# Process-of-care in the ICU:

## A multi-method exploration of an electronic checklist to support medical morning rounds

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# Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Signature of candidate

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In order to alleviate any possible confusion, I would like to point out that I had a few name changes throughout the course of my PhD candidature. After getting married I transitioned from my maiden surname (Hewson) to my married name (Conroy) by hyphenating the two together (Hewson-Conroy) for a period of time to ensure there was an apparent link between my published work. This will be evidenced in my list of publications and presentations located in the Introduction chapter of this thesis.

Finally, I would like to express how thankful I am that I was given the opportunity to reach this milestone. I do not come from what western society considers a 'privileged' background, but I had all I needed to grow, learn and make informed choices about my future. There are many people in the world who are not afforded such opportunities, therefore I consider myself privileged and fortunate to be in this position. I am sure I will put the knowledge and skills acquired throughout my PhD candidature to good use.

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# List of Abbreviations

| | |
|---|---|
| ACSQHC | Australian Commission for Safety and Quality in Health Care |
| AE | Adverse Event |
| AERA | American Educational Research Association |
| AHRQ | Agency for Healthcare Research and Quality |
| ANZ | Australia and New Zealand |
| ANZICS | Australian and New Zealand Intensive Care Society |
| APA | American Psychological Association |
| APACHE | Acute Physiological, Age and Chronic Health Evaluation |
| API | Application Programming Interface |
| apps | Software applications |
| BI | Bias Index |
| BSL | Blood Sugar Level |
| CDSS | Clinical Decision Support System |
| CEC | Clinical Excellence Commission |
| CI | Confidence Interval |
| CIS | Clinical Information System |
| CL | Central Line |
| CLAB | Central Line Associated Bacteraemia |
| CLABSI | Central Line Associated Bloodstream Infection |
| COW | Computer-On-Wheels |
| CR-BSI | Catheter Related-Blood Stream Infection |
| CRF | Case Report Form |
| CTG | ANZICS Clinical Trials Group |
| CUSP | Comprehensive Unit-based Safety Program |
| CVC | Central Venous Catheter |
| CVI | Content Validity Index |
| DVT | Deep Venous Thromboembolism |
| EBM | Evidence-Based Medicine |
| e-checklist | Electronic checklist |

| | |
|---|---|
| FASTHUG | Feeding, Analgesia, Sedation, Thrombo-prophylaxis, Head-of-bed elevation, stress Ulcer prevention, Glucose control |
| GEE | Generalized Estimating Equations |
| GI | Gastro-Intestinal |
| HDU | High Dependency Unit |
| HOB | Head-of-Bed |
| HREC | Human Research Ethics Committee |
| ICCMU | Intensive Care Coordination and Monitoring Unit |
| ICU | Intensive Care Unit |
| IHI | Institute of Healthcare Improvement |
| IoM | Institute of Medicine |
| IQR | Inter-Quartile Range |
| IV | Intra-Venous |
| JVM | Java Virtual Machine |
| LOS | Length of stay |
| M&M | Morbidity & Mortality |
| MAC | Macintosh computer |
| MET | Medical Emergency Team |
| MRN | Medical Record Number |
| NA | Not Applicable |
| NCME | National Council on Measurement in Education |
| NHMRC | National Health and Medical Research Council |
| NICE SUGAR | Normoglycaemia in Intensive Care Evaluation (NICE) and Survival Using Glucose Algorithm Regulation (SUGAR) |
| NICS | National Institute of Clinical Studies |
| NICU | Neonatal Intensive Care Unit |
| NSW | New South Wales |
| NUM | Nurse Unit Manager |
| OR | Odds Ratio |
| PC | Personal Computer |
| PDA | Personal Digital Assistant |
| PDSA | Plan-Do-Study-Act |
| PI | Prevalence Index |

| | |
|---|---|
| PICU | Paediatric Intensive Care Unit |
| PIMS | Performance Indicators and Medication Safety |
| Pneg | Proportion of negative agreement |
| Ppos | Proportion of positive agreement |
| Pt | Patient |
| QI | Quality Improvement |
| QUM | Quality Use of Medicines |
| RCT | Randomised Controlled Trials |
| SAQ | Safety Attitudes Questionnaire |
| SD | Standard Deviation |
| SPC | Statistical Process Control |
| SPSS | Statistical Package for the Social Sciences |
| SUP | Stress Ulcer Prophylaxis |
| TPN | Total Parenteral Nutrition |
| US | United States of America |
| UK | United Kingdom |
| VAP | Ventilator-Associated Pneumonia |
| VTE | Venous Thrombo-Embolism |
| WHO | World Health Organization |

# Glossary of Terms

| | |
|---|---|
| APACHE | Predicted risk of death score calculated using the worst physiological values in the first 24 hours and other patient and admission data |
| FASTHUG | Mnemonic for use by ICU clinicians at bedside e.g. during patient rounds |
| MRN | Medical record numbers are unique patient identifiers, specific to each individual hospital. |
| PDA | An electronic handheld computer |
| PDSA | Model for implementing and evaluating quality improvement strategies |
| Process-of-care | Practices involved in the delivery of care |
| SPC | Statistical process control is a method of analysing data that utilises control charts to display variation in process data over time. |

# Abstract

The need for comprehensive and effective methods to ensure the delivery of required processes of care to intensive care unit (ICU) patients is acknowledged globally. In response various tools have been implemented, although many have not yet been empirically tested or rigourously evaluated in ICUs. Early evidence suggests that using a checklist is one way of ensuring evidence-based or accepted processes of care are performed routinely and systematically.

The aim of this program of study was to identify areas of need, then develop, validate, test and evaluate an electronic process-of-care checklist (e-checklist) for use by intensive care physicians during morning ward rounds in a tertiary-level adult ICU. Need for improvements in the delivery of ICU processes of care were identified via a comprehensive literature search, a point prevalence study of 50 Australian and New Zealand ICUs, and baseline data collected at the local ICU level.

Evidence on checklist validity was obtained via multiple methods at different research stages: comparison of checklist responses and documentation of care recorded in patients' medical records demonstrated high correlations for each care component, providing support for its concurrent validity; local clinician interviews and a modified-Delphi technique using an expert clinician panel confirmed the relevance and adequacy of content and produced a list of clear, concise and descriptive checklist statements; high levels of concordance between clinician and auditor responses during the intervention phase contributed evidence to the e-checklist's construct validity based on response processes; and user feedback obtained before and after the intervention demonstrated the e-checklist had face validity with ICU physicians. Importantly, the prospective before-after intervention study demonstrated improved compliance with processes of care over time (odds ratios ranged from 1.9 for mechanical ventilation weaning to 22.9 for pain management) and user-satisfaction was achieved.

Implications for practice include implementing this versatile tool at the point-of-care to collect real-time, process-of-care data that can be completed by clinicians delivering and auditing care. Recommendations for further research include: testing for reliability; investigating the reasons for practice variability and impact on outcomes; conducting observations of e-checklist utility in clinical practice and in larger multi-centre studies

adequately powered to detect significant differences in patient outcomes over time; and comparing the e-checklist with other clinical support tools or across different delivery platforms such as tablet PCs.

Overall, this research demonstrated the utility of an e-checklist in measuring and improving the delivery of ICU processes of care and provided a substantial amount of evidence in support of its' construct validity.