The Australian and New Zealand Intensive Care Society Clinical Trials Group point prevalence program, 2009–2016

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ABSTRACT

Background: Cross-sectional point prevalence studies collect observational data at a single time point and may be used to facilitate subsequent research hypotheses and discovery.

Methods: We report the process of implementation and substantive outputs of the Australian and New Zealand Intensive Care Society Clinical Trials Group (ANZICS CTG) point prevalence program, conducted in participating intensive care units from 2009 to 2016.

Results: Seventy-seven of a maximum 197 adult ICUs across Australia and New Zealand participated in 9 specified study days over 18 days of data collection and collected data on 5043 participants, with an average of 44 ICUs per study day. All eight Australian and New Zealand paediatric ICUs have participated in dedicated simultaneous paediatric study days. Thirteen manuscripts were published in peer-reviewed journals and data have contributed to 14 individual programs of research, including 18 subsequent grant applications for further research.

Conclusion: The ANZICS CTG point prevalence program has resulted in the collection of a substantial body of observational data that has facilitated the development and completion of subsequent research programs and provided opportunities for subsequent capacity development.

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Undertaking research in the critical care setting is challenging; researchers face time and resource constraints, and patients in the intensive care unit and their families are vulnerable. Cross-sectional point prevalence studies offer efficient and discrete methods to collect observational data at a single time point. These data can be used to develop hypotheses that may inform clinical trial design, to assist researchers in determining a proof of concept, to document variations in clinical practice and to measure knowledge translation after new evidence becomes available.[1-3]

In 2009, an increasing number of ICU researchers in Australia and New Zealand were conducting single-centre, observational studies under the auspices of the Australian and New Zealand Intensive Care Society Clinical Trials Group (ANZICS CTG). In response to the increasing demand for observational data, the ANZICS CTG established a point prevalence program to facilitate the collection of cross-sectional observational data using established research infrastructure and recurring operational processes.[4] The program aimed to provide an efficient mechanism for collecting data representative of clinical practice and to reduce the administrative workload for investigators and research coordinators.

In 2016, the ANZICS CTG point prevalence program was in its 8th year. We report the principles of developing and implementing a point prevalence program and provide an overview of research outputs from this program.

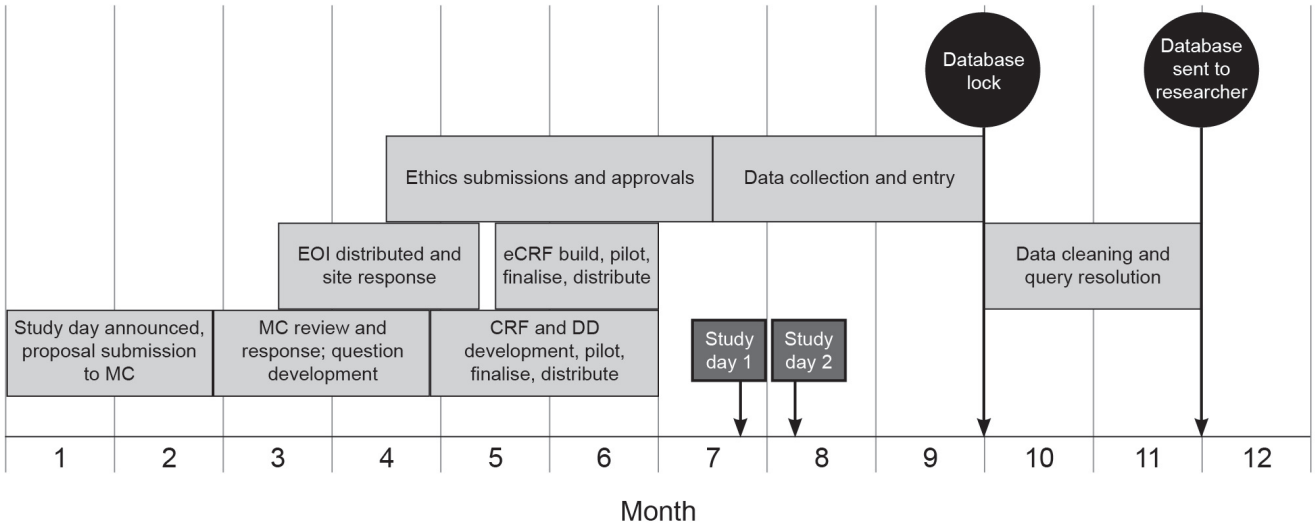
Methods

The point prevalence program is a joint collaboration between the ANZICS CTG and the George Institute for Global Health; a collaboration that was established by the ANZICS CTG executive in 2009.

The program consists of single-day point prevalence studies conducted in Australian and New Zealand ICUs on designated days each year (see study day timeline, Figure 1). Re-identifiable data on all patients occupying a bed in the ICU at a 10 am census point are collected for 24 hours on the corresponding ICU chart day. Routine clinical and demographic data are collected on standardised data collection forms. Standardised data include admission and discharge information, diagnosis and diagnosis subcategories, illness severity scores (Acute Physiology and Chronic Health Evaluation [APACHE] or Paediatric Index of Mortality),[5,6] organ dysfunction score (Sequential Organ Failure Assessment),[7] research involvement, and vital status at discharge from the ICU or hospital or at 1 month after the study day (Figure 1).

Investigators who are interested in using the program to conduct research are required to submit a research proposal using a standardised template describing background, aims, objectives, questions, expected outcomes and relevance of the research. Proposals are peer-reviewed by the program management committee and judged according to clinical relevance and feasibility within the limitations of a cross-sectional study design. Investigators are encouraged not

Figure 1. Point prevalence program timeline



MC = management committee. EOI = expression of interest. CRF = case report form. DD = data dictionary. eCRF = electronic case report form.

to request prevalence data on rare conditions; requested variables should be mostly categorical; and there should be no assumptions of causal inferences between the study factor and outcome variable.[2] Approved projects are then divided into individual data collection forms and these are added to the standardised data collection forms. Research questions from up to six individual investigators may be included in a single study day.

The study protocol provides a summary of processes, regulatory requirements and aspects that are consistent for each study day, thus avoiding the requirement for frequent protocol amendments. A summary of study day-specific variables is submitted to approving ethics committees each study day. A data completion manual (data dictionary) containing explanations and definitions of all study variables is developed from existing document templates, and consistent definitions are used for all routinely collected variables. Since 2012, data have been collected electronically via the Research Electronic Data Capture (REDCap) web application, enabling efficient duplication of standard forms and easy adaptation of existing templates for collection of data for new investigations.[8]

Multicentre ethics approvals for studies with low-to-negligible risk are obtained in jurisdictions where available. Where multicentre approval is not available, sites obtain individual ethics approval or conduct the program as a quality-audit initiative. As the research is observational, waived consent is granted by ethics committees.

A block amount of $10 000 is allocated for site payments for each study day, from which a per-patient payment is calculated from the total number of patients enrolled.

Results

Between April 2009 and October 2015, we conducted 9 study days over 18 days of data collection, and 34 individual studies (Table 1). Since 2009, data on 5043 adult participants (aged > 16 years) were collected. Demographic and clinical characteristics of the cohort were consistent over time (Table 2). The mean age of adult participants was 59 years, 61% were male, and the mean APACHE II severity of illness score[6] was 18. Of 5043 adult patients, 496 (9.8%) were recruited into an interventional clinical trial, and this has been consistent over time.

Seventy-seven of a possible 197 adult ICUs, and each of the eight dedicated paediatric ICUs across Australia and New Zealand,[9] participated in a point prevalence study day, with an average of 44 adult ICUs participating per study day (Appendix, Table 1, online at cicm.org.au/Resources/Publications/Journal). Among the participating adult ICUs, tertiary referral centres accounted for about 50%, metropolitan hospitals for 33%, and regional–rural and private hospitals each represented about 8%. Of the participating ICUs, 79% of tertiary referral centres, 77% of metropolitan hospitals, 42% of regional–rural centres and 40% of private hospital ICUs have contributed data to 3 or more study days (Table 3).

Program data have resulted in 13 publications in four peer-reviewed journals.[10-23] The data contributed to 14 separate programs of research within the ANZICS CTG and supported 18 grant applications for further research, including investigations on fluid resuscitation,[13,24] mechanical ventilation,[25] temperature management,[15,17,26] sepsis,[25,27,28] nutrition,[21,29] stress ulcer prophylaxis[30] and

Table 1. Information collected, investigations and outputs, by study day

Study day (year)	Studies included	Pub.	Pres.	Supp. further res.	Aided grant applic.	Funding agency	Study name; registration
1 (2009)	Compliance with processes of care	Yes	Yes	No	No	na	na
	Temperature management in acute brain syndrome	Yes	Yes	Yes	Yes	ICF/STGMRF	CLARITY; TTM-TBI
2 (2009–2010)	Physiotherapy practices and mobilisation	Yes	Yes	Yes	Yes	NHMRC/ICF	TEAM; NCT01674608
	Steroids in sepsis and septic shock	No	Yes	Yes	Yes	NHMRC/HRC	ADRENAL; NCT01448109
	Patient comfort and safety in ICU	Yes	Yes	No	No	na	na
	Fluid resuscitation	Yes*	Yes	Yes	Yes	NHMRC/HRC	PLUS; NCT02721654
	Limitation or withdrawal of treatment	No	Yes	No	No	na	na
3 (2010)	Vitamin D supplementation in ICU	No	Yes	Yes	Yes	ICF/SVC	Randomised study of single dose IM cholecalciferol in critically ill adults
	Oral hygiene	No	Yes	Yes	Yes	NHMRC/HRC	SuDDICU; NCT02389036
	Temperature management in patients with non-neuro. conditions	Yes	Yes	Yes	Yes	HRC HRC	HEAT; ACTRN12612000513819 REACTOR; ACTRN12616001285448
	Nutrition	Yes	No	Yes	Yes	ANZCA	TARGET; ACTRN12611000793910
	Ventilation	No	Yes	Yes	Yes	NHMRC/HRC	PHARLAP; NCT01667146
4 (2011)	Sodium administration in intensive care	Yes	Yes	Yes	Yes	na	na
	Fluid resuscitation	Yes	Yes	Yes	Yes	NHMRC/HRC	PLUS; NCT02721654
5 (2012)	Atrial fibrillation in intensive care	No	Yes	No	No	na	na
	Fluid resuscitation	Yes	Yes	Yes	Yes	NHMRC/HRC	PLUS; NCT02721654
6 (2012)	Oxygen therapy	Yes	Yes	Yes	No	na	na
	Hospital at night	Yes	Yes	No	No	na	na
	Fluid resuscitation	Yes	Yes	Yes	Yes	NHMRC/HRC	PLUS; NCT02721654
7 (2013)	Physiological monitoring and targets	Yes	Yes	Yes	No	HRC	ICU ROX; ACTRN12615000957594
	Non-invasive ventilation and nutrition	No	Yes	No	No	na	na
	Hypercapnoeic respiratory failure	No	Yes	Yes	No	na	na
	Glycaemic targets	No	No	No	No	na	na
	Fluid resuscitation	Yes	Yes	Yes	Yes	NHMRC/HRC	PLUS; NCT02721654
8 (2014)†	Electrolyte replacement	No	No	–	–	–	–
	Treatment intensity	Sub.	Yes	–	–	–	–
	Maintenance fluids	Yes	Yes	–	–	–	–
	Fluid resuscitation	No	Yes	–	–	–	–
9 (2015)†	Fluid resuscitation	No	No	–	–	–	–
	Gold standards framework criteria	No	No	–	–	–	–
	Treatment intensity (part 2)	Sub.	No	–	–	–	–
	Sputum plugging	Sub.	No	–	–	–	–
	Suctioning	No	Yes	–	–	–	–
	Sleep quality	Sub.	Yes	–	–	–	–

Pub. = published. Pres. = presented. Supp. = supported. res. = research. applic. = application. na = not applicable. ICF = Intensive Care Foundation. STGMRF = St George and Sutherland Medical Research Foundation. CLARITY = Cross-sectional Study of Temperature Management after Acute Brain Injury. TTM-TBI = target temperature management in traumatic brain injury. NHMRC = National Health and Medical Research Council (Australia). TEAM = Trial of Early Activity and Mobilization. NCT = National Clinical Trial. HRC = Health Research Council (New Zealand). ADRENAL = Adjunctive Corticosteroid Treatment in Critically Ill Patients with Septic Shock. ICU = intensive care unit. PLUS = Plasma-Lyte 148 vs Saline. SVC = St Vincent's Clinic. IM = intramuscular. SuDDICU = Selective Decontamination of the Digestive Tract in Critically Ill Patients Treated in ICUs. neuro. = neurological. HEAT = Permissive Hyperthermia through Avoidance of Paracetamol in Known or Suspected Infection in the ICU. ACTRN = Australian New Zealand Clinical Trials Registry Number. REACTOR = Randomised Evaluation of Active Control of Temperature v Ordinary Temperature Management in Mechanically Ventilated Adults in ICU with Fever. ANZCA = Australian and New Zealand College of Anaesthetists. TARGET = The Augmented versus Routine Approach to Giving Energy Trial. PHARLAP = prospective, multi-centre, randomised controlled trial of the clinical efficacy of a ventilation strategy compared with standard mechanical ventilation in patients with acute respiratory distress syndrome across Australia and New Zealand. ROX = evaluating the effects of two approaches to oxygen therapy in ICU patients requiring life support. Sub. = submitted. * Fluid resuscitation studies published as a translational time series. † Only publication and presentation outputs reported for Study Days 8 and 9 due to recency of study days.

Table 2. Site and patient characteristics

Characteristic	Month, year (study day)								
	May–Jun, 2009 (1)	Dec–Feb, 2009–2010 (2)	Nov–Dec, 2010 (3)	Sep–Oct, 2011 (4)	May–Jun, 2012 (5)	Nov–Dec, 2012 (6)	Nov–Dec, 2013 (7)	Sep–Oct, 2014 (8)	Sep–Oct, 2015 (9)
Study sites									
Adult sites, *n*	48	39	46	44	53	38	31	49	49
Paediatric sites, *n*	0	6	0	7	7	7	4	7	0
Patients									
Adult patients, *n*	682	566	507	511	585	468	397	645	682
Mean age, years (SD)	60.0 (18)	60.0 (16.5)	58.8 (17.2)	58.1 (17.9)	60.3 (17.5)	59.5 (18.1)	58.7 (17.3)	59.8 (17.6)	59.6 (16.8)
Male, *n* (%)	418 (61.3%)	359 (63.4%)	327 (64.5%)	315 (61.6%)	358 (61.2%)	300 (64.1%)	243 (61.2%)	386 (59.8%)	393 (57.6%)
Mean APACHE II score (SD)	18.5 (7.9)	18.5 (7.7)	17.4 (7.2)	18.7 (8.0)	18.4 (7.9)	18.3 (7.69)	18.4 (7.4)	19 (8.7)	17.3 (7.6)
Admission source, *n* (%)									
Emergency department	158 (23.2%)	145 (25.6%)	135 (26.6%)	159 (31.1%)	160 (27.4%)	111 (23.7%)	100 (25.1%)	167 (25.9%)	188 (27.5%)
Hospital ward	146 (21.4%)	100 (17.7%)	109 (21.5%)	108 (21.2%)	123 (21.0%)	106 (22.6%)	89 (22.4%)	154 (23.9%)	142 (20.8%)
Transfer from other ICU	42 (6.2%)	31 (5.5%)	20 (3.9%)	18 (3.5%)	20 (3.4%)	23 (4.9%)	16 (4.0%)	27 (4.2%)	32 (4.7%)
Transfer from other hospital	62 (9.1%)	58 (10.2%)	43 (8.5%)	51 (10.0%)	54 (9.2%)	51 (10.9%)	35 (8.8%)	59 (9.1%)	51 (7.5%)
Theatre after emergency surgery	112 (16.4%)	91 (16.1%)	88 (17.4%)	70 (13.7%)	85 (14.5%)	65 (13.9%)	62 (15.6%)	80 (12.4%)	114 (16.7%)
Theatre after elective surgery	160 (23.5%)	140 (24.7%)	110 (21.7%)	104 (20.4%)	143 (24.4%)	112 (23.9%)	95 (23.9%)	158 (24.5%)	155 (22.7%)
Enrolled in clinical trial, *n* (%)	31 (4.5%)	22 (3.9%)	87 (17.2%)	64 (12.5%)	32 (5.5%)	47 (10.0%)	49 (12.3%)	79 (12.2%)	85 (12.4%)

APACHE = Acute Physiology and Chronic Health Evaluation. ICU = intensive care unit.

mobility practices[20,31] (Table 1). Of these grant applications, six from 12 successful applications led to funded studies that have been coordinated by the George Institute,[24,26,27,30] exemplifying a return on investment for research institutes willing to invest time and resources into this kind of program.

In 2010, the program and operational framework was extended to enable data capture on all patients receiving care in ICUs throughout Australia and New Zealand. This was achieved through the inclusion of paediatric ICUs and modification of the case report forms to allow inclusion of patients aged < 16 years in any ICU.

The program facilitated new national and international collaborations. In 2013, ICUs involved in the 7th study day contributed data to a global epidemiological study measuring the burden of sepsis in critical illness.[32] The visibility of the point prevalence program to investigators overseas has led to the paediatric ICUs being invited to participate in several international point prevalence studies.[1,33]

The program enabled the efficient evaluation of the effects of evidence from clinical trials on clinical practice over several years and several time points.[13] This has provided a major component of the body of translational evidence surrounding fluid resuscitation practices in critically ill patients across Australia and New Zealand, which remains a key focus area of research into critical illness locally and globally.

Discussion

We developed a binational program of point prevalence research, spanning the complete age range of critical care patients. This reduced the administrative burden on investigators, research coordinators and ICUs and provided a substantial body of generalisable observational data. Implementation of the program has provided novice researchers with opportunities to conduct multicentre observational research supported by academic mentors within an experienced operational research team.

The purpose of this point prevalence program was to collect information on the absence or presence of the characteristics of interest to researchers and to use this information to support further research. Research outputs include multiple publications in a range of peer-reviewed journals and feasibility data that have supported grant

Table 3. Adult study site participation, by type and study day

Study site hospital type, *n*	Month, year (study day)									Study participation rate, *n/N* (%)	
	May–Jun, 2009 (1)	Dec–Feb, 2009–2010 (2)	Nov–Dec, 2010 (3)	Sep–Oct, 2011 (4)	May–Jun, 2012 (5)	Nov–Dec, 2012 (6)	Nov–Dec, 2013 (7)	Sep–Oct, 2014 (8)	Sep–Oct, 2015 (9)	≥ 4 study days	All study days
Tertiary	28	20	23	24	26	20	18	22	23	26/33 (79%)	9/33 (27%)
Metropolitan	13	14	16	16	20	12	9	16	14	17/22 (77%)	5/22 (23%)
Regional or rural	3	2	4	2	4	3	2	7	4	5/12 (42%)	0/12
Private	5	3	3	3	4	3	2	4	8	4/10 (40%)	1/10 (10%)
*Total**	*49*	*39*	*46*	*45*	*54*	*38*	*31*	*49*	*49*	–	–

* Mean number of sites participating each study day = 44; total number of intensive care units that have participated in any point prevalence program day = 77.

applications for trials funded by the Australian and New Zealand governments. Despite a lack of direct substantial funding to participating sites, the overall productivity of the program has generated opportunities for participation in further research, proving a return on investment for participating ICUs and a substantial contribution to capacity building for the ANZICS CTG and the George Institute for Global Health.

The ANZICS CTG point prevalence program uses established research infrastructure to collect observational data that support future research. This collaborative program of research has produced substantive research outputs that have assisted in building the research capacity and global profile of Australian and New Zealand critical care research.

Competing interests

None declared.

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