The Environmental Benefits of Using Prefilled 'Emergency' Drugs

Dr M. Clayton-Smith, Dr A. Kendall-Smith & Dr T. Clarke
Manchester University NHS Foundation Trust

Manchester University NHS Foundation Trust

Background

Prefilled drug syringes are recommended for their improved patient safety profile relating to their clear labelling, reduced dilution errors and lower infection risks [1]. They have also been cited as a potential method of reducing the carbon footprint of anaesthesia [2]. This is particularly true of 'emergency drugs', the common anaesthetic practice of drawing up 'just in case' drugs to rapidly correct unanticipated complications of anaesthesia, usually hypotension and bradycardia. These commonly include atropine, glycopyrrolate, metaraminol and ephedrine [3]. Syringes of these drugs are routinely drawn up at the beginning, and then discarded unused at the end of, each list.

Our project aimed to quantify environmental benefits of switching to prefilled emergency drug syringes that can remain unopened and returned to storage for future use, instead of being discarded daily.

Method

Audit was undertaken to identify current departmental practices for drawing up emergency drugs and the level of wastage. On three discrete weekdays, following the scheduled WHO checklist at 0830, all theatres with an anaesthetic team present in a tertiary teaching hospital were visited to establish which emergency drugs had been drawn up. At 1630 (the end of the second session) Theatres were visited again to establish which emergency drugs had been discarded or were still present unused.

At the beginning of this process a life cycle inventory was performed to calculate the theoretical Global Warming Potential (GWP) measured in carbon dioxide equivalents ($kgCO_2eq$) for the materials (Figure 1) used and their disposal by incineration. (Table 1).

Figure 1

Table 1

Life Cycle Inventory for production and disposal of individual units of emergency drugs

		Drug			
	Material	Metaraminol 20ml syringe	Ephedrine 10ml Syringe	Atropine 2ml syringe	Glycopyrrolate 2ml syringe
Production	Plastic	66.2	33.0	9.4	9.4
	Glass	1.4	1.4	1.4	1.4
	Steel*	0.7	0.7	0.7	0.7
	Paper	0.8	0.5	0.4	0.4
	Drug	Unknown	2.5**	Unknown	Unknown
Disposal	Incineration***	61.2	32.4	11.8	11.8
	Total GWP (gCO_2eq)	130.3	70.5	23.7	23.7

Values calculated the UK Government greenhouse gas conversion factors 2020 [4] except*[5] **[6], and *** [7].

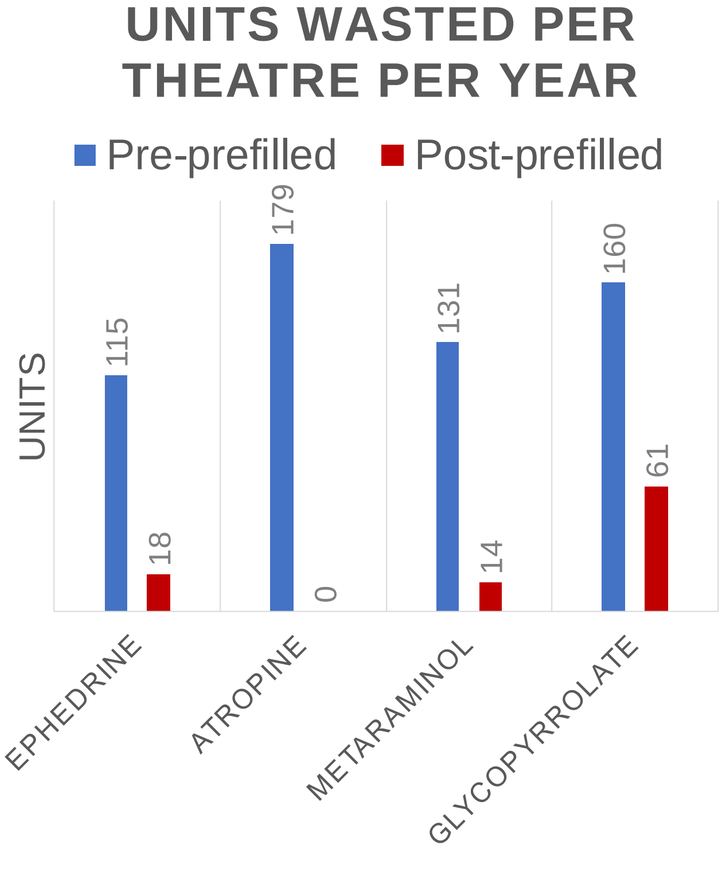
Prefilled syringes for atropine, ephedrine and metaraminol (Figure 2) were then introduced across the site, a large tertiary centre. Following this re-audit was undertaken to assess any reduction in drawing up of emergency drugs when pre-filled syringes were available. The change in GWP accounted for by change in practice was subsequently calculated based on these figures.

Figure 2

Results

Practice for drawing up emergency drugs pre and post intervention are shown in Graph 1 and Table 2.

Graph 1



Pre-intervention 100% (52/52) of theatres audited drew up emergency drugs with an average 585 syringes of emergency drugs wasted per theatre per year, generating 6.1kg of waste. This gave a GWP for production and disposal of 34.2 $kgCO_2eq$ for the wasted drugs. Following the approval and introduction of prefilled syringes there was a substantial change in practice with 63% of theatres no longer drawing up emergency drugs at all, reducing waste to 93 syringes per theatre per year, with a mass of 0.8kg and GWP of 4.7$kgCO_2eq$. This represents a GWP reduction of 86%.

Table 2

	Pre-intervention (n = 52 theatres)		Post-intervention (n = 54)	
	Theatres drawing up (%)	Wastage (%)	Theatres drawing up (%)	Wastage (%)
Metaraminol	96	54	11	50
Ephedrine	88	52	9	80
Atropine	79	89	0	0
Glycopyrrolate	73	90	26	93

Discussion

Our project showed that the introduction of pre-filled 'emergency' syringes significantly altered the practice of anaesthetists drawing up of 'emergency drugs' across a large hospital site with an 84% reduction in the number of syringes used.

Of interest, even though pre-drawn glycopyrrolate was not supplied there was a 47% reduction in the amount it was routinely drawn up. This may reflect anaesthetists feeling they do not need a second chronotrope with pre-filled atropine available.

An environmental assessment of this intervention indicates that switching to pre-filled syringes has produced a small but measurable reduction of the anaesthetic carbon footprint provided on site. There are likely to be patient safety benefits but these were felt to be unlikely to be identifiable over the timeframe of the project given the relative infrequency of drug administration errors due to emergency drugs.

Whilst the results of our project were expected we did feel there were some limitations:

1. The use of the lifecycle inventory was practical with the resources available however the lack of GWP available for 3 out of the 4 drugs was not ideal. Given that the drug itself only counted for 3% of the total GWP for the one drug (Ephedrine) we had a value for it was felt that figures obtained by our methods would give an approximate overall figure. A full life cycle analysis of the whole process would be the optimal method for this stage.
2. Data collection at 0830 was relatively straightforward owing to a unified WHO briefing time across site, the second data collection point was not as reliable owing to the varying times that drugs were discarded at the end of the day.
3. The financial costs of introducing the pre-filled syringes was considered in the process, although there was a small net cost anticipated to the trust this was considered likely to be offset by any saving in costs associated with drug errors prevented.

Our project demonstrates positive outcomes that should be easily translatable to other anaesthetic departments. When added to their significant patient safety benefits, the environmental benefits of prefilled syringes make a strong case for their use even more compelling.

References

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