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Science Letter

The impact of using prefilled syringes on a standard operating procedure for preparing injectable medicines in clinical areas

Preparing injectable medicines is a complex process [1], frequently performed by anaesthetists (an average of about 10 drug administrations per case) [2] and with more steps on which human factors can apply than any other procedure anaesthetists carry out. Design changes are one way of reducing human factor influences [3] and the use of prefilled syringes could make medication errors 17 times less likely during this process [4].

A prefilled syringe is defined as a syringe that is already filled and correctly labelled before it enters the final clinical area, where it can be administered immediately without further manipulation. Standard operating procedures (SOP) are a way to deliver sustainable reductions in challenging patient safety problems. We decided to investigate how many steps the use of prefilled syringes would eliminate from an SOP to prepare injectable medicines in clinical areas, and if any risks of harm were consequently removed.

We chose the SOP for *Preparing Injectable Medicines in Clinical Areas* from the National Patient Safety Agency promoting safer use of injectable medicines alert [5] as the most applicable to UK practice. We analysed the SOP sections 2.1 General; 2.2 Withdrawing solution from an ampoule into a syringe; and 2.7 Labelling injection and infusion containers, to see which steps would be eliminated when prefilled syringes were used instead of a self-filled syringe (online Supporting Information Table S1). These sections were selected as they covered the most frequent injectable medicine preparations used in anaesthesia. We then reviewed the eliminated steps to see if they were associated with any risks of harm (online Supporting Information Table S1). This is the first such detailed analysis of a nationally recognised SOP and it showed that of the 52 steps involved 30 (58%) would be eliminated by using a prefilled syringe and, of those steps eliminated, 22 (73%) could have caused harm if performed incorrectly.

One example of this design change improving patient safety is the removal of the possibility of incorrect syringe labelling; this error resulted in six cases of awareness reported in the 5th National Audit Project. Using prefilled syringes would eliminate this potentially harmful step and reduce such serious medication errors. This analysis provides additional evidence to reinforce the Royal Pharmaceutical Society's recommendation that the manipulation of medicines in clinical areas should be minimised [6]. We found 28 possible harmful manipulation risks associated with the steps eliminated from the SOP, and some of these appeared more than once, with injection contamination possible during six steps and needlestick injury possible during three (online Supporting Information Table S1). It has been shown that up to 6% of injections prepared in the operating theatre could be contaminated [7]. It is unlikely that any other design change could remove such a large number of potentially harmful steps anywhere else in anaesthesia practice. Beyond increasing patient safety by decreasing the possibility of medication errors, the removal of so many steps also frees up staff time to perform other important tasks. This could cut errors elsewhere by reducing cognitive load [3]. Additionally, using prefilled syringes has many other advantages such as the potential for electronic medication recognition [2] and the elimination of waste [1].

There are some limitations to this study. We only analysed three sections of one SOP, but this was detailed, drawn up, published by the National Patient Safety Agency and is nationally accepted. It is possible that other clinicians may have some variations to this SOP, thereby increasing or decreasing the number of steps, and despite injectable medicine preparation being an important area of practice that is ubiquitous with well-known safety hazards, this requires further study. A few of the steps may be considered by some to be equivocal to removal through the use of prefilled syringes although this would not be substantially different or diminish the message of this study. Indeed, the large number of steps automatically eliminated by design change to prefilled syringes is particularly notable when other significant human factor-related design changes in anaesthesia, e.g. adoption of the British Standard Medical gas probe for oxygen possibly only altered one step.

In summary, we have shown that 58% of the steps in a SOP for preparing injectable medicines can be eliminated

by using prefilled syringes. Up to 73% of these eliminated steps could have caused harm to patients and staff if performed incorrectly. This finding supports that clinicians should always use prefilled syringes wherever possible [1, 2, 8]. Not routinely using prefilled syringes should now have to be justified and acknowledged as a safety risk in organisational risk registers.

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Supporting Information

Additional supporting information may be found online via the journal website.

Table S1. Extract of steps from the NPSA 2007 Standard Operating Procedure for Preparing Injectable Medicines in Clinical Areas.