Institution: University of Surrey

Unit of Assessment: UOA 3 Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study:

Saving lives through the altered use of routine oxygen therapy in acute myocardial infarction

1. Summary of the impact (indicative maximum 100 words)

Approximately 150,000 individuals suffer a myocardial infarction in the UK every year, and world-wide this figure approaches 8 million people every year. The care received by an individual during the acute phase of a myocardial infarction is an important determinant of patient survival. Oxygen therapy has been a mainstay of this acute phase treatment for almost a century.

Research conducted at Surrey highlighted important uncertainties and inadequacies about the safety of oxygen therapy, leading to a follow-up large randomised trial to further investigate this issue, as well as influencing national and international guidelines for emergency cardiac care.

2. Underpinning research (indicative maximum 500 words)

Coronary heart disease is a major cause of morbidity and mortality in the world. In the U K alone, 150,000 individuals suffer a myocardial infarction every year, with an estimated cost to the UK economy of £960M for the immediate care alone.

For many decades, there has been an emphasis on the use of oxygen during the treatment of acute myocardial infarction, with a hypothesised benefit of improving oxygenation of ischaemic myocardial tissue, leading to improved patient outcome.

A cross-institutional research team (including researchers from Surrey) first examined the practice and beliefs of ambulance, emergency department and cardiology staff through a cross-sectional survey (**1**). They demonstrated that in the UK >98% of respondents always or usually used oxygen during the treatment of acute myocardial infarction, with 80% having local guidelines that recommended its use. Importantly three-quarters of ambulance and emergency department respondents believed that oxygen treatment 'definitely or probably' reduced the risk of death, this figure was less than half for cardiology staff. As such, this was the first demonstration that there was a disconnect between the guideline recommendations on oxygen use, and the perception of patient benefit (**1**). In addition, less than 1% of respondents, from all classes, thought that oxygen use during acute phase treatment produced an increased risk of death.

This area of uncertainty was further explored through a systematic review and meta-analysis undertaken for the Cochrane Collaboration by the research team. Examination of randomised - controlled trials encompassing 387 patients who suffered a myocardial infarction, demonstrated that not only was there no significant benefit associated with oxygen use, but its use was associated with a three-fold increase in the relative risk of death when compared to the use of air alone (**2**). This report, plus the follow-up publication (**3**) highlighted important uncertainties regarding routine use of oxygen in early treatment of patients with a heart attack.

3. References to the research (indicative maximum of six references)

1. Burls, A., Emparanza, J., **Quinn, T.** and Cabello, J. Oxygen use in acute myocardial infarction – an online survey of health professionals' practice and beliefs. Emergency Medicine Journal (2010) **27:** 283-286 DOI: 10.1136/emj.2009.077370

2. Cabello, J.B., Burls, A., Emparanza, J.I., Bayliss, S. and Quinn, T. Oxygen therapy for acute

myocardial infarction. Cochrane Database Syst Rev (2010) **6:** CD007160 DOI: 10.1002/14651858.CD007160

3. Burls, A., Cabello, J., Emparanza, J., Bayliss, S. and Quinn, T. Oxygen therapy for acute myocardial infarction – a systematic review and meta-analysis Emergency Medicine Journal (2011) **28:** 917-923 DOI:10.1136/emj.2010.103564

4. Details of the impact (indicative maximum 750 words)

Prior to the work detailed here, a mainstay of acute phase treatment for myocardial infarction was the use of oxygen, and this was reflected in national and international guidelines. However, despite its widespread use there was a clear disconnect in its perceived benefit between acute phase responders (>98% perceived patient benefit) and cardiologists (48%). A systematic review and meta-analysis of randomised controlled trials suggested that oxygen might even be associated with worse patient outcome, with a three-fold increase in relative risk of mortality compared to the use of air alone, raising further concerns about patient safety.

The research has challenged existing practice at both national and international level, and has led to policy impact at regional, national and international level. This is evidenced by revisions to the guidelines issued by the European Society of Cardiology (**Ref 1**), the American College of Cardiology (**Ref 2**) and in Australia and New Zealand (**Ref 3**) on the emergency cardiovascular care for patients following myocardial infarction. In addition, such was the importance of this work that the Scottish Intercollegiate Guidelines Network (SIGN) amended their current acute coronary syndromes 'mid-term' to incorporate the findings of the Cochrane Review on the day it was published (**Ref 4**).

The policy impact will lead to both health and wellbeing, and economic benefits. In the UK, the fatality rate from acute myocardial infarction is approximately 16% (**Ref 5**). Given the three-fold decrease in relative risk of death associated with the use of air in acute care compared to oxygen, this equates to a reduction of 16,000 deaths in the UK per annum, or 850,000 worldwide. The worldwide cost of hospitalisation from acute myocardial infarction is in the range US $1500-$9000, and any reduction in adverse effects due to improved patient care will clearly result in a significant economic impact (**Ref 6**).

In addition to the impact on public policy and its resultant impact on health and wellbeing, this work has had a significant impact on both society and practitioners. As highlighted in the underlying research, there existed significant uncertainty within secondary care practitioners of the perceived benefit of oxygen therapy, and a deeper lack of awareness in patients themselves. A dissemination/public engagement process has followed from these findings, enhancing awareness of the issues surrounding oxygen treatment following myocardial infarction. These include significant international media attention (New York, New Zealand, Australia, Scandinavia etc.; **Ref 7**), plus inclusion in the second edition of the popular science book 'Testing Treatments' (**Ref 8**).

In summary, every year millions of individuals suffer a myocardial infarction world-wide. It is well recognized that the acute phase treatment that patients receive has a major impact on their outcome, and oxygen had been routinely used in such treatment for decades. The research team of Quinn et al., highlighted major concerns with the use of oxygen in this acute phase, and provided evidence suggesting that it may even be detrimental to health outcomes. In response to this work, national and international guidelines have been altered to remove the recommendation for oxygen use except in very specific circumstances, and has led directly to the initiation of at least one international, large follow-up randomised trial (**Ref 9**). As such, this work will lead to the improved treatment of millions of myocardial infarction sufferers every year.

5. Sources to corroborate the impact (indicative maximum of 10 references)

Ref 1. European Resuscitation Council Guidelines
Nolan JP. et al., (2010) *European Resuscitation Council Guidelines for Resuscitation 2010 Section 1. Executive summary*. Resuscitation 81: 1219-1276.
DOI: 10.1016/j.resuscitation.2010.08.021

Ref 2. American College of Cardiology/American Heart Association Guidelines
O'Gara PT., et al (2013) *ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines.* J Am Coll Cardiol. 2013 Jan 29;61(4):e78-e140. DOI: 10.1016/j.jacc.2012.11.019.

Ref 3. Australia and New Zealand Guideline Addendum
Chew, DP. et al., (2011). *Addendum to the National Heart Foundation of Australia/Cardiac Society of Australia and New Zealand Guidelines for the management of acute coronary syndromes (ACS) 2006*. Heart Lung Circ. 2011 Aug;20(8):487-502.
DOI: 10.1016/j.hlc.2011.03.008
Kelly, A-M. What is new for emergency physicians in the Heart Foundation's 2011 Addendum to its Guidelines for the management of acute coronary syndromes? Emergency Medicine Australasia (2011) **23:** 517-520. DOI: 10.1111/j.1742-6723.2011.01482.x

Ref 4. Scottish Intercollegiate Guidelines Network (SIGN)
National Clinical Guidance 93: Acute Coronary Syndromes (2013)
http://www.sign.ac.uk/pdf/sign93.pdf

Ref 5. Medical Emergency Fatality Rates
Mason A, Seagroatt V, Meddings D, Goldacre M. (2005) *Screening indicators for medical emergencies. Report 1: Case Fatality Rates.* Oxford: National Centre for Health Outcomes Development at the University of Oxford,
www.uhce.ox.ac.uk/hessepho/reports/CR12.pdf

Ref 6. Cost of Hospitalisation due to Myocardial Infaction
Kauf, et al. (2006) *The cost of acute myocardial infarction in the new millennium: evidence from a multinational registry. American Heart Journal* 151: 206-12
DOI: 10.1016/j.ahj.2005.02.028

Ref 7. International Media Impact:
http://www.sciencedaily.com/releases/2010/06/100615191651.htm (2010)
http://www.patientsafetysolutions.com/docs/July_2010_Cochrane_Review_Oxygen_in_MI.htm (2010)
http://www.nzherald.co.nz/health/news/article.cfm?c_id=204&objectid=10652186 (2010)
Forskning & Framsteg volume 8, December 2010 pages 16-19

Ref 8. Evans, I., et al., (2011) Testing Treatments – Better Research for Better Healthcare 2nd Ed. (Chapter 5) ISBN 978-1-905177-48-6 http://www.testingtreatments.org/the-book/

Ref 9. Clinical Trials Registry (2013)
http://www.clinicaltrials.gov/ct2/show/NCT01787110?term=%22oxygen%22+AND+%22AMI%22&rank=1