

Institution: University of Plymouth		
Unit of Assessment: UoA4		
Title of case study: Changing understanding and practice in anaesthesia		
Period when the underpinning research was undertaken: 2008-2014		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Professor Jackie Andrade	Role(s) (e.g. job title): Professor of Psychology	Period(s) employed by submitting HEI: 2007- present
Period when the claimed impact occurred: 2014 – 01.11.20		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact (indicative maximum 100 words) Andrade led the psychological component of a major international research project on accidental awareness during general anaesthesia (AAGA). This research investigated the incidence, causes and consequences of AAGA. Its findings identified practices that reduce long-term harm. They led to changes in how AAGA is described to patients, a new national protocol for reducing psychological trauma after surgery, changes to the UK medical curriculum and exams, and new medical guidelines designed to prevent AAGA. This impact is significant for patients because, as NAP5 results showed, these recommended practices can mitigate the potentially serious psychological consequences of AAGA.		
2. Underpinning research (indicative maximum 500 words) AAGA is poorly understood because it is rare – too rare to be studied within a single hospital or trust. It is the second most common concern of patients pre-operatively and third most common cause of litigation against UK anaesthetists, accounting for 20% of all claims. Its consequences can be life-changing for patients. The Fifth National Audit Project (NAP5), the world's largest study of AAGA, was established in 2011 to address these concerns: to improve patient information and consent, to develop strategies for prevention and management, and to better understand causes and consequences of AAGA. NAP5 was run by a panel comprising consultant anaesthetists, medicolegal experts, a patient representative, a risk manager, and two psychologists. Andrade was invited as a psychologist because of her research on memory and awareness in anaesthesia spanning 20 years, including a key paper on AAGA in children [3.5]. As a panel member, Andrade contributed to the study design, data collection, reporting protocols, analysis and classification of each reported case of AAGA, recommendations for practice, and dissemination of findings. As one of the few academics, she was strongly involved in data interpretation and drafting of publications [3.1-3.4] across the whole project. Her psychological input was particularly critical in classifying the cases on AAGA experience, distress during AAGA, human factors contributions, and psychological sequelae. Andrade led the analysis and reporting of psychological components, and authorship of the NAP5 report chapter on patient experiences [3.1a], which formed the basis of publication 3.2 (first-authored by NAP coordinator, as convention). Andrade co-authored chapters on paediatric awareness [3.1b] and consent [3.1c] and contributed to the protocol and results papers [3.3, 3.4]. Key results [with supporting references] were: A. Half of patients who experienced AAGA suffered long-term psychological sequelae, including symptoms of post-traumatic stress disorder [3.1a,3.2].		

- B. Experiencing paralysis during AAGA was associated with greater immediate distress and long-term harm [3.1a,3.2].
- C. Good communication during or after AAGA protected patients from long-term harm [3.1a,3.2].
- D. Patients often did not report AAGA until they needed a subsequent operation. Delayed reports were associated with similar harm to immediate reports [3.1a,3.2].
- E. Incidence of spontaneously reported AAGA (1:19000) was much lower than the incidence estimated from studies that probed AAGA recall, suggesting barriers to reporting. There were no fabricated reports [3.4].
- F. 22% of AAGA reports came from cases where the patient, correctly, received sedation rather than general anaesthesia but miscommunication meant that they thought that they would be unconscious and therefore reported AAGA [3.1a, 3.2].
- G. Key human and organisational failures were (a) injecting the wrong drug and (b) failing to monitor anaesthetic delivery during transfer to theatre, particularly after prolonged airway intubation [3.2, 3.4].
- H. AAGA risk was increased by: Caesarean section, total intravenous anaesthetic (TIVA) techniques, patient obesity, and – massively – the use of neuromuscular blockers [3.4].

These results show that AAGA is serious [A] and under-reported [E]; communication is critical from consent through to after-care [B-F]; better awareness of procedural risks could reduce AAGA [G]; using neuromuscular blockers to paralyse patients for surgery is a major risk factor for AAGA and subsequent psychological harm [B, H].

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

The NAP5 report and associated papers were published simultaneously. The report won the British Medical Association's 2015 anaesthesia book of the year award. BMA's reviewer wrote: "It definitely will improve care for patients worldwide". Panel members were awarded the Humphry Davy medal by the Royal College of Anaesthetists (RCoA) for their contribution to anaesthesia.

The research papers were published in both Anaesthesia and the British Journal of Anaesthesia, to reflect the joint stewardship of the research by the RCoA and Association of Anaesthetists. They have been highly cited.

- 3.1 Pandit JJ, Cook TM, the NAP5 Steering Panel (2014). *NAP5. Accidental Awareness During General Anaesthesia*. London: The Royal College of Anaesthetists and Association of Anaesthetists of Great Britain and Ireland. ISBN 978-1-900936-11-8 including the following chapters. <https://www.nationalauditprojects.org.uk/NAP5report>
 - 3.1a. Andrade J, Wang M, Pandit JJ. Patient experiences and psychological consequences of AAGA (ch.7).
 - 3.1b. Sury MRJ, Andrade J. AAGA in children (ch.15).
 - 3.1c. Pandit JJ, Hitchman J, Bogod DG, Andrade J, Hainsworth J, Plaat F, Torevell H, Wang M. Consent in the context of AAGA (ch.21).
- 3.2 Cook, T. M., Andrade, J., Bogod, D. G., Hitchman, J. M., Jonker, W. R., Lucas, N., ... & Paul, R. G. (2014). 5th National Audit Project (NAP5) on accidental awareness during general anaesthesia: patient experiences, human factors, sedation, consent, and medicolegal issues. *British Journal of Anaesthesia*, 113(4), 560-574 and *Anaesthesia*, 69(10), 1102-1116. 81 citations. <https://doi.org/10.1093/bja/aeu314>
- 3.3 Pandit, J. J., Andrade, J., Bogod, D. G., Hitchman, J. M., Jonker, W. R., Lucas, N., ... & Paul, R. G. (2014). 5th National Audit Project (NAP5) on accidental awareness during general anaesthesia: protocol, methods, and analysis of data. *British Journal of Anaesthesia*, 113(4), 540-548 and *Anaesthesia*, 69(10), 1078-1088. 54 citations. <https://doi.org/10.1093/bja/aeu312>
- 3.4 Pandit, J. J., Andrade, J., Bogod, D. G., Hitchman, J. M., Jonker, W. R., Lucas, N., ... & Paul, R. G. (2014). 5th National Audit Project (NAP5) on accidental awareness during

general anaesthesia: summary of main findings and risk factors. *British Journal of Anaesthesia*, 113(4), 549-559 and *Anaesthesia*, 10(69), 1089-1101. 279 citations. Altmetrics 36 and 112. <https://doi.org/10.1093/bja/aeu313>

3.5 Andrade, J., Deeprose, C. & Barker, I. (2008). Awareness and memory priming in paediatric surgery with general anaesthesia, *British Journal of Anaesthesia*, 100(3), 389-396. DOI 10.1093/bja/aem378 (reprinted in BJA South African Excerpts Edition, 8(3), 163-170). 42 citations <https://doi.org/10.1093/bja/aem378>

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

Pathway to impact: The NAP5 report [3.1] included recommendations for clinical practice, such as better monitoring of neuromuscular blockade [from finding H], and two specific instruments: the ABCDE handover checklist [3.4] to reduce anaesthetic errors during transfer to theatre [G] and the awareness support pathway [3.2] to guide anaesthetists' management of AAGA cases [based on findings B-E]. To maximise reach, Andrade and others presented the findings and recommendations in September 2014 at the Royal College of Medicine and Association of Anaesthetists.

Impact 1: Improving professionals' understanding of AAGA

Finding [A] that AAGA leads to long-term psychological harm has made anaesthetists more aware of AAGA as a serious complication [evidence 5.1]. A consultant anaesthetist testified to the impact of findings B and H: *"We now always make sure that neuromuscular blockade is reversed at the end of the operation. I am much more aware, because of NAP5, of the possibility that emergence [from anaesthesia] with residual paralysis could be perceived by the patient as awareness during surgery. I know my colleagues are too."* [5.2]

To ensure that anaesthetists understand the implications of AAGA and its prevention, RCoA introduced NAP5 findings and recommendations into its Fellowship examination curriculum in 2015. Approximately 900 candidates take the examination each year. Exam preparation textbooks have been updated accordingly [5.3].

Impact 2: Improving information for patients

RCoA updated their patient information leaflet "Accidental Awareness during General Anaesthesia" in 2017 [5.4], to incorporate findings on incidence [E], risk [G,H], subsequent operations [D] and awareness support [A,C]. An RCoA survey the same year found that the leaflet was already being used by a quarter of preassessment anaesthetic leads [5.4]. RCoA also updated its main leaflet, "You and Your Anaesthetic", in 2015 to incorporate finding E on incidence of AAGA [5.4]. Regional NHS trusts subsequently updated their own versions of the RCoA leaflet [5.4]. Finding F led to RCoA issuing a new patient leaflet, Sedation Explained, in 2018 to explain the differences between sedation and anaesthesia, including their impacts on memory [5.4].

Impact 3: Helping anaesthetists deliver safer anaesthesia.

The Association of Anaesthetists published a new 5.5]. It recommended using the ABCDE handover checklist [reference 3.4] and monitoring neuromuscular blockade to ensure paralysis has worn off at the end of surgery as 'patients interpret unintended paralysis in extremely distressing ways' [findings B,H]. A consultant anaesthetist at Royal United Hospitals Bath testified that the checklist is embedded in practice: *"ABCDE check is used by every anaesthetist in all hospitals in Bath for every case"* [5.6]. Although direct impacts on AAGA can only be tested in another very large study, there are signs that practice has improved. Since NAP5, monitoring of neuromuscular blockade in obstetric anaesthesia has increased to 53% in 2018, from 38% in 2013, and use of drugs to reverse paralysis has increased to 88%, from 68% in 2013 [5.12].

Andrade, Cook, Pandit and Wang responded to NAP5 findings [A-E] by developing an awareness support pathway to reduce likelihood that AAGA causes lasting psychological harm [3.1a, 3.2]. A consultant used this pathway when their patient experienced awareness: *"I found it*

incredibly helpful having a written series of steps to go through to make sure the patient was followed up and everything was done to help her” [5.2].

Findings on specific AAGA risks [H] led to new Association of Anaesthetists guidelines on *Peri-operative management of the obese surgical patient* (2015), *Guidelines for the safe practice of total intravenous anaesthesia* (2018), and *Safer pre-hospital anaesthesia* (2017) [5.5]. In March 2019, RCoA and AAGBI published the NAP5 Handbook [E.9] to make concise guidance on communicating and responding to AAGA available to anaesthetists and healthcare directors [based on findings A-F]. It incorporates recommendations on neuromuscular blocker monitoring [B,H], and the awareness support pathway.

International reach is shown by the American Association of Nurse Anesthetists’ 2016 position statement on Unintended Awareness during General Anesthesia, which cites NAP5 in support of its guidelines on anaesthesia, including the recommendation on neuromuscular blockers [H; 5.11]. A US anaesthesiologist commented that, by raising awareness of psychological sequelae, NAP5 has “enabled an approach to caring for awareness patients by referring them to psychologists” [5.12]. An anaesthesia update by the Australian and New Zealand College of Anaesthetists in 2015 [5.12] discussed NAP5’s findings [G,H] and recommendations on reducing drug errors in obstetric anaesthesia [3.4].

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

- 5.1 Maronge & Bogod (2018) Complications in obstetric anaesthesia: <https://doi.org/10.1111/anae.14141>
- 5.2 Testimonial from consultant anaesthetist from University Hospitals Plymouth NHS Trust
- 5.3 Blandford (2016) Passing the Primary FRCA SOE: A Practical Guide
- 5.4 RCoA Patient Information Leaflets
RCoA patient information leaflet 08: Accidental Awareness during General Anaesthesia
RCoA email on uptake of new leaflet
RCoA leaflet You and Your Anaesthetic
Royal United Hospitals Bath patient information leaflet https://www.ruh.nhs.uk/patients/patient_information/ANA001_Important_information_about_your_anaesthetic.pdf
Royal Devon and Exeter Hospital patient information leaflet patient-information- https://www.rdehospital.nhs.uk/media/xrrj5r3x/patient-information-leaflet-anaesthesia-your-questions_answered-rde-18-149-001.pdf
RCoA sedation leaflet: <https://www.rcoa.ac.uk/sites/default/files/documents/2019-10/12-SedationExplainedweb.pdf>
- 5.5 Association of Anaesthetists’ updated guidance on anaesthetic monitoring: <https://bit.ly/36osuuw>
- 5.6 Testimonial on use of ABCDE checklist from consultant anaesthetist at Royal United Hospitals Bath
- 5.7 Odor et al (2020) General anaesthetic and airway management practice for obstetric surgery in England: a prospective, multi-centre observational study, *Anaesthesia*. Paper reporting improvement in monitoring and reversal of neuromuscular blockade in obstetric anaesthesia since NAP5 demonstrated risks
- 5.8 Association of Anaesthetists guidelines on *Peri-operative management of the obese surgical patient* (2015), *Guidelines for the safe practice of total intravenous anaesthesia* (2018), and *Safer pre-hospital anaesthesia* (2017)
- 5.9 NAP5 Handbook <https://anaesthetists.org/Home/Resources-publications/Guidelines/The-NAP5-Handbook>
- 5.10 American Association of Nurse Anesthetists’ 2016 position statement on Unintended Awareness during General Anesthesia https://www.aana.com/docs/default-source/practice-aana-com-web-documents-%28all%29/unintended-awareness-during-general-anesthesia.pdf?sfvrsn=e20049b1_4

- 5.11 Testimonial from anaesthesiologist from University of Michigan Medical School
- 5.12 Australasian Anaesthesia (2015), invited papers and continuing education lectures published by the Australian and New Zealand College of Anaesthetists <https://www.anzca.edu.au/resources/college-publications/australasian-anaesthesia-%28the-blue-book%29/blue-book-2015-%281%29>