Colour coding and redesign improves safety during anaesthesia

Error in the administration of drugs to patients is a well-known source of harm during healthcare. This is of particular concern during anaesthesia because many powerful drugs are used. We applied good design principles to the anaesthetist's workspace in the operating room with the aim of creating new opportunities for checking and to make this workspace less error prone. The changes we made included introducing the new international colour code standard for anaesthetic drugs to a number of aspects of the workspace, including larger drug labels. This colour code standard assigns a particular colour to each pharmacological class of drug – for example opioids are blue, muscle relaxants are red, and so forth. This is a significant step forward from the situation of a few years ago when different colour sets were in use in the same country and even within the same hospital – clearly an accident waiting to happen. We provided the new labels on procedure-specific sheets, where each sheet contained all the labels typically required during an anaesthetic of that type. Anaesthetists were instructed to use a new label sheet for each anaesthetic – thus the state of the label sheet acted as an additional check of the drugs that had been prepared during the anaesthetic (Fig. 1).

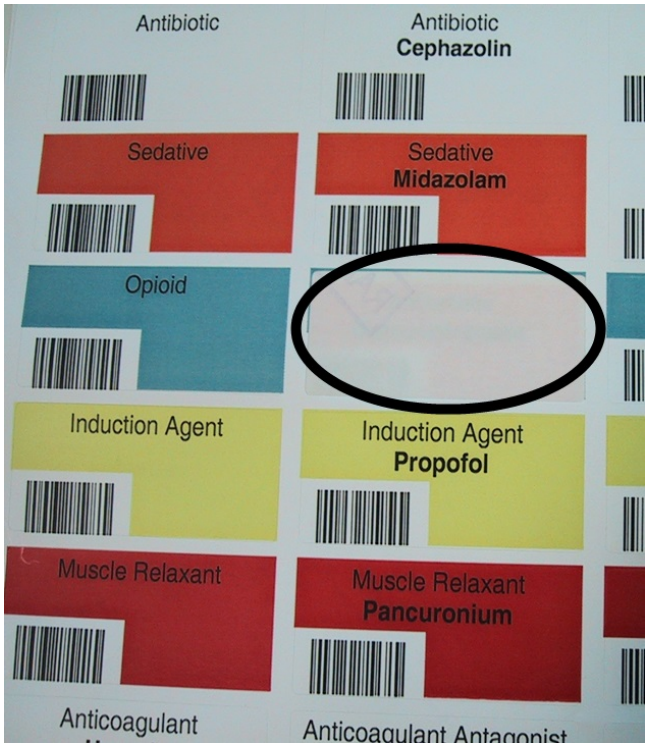

Fig. 1. Part of a label sheet from the new system showing that a label from the blue row has been removed, thus indicating that an opioid has been prepared, in this case Fentanyl.

The drug colour code was also applied to a number of other aspects of the anaesthetist's workspace, including the compartments inside the drug trolley drawers where drugs were stored, and the labels of commonly used drugs that were provided in pre-filled syringes. We also incorporated barcodes into all labels, enabling the identity of the drug to be checked by scanning it, before the drug was administered to the patient – scanning a drug led to a voice announcement of the drug name and the appearance of the drug name in large letters on a computer screen, along with the drug colour code. Finally, we also introduced new drug trays, containing three distinct zones – one zone for drugs currently in use, one for drugs which are intended to be given at a later stage (thus acting as a reminder), and one for empty containers of drugs which have been given. Thus the new drug tray acted as an additional physical record of the progress of the anaesthetic. During our clinical study of these safety initiatives we collected incident reports from cases of patients cared for using conventional methods of anaesthesia and with the new system. We included 74,478 patient cases in our study (Webster CS et al., 2010). Incident reports indicated that using the new system significantly reduced the rate of drug administration error by 35% – from 268 errors in 550,105 drug administrations with conventional methods to 58 errors in 183,852 drug administrations with the new system ($p = 0.002$). One of the most common forms of drug error during anaesthesia is a drug swap error, where a wrong drug is accidentally swapped with another and given to the patient – this is particularly dangerous when the wrong drug is from a different pharmacological class than the one intended. It was therefore pleasing to find that drug swap errors between differently colour-coded pharmacological classes were reduced by 66% with the use of the new system – and to my knowledge, this represents the first evidence of the value of the international colour code standard for improving safety during anaesthesia. We subsequently confirmed these safety advantages in an observation study in the operating room which showed a 21% reduction in drug administration and recording errors with the new system (Merry AF et al., 2011). We conclude that systematic redesign of healthcare systems can improve patient safety.

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