

# Preventing Wrong Gas Delivery to Patients

**PETER MASON, JOANNE YOUNG & DI TAYLOR**



Division of Clinical Governance, Flinders Medical Centre, South Australia

Key issue: Air / Oxygen delivery & adverse events

## Background

Incidents involving the inadvertent administration of the wrong gas to patients are a world wide problem and can lead to severe adverse patient outcomes. Over the last 12 months, Flinders Medical Centre (FMC) observed an increased number of incidents reported via AIMS<sup>1</sup> (Australian Incident Management System) and an increased MET (Medical Emergency Team) call rate relating to the issue. A Patient Safety Advisory<sup>2</sup> published by the South Australian Department of Health also indicated this type of incident was being reported at greater levels than before.

## Investigation

An 'expert' panel was created involving medical, nursing, biomedical engineering and safety & quality staff to investigate the "root causes" of the problem. The panel reviewed each reported incident, undertook a literature review<sup>2,3,4</sup>; interviewed staff and the clinical units were visited and audited for medical gas set up (photo 1, 2 & 3).

**Before Photos - identifies visual barriers that can create error**



## Results of Investigation

- The most common error was: Reconnection to air rather than oxygen occurs most frequently when a patient returned from a procedure or was transferring from another clinical unit
- 30% of the clinical units had at least one incorrect air /oxygen set up (Incorrect colour flow nipples; white = oxygen, black = air supply was the most common error).
- Three different brands of flow meters were in use (no standardisation)
- Black air 'nipples' were not readily available from the Supply Department and so staff were forced to use white (oxygen) nipples on air supply connections
- Other contributing factors included: poor lighting, similar medical equipment within the immediate area & bed curtains obscuring the gas panel

## Discussion & Recommendations

The panel reviewed various improvement strategies based on their ability to:

1. Error proof (eliminate potential for human error absolutely) or error reduce (prevent errors being made by providing attention activators / barriers)
2. Identify potential risks and barriers to implementation
3. Cost / risk factor determination

Strategies considered and recommended by the working party:

Type of Recommendation	Recommendation	Risks/Barriers	Costs
Error Proof	Introduce a system, whereby the delivery of oxygen and medical air from the gas outlet panel to the patient is different and not interchangeable (similar to systems used by ventilators and anaesthetic machines).	Viewed as the best solution but system is currently not available in Australia	N/A
Error Reduce	Biomedical designed device (see photos 4 - 6) that alters the connection process of medical air flow meters to incorporate visual/physical barriers: <ul style="list-style-type: none"> <li>Air outlet fitted with device, oxygen unchanged;</li> <li>Label and front panel always positioned at front of flow meter;</li> <li>Clearly labelled;</li> <li>Looks obviously different to oxygen outlet;</li> <li>Requires different process to attach tubing.</li> </ul> Other advantages: <ul style="list-style-type: none"> <li>Fits all medical air flow meters in use;</li> <li>Easy to clean, no infection risk.</li> </ul>	Patients can still be connected to medical air although the risk of this should significantly decrease  AIMS will be monitored for further incidents to evaluate effectiveness	Injection mould required to set up, costs will decrease the greater nos. produced  Cost per bed - approx \$27  Biomedical will install devices; cost will be absorbed by each unit

Strategies considered but rejected by the working party:

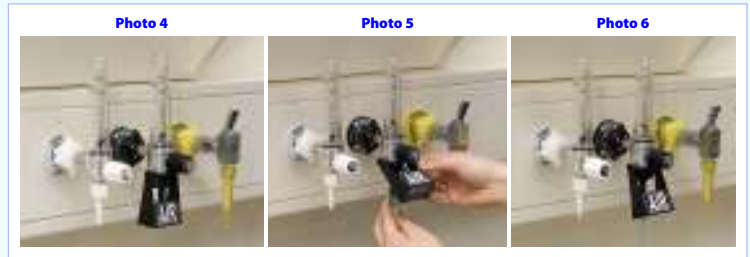
Type	Strategy	Risks/Barriers	Costs
Error Proof	Remove all air flow meters. Deliver all nebulised medication via oxygen	Not recommended by 2 Respiratory Consultants. Evidence suggests 40% of patients with COPD are CO <sub>2</sub> retainers. Delivery of high-flow oxygen to these patients will cause hypercapnia and potentially lead to serious adverse events.	Nil
Error Proof	Remove all air flow meters. Deliver nebulised medication via air driven electric pumps	Potential decreased staff morale as: <ul style="list-style-type: none"> <li>sharing pumps between patients</li> <li>need to locate pump</li> <li>need to clean pump between patients to reduce spread of infection</li> <li>medications due at same time - need to wait till pump finished cycle</li> <li>possible shortage of power outlets at the bedside due to only two power outlets per bed</li> </ul> Patient complaints as medication maybe delayed	Approx - \$31,000 (Pumps are \$300 each, 4 per ward, 26 wards in hospital) Approx cost per bed = \$68  Additional costs for maintenance. Additional cost for nursing time to locate pumps
Error Reduce	Educate staff to remove air flow meters when not in use	Not all air flow meters will be removed (staff need to remember/ staff are busy/more convenient to leave in place) Event could recur	Nil

Recommendation approved

Develop a device to alter the connection process to medical air flow that creates strong visual / physical barrier was selected as the most viable alternative.

- A black moulded plastic (clearly labelled AIR) device has been developed to fit over the black air nipple
- All air outlets have been fitted with the device and a hospital wide education campaign was undertaken
- A Patient Safety Alert was developed and promoted to medical & nursing staff

The "Air Guard" in use



The Air Guard system was implemented in July 2007 & is awaiting evaluation.

## Evaluation Strategies

- AIMS will be monitored for further incidents to evaluate the effectiveness of the new system
- A staff satisfaction questionnaire will be undertaken 6 months after implementation of the new system

## Lessons Learnt

- Check air/O<sub>2</sub> meters - there may be an incident waiting to happen or some you don't know about
- Incident monitoring and incident review is integral to diagnosing problems (aggregate your data)
- Sometimes there is a 'widget' that can solve the problem (we think)
- Put your thinkers to work - they can come up with great things locked in a room!
- Act quickly to prevent more errors

For further information about the "Air Guard" contact:

Joanna Young - Patient Safety Coordinator, Flinders Medical Centre  
Or Glenn Kennett - Biomedical Specialist, Flinders Medical Centre

joanna.young@fmc.sa.gov.au  
glenn.kennett@fmc.sa.gov.au

Acknowledgements

Glenn Kennett, Julie Buckmann, Patricia Rose, Jackie Chaunut, Roy Standen, Penny Markham, Mark Whittington, Peter Frith, Jeff Bowden & all clinicians who reported the incidents via AIMS

References

1. Advanced Incident Management System
2. Patient Safety Advisory: Veterans Health Administration, USA, 2002
3. Agency for Healthcare Research and Quality, 2004
4. South Australian Department of Health Advisory, 2006
5. Plant, PK et al. One year prevalence study of respiratory acidosis in acute exacerbation of COPD: implications for the provision of non-invasive ventilation and oxygen administration. Thorax 2000; 55: 550-54