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Emergency suction equipment: barriers to use and effective interventions

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Abstract

Both investigators had personally experienced situations when they were let down by emergency suctioning equipment on the wards: due to either lack of, or operator inability to use, equipment. Failings in emergency suction have been highlighted in a recent National Patient Safety Agency signal.

We focused on improving the usability of cardiac arrest trolley suction: a complex process involving turning a small, hidden lever. We produced three clearly visible bright labels which provided simple prompts to the operator.

Two wards and two sampling periods were used in a randomised controlled design. Medical, nursing and allied healthcare staff participated. A scenario of a vomiting patient was given and staff were asked to use emergency suction. This was timed.

On the control ward, 5/10 staff members were able to successfully suction on day 1 and the mean time spent trying to activate suction was 43 seconds. On the second sampling day 6 were able to successfully suction and the mean time taken was 50 seconds. On the intervention ward, 7/10 staff members were able to suction with a mean time of 53 seconds spent. Post-intervention, all 10 staff members successfully suctioned with an average time of 30 seconds. The intervention gathered strongly positive feedback. These interventions are being incorporated into sustainable systems changes.

Poor equipment design is a needless distraction during an emergency in a busy ward setting. Simple, innovative solutions provide assistance in a pressured situation. Ideally these would become uniform and lead to a culture shift towards simple, intuitive design.

Problem

Emergency suction is a fundamental item of equipment which should be readily available for use to all healthcare professionals in the hospital setting. Use of emergency suction can be vital in an emergency, for example when dealing with vomit or secretions. It is natural to assume that emergency suction would be maintained in a state of readiness and that the equipment would be, by its nature, intuitive to use. Both of the investigators however had had personal experiences where they were let down by the inability of ward staff to effectively use emergency suction, either due to deficiencies in equipment readiness or operator inability.

Background

In 2011 the National Patient Safety Agency(NPSA) released a signal highlighting 104 serious incidents between 2005-2009 involving emergency airway suctioning systems. Common causes included incompletely or incorrectly set up equipment.

In most hospital ward environments, there are two types of airway suctioning devices: wall-mounted suction and emergency suctioning equipment usually located on the cardiac arrest trolley. It was our observation that the vast majority of wall-mounted suction units were not kept in a state of readiness. The protocol for preparing the bed space required nursing staff to replace suction and oxygen fittings "if necessary" only; and what qualified as "necessary" was not stated. Equally, operating the cardiac arrest trolley emergency suction involved several different complex steps, which were not inherently obvious to the operator.

Baseline Measurement

Initially, the investigators wished to quantify the readiness of wall-mounted suction. Adjacent to the patient's bed space, this would naturally be the first port of call in an emergency requiring suctioning equipment. Across all of our department's base wards, only 14% (n=8) of wall mounted suction units (total of 131) were ready for use, with 70% having some but not all parts present, 10% having none of the required parts and 6% having all parts but unconnected.

The investigators then wished to measure the ability of ward staff to use emergency crash trolley suction units. Two wards were visited. On each ward, ten staff members were asked to participate in a quick test. Staff members included a full range of allied healthcare professionals including healthcare assistants, staff nurses, ward sisters, physiotherapists and doctors of all grades.

The scenario given was that of a patient who is vomiting and choking. The staff member is asked to operate the crash trolley suction unit. We then timed how long it took each staff member to correctly activate the suction unit (a complex process involving

multiple non-intuitive steps). On the two wards, 4/10 and 5/10 respectively were unable to use the suction unit at all. Average time to activation was 47.8 seconds. Comments recorded included feeling unfamiliar and unprepared with such equipment, frustration and occasionally panic at using it in a time-pressured situation.

See supplementary file: baseline.pptx

Design

When measuring crash trolley suction use it became clear that users were finding it difficult to perform the various tasks necessary to correctly operate the suction unit. These steps included opening a valve on the oxygen cylinder before turning a circular suction knob. The oxygen cylinder valve is opened by a lever which is not easily seen from the position of the operator.

We designed three clear bright yellow stickers using a cheap handheld label printer. One sticker was placed on top of the suction unit pressure gauge and read "Turn O2 lever on". The second sticker was placed on both sides of the oxygen cylinder lever and read "Turn", with an arrow to indication the direction the lever should be turned. The third sticker was attached to the circular suction knob and simply read "Suction".

This intervention was discussed with the hospital equipment pool who maintained the oxygen cylinders. They felt that if it reduced error and improved usability that they could be placed on the oxygen cylinders or suction units as they circulated through their departments for maintenance. Within a short space of time all equipment in circulation would be labelled and new items would be labelled within a short space of time. This would be sustainable as the labels should last for a long time and the labelling process would be incorporated as part of existing equipment maintenance processes. Its cost in terms of both time and resources necessary is minimal. It may even save time in unnecessary equipment pool calls following incidents of incorrect usage.

Strategy

PDSA Cycle 1: Following baseline testing on two wards, we trialled the intervention on one ward, using ten staff members (with the other ward kept as a control ward). The intervention stickers led to a significant improvement in both the proportion of staff able to use the emergency suction unit (all able to use compared to only 6/10 on control ward) as well improving efficiency of use (mean time to operate 29.9 seconds compared with 50.3 on control ward).

See supplementary file: PDSA Cycles_suction.doc

Post-Measurement

Our study design was randomised and controlled: we randomly selected two wards with a similar patient mix and randomly allocated one as control and one as intervention. We had two testing periods - pre- and post-intervention. This study design was chosen to attempt to eliminate the effect of innate differences between the wards as well as account for the effect of practise from one testing period to the next. We could look at the difference between testing periods on both wards to gauge the true effect of the intervention.

10 staff members were tested on each ward. They were given the scenario of a choking patient and asked to operate the crash trolley suctioning equipment.

In the pre-intervention testing, 7/3 and 5/5 of staff members on the intervention and control wards, respectively, were able to use the suction unit. They took a mean 53.1 and 42.5 seconds to do this. Doctors and allied healthcare professionals were the slowest, taking an average of 59 and 60 seconds, respectively. Nurses however took an average of 32 seconds to operate the suction, potentially due to the responsibility for nurses working night shifts to check the equipment in the early hours of the morning.

Feedback recorded included the following comments:
'Nothing's happening! Why has it run out?'
'Where is it? Where is it?'
'I've panicked at a crash using one of these before!'
'Hopefully someone who knows would be around!'

Post intervention, all of the staff members in the intervention group were able to use the suction unit, and 7/10 of those in the control ward. Mean time taken to use the unit was 29.9 and 50.3 seconds, respectively. There was an improvement across all types of healthcare professional with nursing staff improving the most and medical staff improving the least following the intervention.

Comments on the intervention ward included:
'Never used this before.'
'OK, turn lever...which lever? Oh, that lever! It works!'
'Much easier!'
'Really good, clear labels - I've never used it before as only work days!'
'I would absolutely welcome this on my ward permanently.'
'I've never used it before. Has it gone dead? Oh, what's this?'
'I felt the stickers make it really obvious.'

See supplementary file: results.pptx

Lessons and Limitations

It is difficult to change any system which has been longstanding and affects many clinical areas and members of staff. We did not want to alienate staff by making them feel that by pointing out deficiencies we were criticising them, their staff or wards. We strove to create a culture during the project of "all of us working together to improve systems". When testing with staff who were unable to use suction equipment, the risk was that they they might become frustrated or embarrassed. We emphasised to them that they were this was not the fault of individuals but a problem with a system and with unintuitive equipment. We reassured them that we had not fared any better. We knew there was a problem and that was what we were trying to remedy. By being a part of our project, they were now a part of finding a solution.

One obvious limitation of this project so far is its small scale - two wards of ten staff members tested on two occasions. The small numbers made the usefulness of statistical tests of significance dubious. It serves the purpose of a pilot study and provides useful indicators. Large scale testing would be ideal and will be a long-term aspiration.

This quality improvement project is only useful if it is sustainable. No matter what we found or how many people we disseminated our findings to, once we leave our organisation the ideas may be long forgotten. Our energies will now be directed into incorporating our intervention into standard practice and, if this shows a benefit, keeping it there. It will hopefully provide a model which can be emulated elsewhere.

Conclusion

This project came about due to the personal frustrations of two foundation trainees attempting to use emergency suctioning equipment in desperate situations. What seemed initially to be isolated problems, we quickly learnt reflected problems which affected many more people.

Our problems accessing wall-mounted suction was not just "bad luck" - a vast lack of wall mounted suction afflicted our building - we measured it, proved it, and now senior staff in our trust have taken notice and are taking steps to improve this. Reasons for this lack included the wording of bed space preparation forms - solved by removing the latter two words from "prepare emergency suction if necessary". Similarly, suction units were not fitted as it led to cleaning audits being failed (suction units gathered dust). This has been addressed and priorities adjusted.

Our personal experiences with being unable to use emergency crash trolley suction were not our fault. As with so many incidents, the problem was not with the individual but with the equipment, with the system. We felt strongly that the equipment was difficult to use and we feel, proved that in our tests - an average of 47.8 seconds taken to operate emergency suction across both wards seems far from ideal, with many staff unable to operate it at all.

We felt that use of this vital piece of equipment should and must be simpler. We felt that even as junior doctors, we could do a better job. So found out what users were supposed to do and we designed three simple bright stickers which spelt it out, and were near-impossible to miss. We thought this would make the equipment easier to use and we tested it under pressure. We showed that it enabled everyone to be able to use the suction. We showed that is also significantly decreased the amount of time it took them to do so. We are now incorporating this labelling into the routine maintenance of the equipment.

There is nothing elaborate about our project. It is simply the product of personal frustration, and an inner hunch that things could be done better; things could be simpler. We found that what seemed an individual frustration was one shared across the full range of healthcare professionals regardless of role or experience. We found that a simple intervention made a positive difference and we hope that by rolling it out across the hospital as a sustainable standard, it will have a lasting beneficial effect on patient safety.

References

1. National Patient Safety Agency (NPSA): Airway suction equipment patient safety signal. 2011. Available online at: http://www.nrls.npsa.nhs.uk/resources/?entryid45=94845