-50,52,54,55</sup> two studies were randomised-controlled studies,<sup>46,53</sup> one was a simulation study,<sup>51</sup> and one study used a quasi-experiment three group design (comparing one control group and two intervention groups).<sup>18</sup> Studies without a control group make it difficult to determine whether any changes observed are due to the intervention being tested or are a result of other factors which may have occurred over time. Although all 29 studies used the term 'interruption', a definition was only provided in 17 studies.<sup>14,30,31,36,38-42,44,45,47-50,52,53</sup> The different definitions applied make direct comparison of results between studies difficult.

### Interventions to reduce interruptions

Interventions designed to reduce interruptions varied and all involved multiple elements. Two studies allocated a specific room for medication preparation to eliminate external stimuli;<sup>37,47</sup> one study involved relocation to new facilities with separate medication rooms;<sup>45</sup> and two studies made changes to existing medication rooms to remove everything that was not pertinent to medication administration to reduce interruptions to nurses.<sup>30,40</sup> Twelve interventions that were evaluated included 'Do not interrupt' vests or sashes worn by nurses during medication administration,<sup>18,31,36,37,41,42,44,50,52-55</sup> 12 included signs requesting that nurses administering medications not be interrupted,<sup>30,31,35,36,38,42,43,49,50,53,54</sup> five included marked quiet zones for medication preparation,<sup>14,31,42,50,54</sup> and four included checklists to be used by nurses

during medication administration.<sup>18,36,49</sup> Diversion strategies, such as allocating other staff not performing medication administration to attend to phone calls and non-emergency patient inquiries, were also implemented.<sup>18,30,31,35,48,50</sup> Other common interventions included staff education and training,<sup>31,41-44,46,48,49,51,53,54</sup> and patient education (e.g., flyers).<sup>31,39,42,53</sup>

### Effectiveness of interventions in reducing interruptions

Twenty-one studies which measured changes in overall interruption rates before and after interventions showed a reduction in the rate of interruptions during medication administration post-intervention,<sup>14,30-33,35,36,39,41,42,44-50,52-54</sup> and one showed an increase in the interruption rate.<sup>37</sup> Of the 21 studies that showed a decrease in interruption rates, 10 studies did not evaluate the statistical significance of the observed change.<sup>30-32,35,39,44,47,48,50</sup> Of the 11 studies that did, 10 found a significant difference in interruption rates from pre-to-post intervention.<sup>14,33,36,41,42,45,49,52-54</sup> and one did not.<sup>46</sup>

In a randomised controlled study at a major teaching hospital in Australia,<sup>53</sup> four wards were randomised to the intervention, which consisted of five 'bundled' elements, including a 'Do not interrupt' vest to be worn during medication administration; interactive workshops with nurses; education sessions with clinical staff; patient information; and use of reminders (e.g., posters, stickers). A further four wards were randomised to the control group and were blinded to the intervention. Nurses in the intervention wards experienced a significant reduction in non-medication related interruptions from an average of 50 interruptions per 100 administrations to 34 interruptions per 100 administrations ( $p=0.001$ ). In contrast, there was no significant change in interruptions experienced by nurses in the control wards (51/100 administrations to 53/100 administrations post-intervention).

### Effect of interventions on interruptions by source

Fourteen studies evaluated the change in interruption rate by source,<sup>14,18,22,31,36,37,39,42,45,47,48,50,53,54</sup> but only four assessed the statistical significance of the change.<sup>22,36,37,54</sup> One study found that an intervention comprising vests, ward signs, and checklists significantly decreased the average number of interruptions per medication round hour from staff nurses, conversation, missing medications, noise and other causes; but not from personnel, other patients, visitors, doctors and telephone calls.<sup>36</sup> Another study,

which implemented vests and allocated a specific room for medication preparation, found a statistically significant decrease in the number of interruptions due to unavailable medications or materials, patient requests, attending to other activities, and answering telephone calls; but not from searching for information, answering patient call bells, managing documentation and other sources.<sup>37</sup> In addition, they found a statistically significant increase in the number of interruptions from other staff members following the intervention. A further study found interruptions from both staff and patients significantly decreased after the implementation of a sterile cockpit intervention including 'Do not disturb' signs and orange vests.<sup>22</sup>

### **Effect of interventions on time taken for medication administration**

Three studies assessed the effect of interventions on the time taken for medication administration.<sup>30,36,50</sup> All three found a decrease in the time taken for medication administration (e.g., median of 15 minutes to a median of 10 minutes),<sup>30</sup> but none of these studies evaluated the statistical significance of these changes.

### **Effect of interventions on medication administration errors and prescribing errors**

Observed changes in MAE rates following an intervention were reported in thirteen studies.<sup>17,22,31-33,35,40,42,46,48,51,52,55</sup> Only one study evaluated the effectiveness of an intervention (i.e., two 'do not disturb' strategies) to decrease the number of prescribing errors by reducing interruptions during discharge prescription writing.<sup>55</sup> Seven studies evaluated the statistical significance of changes, and five of those studies showed a significant reduction in MAEs,<sup>22,32,33,40,52</sup> whereas two studies found no change.<sup>42,46</sup>

In a before-and-after study, 313 medication administrations were observed in a Dutch university hospital to examine the effectiveness of drug round tabards, which had 'Do not disturb, medication round in progress' printed on them.<sup>52</sup> The study found that there was a significant reduction in both interruptions and MAEs, with a 66% reduction in MAEs found post-implementation (i.e., from 432 MAEs to 120). However, as the study did not have a control group, the reduction in MAEs cannot be attributed solely to the reduction in interruptions, as other factors may have influenced the change.

An Australian randomised controlled study to evaluate a behavioural e-learning intervention designed to educate nurses on how to manage interruptions during medication administration was conducted.<sup>46</sup>

The intervention consisted of a 20-minute module that provided information about interruptions; behavioural strategies on how to manage interruptions (e.g., blocking); simulations of approaches to the management of interruptions; and a discussion involving nurse leaders about ward culture. The study included eight wards randomised to intervention (n=4) and control (n=4) groups, and 806 (402 pre-intervention and 404 post-intervention) medication administration events were observed. The study found no significant differences in the rate of interruptions or clinical errors per 100 medications between the intervention and control wards.

## **Conclusions**

A significant proportion of studies reviewed did not assess the statistical significance of intervention effects, nor did they assess the inter-rater reliability for observations, or control for clustering by ward. The studies almost exclusively evaluated interventions that focussed on nurses and nursing practices. Observations were carried out by nurses from the study hospitals in the majority of studies, which has the potential for bias as they may have had a vested interest in demonstrating a positive effect from the interventions. These limitations, and the fact that most studies were conducted in the USA, usually in only one hospital ward, reduce the generalisability of study findings.

The current evidence base is not sufficient to warrant widespread adoption of "Do not interrupt" interventions. However, policy makers and clinicians should not dismiss interventions aimed at reducing interruptions until further controlled randomised trials have been conducted to assess their value. A greater understanding of the relationships between interruptions, errors in clinical practice and care outcomes is required as a foundation for the development of interventions designed to reduce interruptions in clinical practice. Further research is needed to examine the single contribution of interventions to avoid implementation of unnecessary elements of 'bundled' interventions. It is important to note that not all interruptions are negative, some are necessary and contribute to patient safety, an issue not considered in detail in the identified studies.



## Lessons learned from implementation

- Education of staff, patients, and visitors is essential if interventions targeting interruptions are to be successful.<sup>44,50</sup>
- The source of frequent, unnecessary interruptions should be the target of interventions rather than interventions which target all interruptions.
- User acceptability and sustainability of interventions are important considerations but have rarely been investigated.<sup>44</sup>

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