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A comparison of Antecedents to Cardiac Arrests, Deaths and EMergency Intensive care Admissions in Australia and New Zealand, and the United Kingdom—the ACADEMIA study

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Abstract

Many patients have physiological deterioration prior to cardiac arrest, death and intensive care unit (ICU) admission, that are detected and documented by medical and nursing staff. Appropriate early response to detected deterioration is likely to benefit patients. In a multi-centre, prospective, observational study over three consecutive days, we studied the incidence of antecedents (serious physiological abnormalities) preceding primary events (defined as in-hospital deaths, cardiac arrests, and unanticipated ICU admissions) in 90 hospitals (69 United Kingdom [UK]; 19 Australia and 2 New Zealand [ANZ]). 68 hospitals reported primary events during the three-day study period (50 United Kingdom, 16 Australia and 2 New Zealand).

Data on the availability of ICU/HDU beds and cardiac arrest teams and Medical Emergency Teams were also collected. Of 638 primary events, there were 308 (48.3%) deaths, 141 (22.1%) cardiac arrests, and 189 (29.6%) unplanned ICU admissions. There were differences in the pattern of primary events between the UK and ANZ ($P < 0.001$). There were proportionally more deaths in the UK (52.3% versus 35.3%) and a higher number of unplanned ICU admissions in ANZ (47.3% versus 24.2%). Sixty percent (383) of primary events had a total of 1032 documented antecedents. The most common antecedents were hypotension and a fall in Glasgow Coma Scale. The proportion of ICU/HDU to general hospital beds was greater in ANZ (0.034 versus 0.016, $P < 0.001$) and medical emergency teams were more common in ANZ (70.0% versus 27.5%, $P = 0.001$). The data confirm antecedents are common before death, cardiac arrest, and unanticipated ICU admission. The study also shows differences in patterns of primary events, the provision of ICU/HDU beds and resuscitation teams, between the UK and ANZ. Future research, focusing upon the relationship between service provision and the pattern of primary events, is suggested.

Keywords: Intensive care; Cardiac arrest; Medical Emergency Team; Prevention

Resumo

Muitos doentes têm deteriorações fisiológicas, detectadas e documentadas pelo pessoal médico e de enfermagem, antes da paragem cardíaca, da morte e da admissão na unidade de cuidados intensivos (ICU). A correcção precoce e apropriada das deteriorações detectadas deve beneficiar os doentes. Num estudo observacional multicêntrico, prospectivo, durante três dias consecutivos, estudamos a incidência de antecedentes (anomalias fisiológicas graves) que precederam eventos primários (definidos como mortes intra-hospitalares, paragens cardíacas

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e, admissões imprevistas na ICU) em 90 hospitais (69 no Reino Unido (UK); 19 na Austrália e 2 na Nova Zelândia (ANZ)). 68 hospitais registaram eventos primários durante o período de estudo de 3 dias (50 Reino Unido, 16 Austrália e 2 na Nova Zelândia).

Também foram recolhidos dados sobre a disponibilidade de camas ICU/HDU e de equipas de emergência e de equipas de paragem cardíaca. De 648 eventos primários, houve 308 mortes (48.3%), 141 paragens cardíacas (22.1%) e 189 (29.6%) admissões imprevistas na ICU. Existiram diferenças no padrão de eventos primários entre o UK e a ANZ ($P < 0.001$). Proporcionalmente houve mais mortes no UK (52.3% versus 35.3%) e um número maior de admissões não planeadas na UCI na ANZ (47.3% versus 24.2%). Sessenta por cento (383) dos eventos primários tiveram um total de 1032 antecedentes documentados. Os antecedentes mais frequentes são a hipotensão e uma diminuição na escala de coma de Glasgow. A proporção de camas ICU/HDU em relação ás camas genéricas do hospital era maior na ANZ (0.034 versus 0.016, $P < 0.001$) e as equipas médicas de emergência eram mais comuns na ANZ (70.0% versus 27.5%, $P = 0.001$). Os dados confirmam que os antecedentes são comuns antes da morte, da paragem cardíaca e da admissão imprevista na ICU. O estudo também mostra diferenças no padrão de eventos primários, na disponibilidade de camas ICU/HDU e de equipas de emergência entre o Reino Unido e a Austrália e Nova Zelândia. È sugerida investigação adicional focando a relação entre o fornecimento de serviços e o padrão dos eventos primários.

Palavras chave: Cuidados intensivos; Paragem cardíaca; Equipa médica de emergência; Prevenção

Resumen

Muchos pacientes tienen deterioro psicológico previo al paro cardíaco, muerte y admisión a unidad de cuidados intensivos (ICU), detectado y documentado por el personal médico y de enfermería. Es probable que una respuesta temprana y apropiada al deterioro detectado beneficie a los pacientes. En un estudio multicéntrico, prospectivo, observacional a lo largo de tres días consecutivos, estudiamos la incidencia de antecedentes (anormalidades sicológicas serias) que preceden hechos primarios (definidos como muertes intra hospitalarias, paros cardíacos, y admisiones en ICU no anticipadas) en 90 hospitales (69 Reino Unido[UK]; 19 en Australia y 2 en Nueva Zelandia [ANZ]. 68 hospitales reportaron eventos primarios durante el período de tres días de estudio (50 UK, 16 Australia y 2 en Nueva Zelandia). Se recogieron también datos acerca de la disponibilidad de camas ICU / HDU y equipos de paro cardíaco y Equipos de Emergencias Médicas. De los 638 eventos primarios, 308 (48.3%) fueron muertes, 141 (22.1%) paros cardíacos, y 189 (29.6%) admisiones a ICU no planificadas. Hubo diferencias en el patrón de eventos primarios entre UK y ANZ ($P < 0.001$). Hubo proporcionalmente mas muertes en UK (52.3% versus 35.3%) y mayor número de admisiones a ICU no planificadas en ANZ (47.3% versus 24.2%). El 60% (383) de los eventos primarios tubo un total de 1032 antecedentes documentados. Los antecedentes mas frecuentes fueron hipotensión y caída en la escala de coma de Glasgow. La proporción de camas ICU /HDU a camas de salas generales fue mayor en ANZ (0.034 versus 0.016, $P < 0.001$) y los equipos de emergencias médicas fueron mas comunes en ANZ (70% versus 27.5%, $P = 0.001$). Los datos confirman que los antecedentes son comunes antes de muerte, paro cardiaco, y admisión inesperada a ICU. El estudio también muestra diferencias en los patrones de eventos primarios, la provisión de camas ICU/HDU y equipos de resucitación, entre UK y ANZ. Se sugiere nueva investigación, enfocada hacia la relación entre la provisión de servicio y el patrón de eventos primarios.

Palabras clave: Cuidados intensivos; Paro cardíaco; Equipo de emergencias médicas; Prevención

1. Introduction

There is increasing interest in potentially preventable causes of in-hospital morbidity and mortality [1–4]. Evidence suggests that the management of many critically ill patients can be improved with the result that some cardiac arrests, deaths and intensive care unit (ICU) admissions may be avoided [5–8]. Prior to cardiac or respiratory arrest up to 84% of patients have significant physiological deterioration, much of which is detected and documented by medical and nursing staff [8,9]. Often insufficient action is taken, despite up to 60% of arrests on general hospital wards having potentially correctable antecedent events, such as hypoxia and hypotension [9]. Inadequate care is also reported prior to intensive care admission and leads to increased hospital mortality [6,7]. One study has demonstrated that patients admitted to an ICU from a general ward have a higher rate of serious physiological abnormalities than those from the emergency department or operating room [10].

In recent years there has been an attempt to improve the identification and management of critically ill patients. For example, in Australia, the Medical Emergency Team [11] has been developed to facilitate rapid and appropriate treatment for patients who are at risk of, or have established, critical illness. In the UK, a national reorganisation of critical care services has been encouraged [12] leading to the development of outreach [13] and Patient At Risk Teams [14]. There have also been educational initiatives, e.g. the ALERT^{TM} course [15], to improve multi-professional knowledge, skills and attitudes concerning the management of critically ill patients. However, differences exist in the resources and methods used in these healthcare systems. To date, there is no published, comparative, international data on the incidence of antecedents to cardiac arrests, deaths and emergency ICU admissions and their relationship to such processes.

2. Methods

This study was an international, multi-centre, prospective, observational study, enrolling hospitalised patients aged ≥ 16 years who suffered a cardiac arrest, died, or had an unplanned admission to an ICU. Planned elective surgical admissions and patients transferred from other hospitals and ICUs were excluded. In the UK, invitations to participate in the study were sent to the intensive care unit (ICU) directors or linkmen of all hospitals with an ICU listed in the UK Intensive Care Society (ICS) database. In Australia and New Zealand, participating hospitals were enrolled via the Australian and New Zealand Intensive Care Society (ANZICS) Clinical Trials Group (CTG). The study period was 3 days (24th October–26th October 2000).

For each enrolled hospital, the following data were collected: number of annual hospital admissions, number of acute hospital beds, number of high dependency unit (HDU) beds, number of ICU beds, and whether the hospital possessed a cardiac arrest team, a dedicated team that could be contacted for immediate response to any inpatient in the event of a medical emergency or both.

In-hospital deaths, cardiac arrests, and unplanned ICU admissions were defined as, mutually exclusive, primary events. It was possible for individual patients to have more than one primary event, but if this was the case, each was clearly separate. For example, a patient who suffered a fatal cardiac arrest was recorded as having a single primary event (cardiac arrest), whereas a patient suffering "n" discrete cardiac arrests was recorded as having had "n" separate primary events (cardiac arrests). Antecedents to the primary event were defined as threatened airway, respiratory rate (<5 and >36 breaths per minute), pulse rate (<40 and >140 beats per minute), systolic blood pressure (<90 mmHg), a fall in Glasgow Coma Scale (GCS) of ≥2 points and prolonged seizures. A given primary event could have multiple antecedents. For each primary event, all associated patient documentation was searched for the presence of antecedents during the 24 h prior to the event. Each 24 h period was broken down into a series of time periods (0–15 min, 15 min–1 h, 1–2 h, 2–4 h, 4–8 h, 8–24 h) during which the presence of antecedents was sought. The following data were also collected: location of primary event and the age, gender and resuscitation status of the patient.

Appropriate ethics committee approval was sought and waived in the UK, and was obtained for hospitals in Australia and New Zealand.

All data were collected on specifically designed data collection forms. Data were transcribed to a database written in Microsoft FoxPro. Necessary checks for data consistency and uniqueness were carried out. The Chi-squared test of homogeneity was used to analyse the patterns of primary events and antecedents. When comparing summary data (means ± SD) the Welch t-test (does not assume equal population variances) was used. The Mann–Whitney U test was used to analyse the age distribution of patients in the study.

3. Results

In the UK, 69 hospitals enrolled in the study, although only 50 reported primary events during the study period. In Australia, 19 hospitals were enrolled and 16 reported primary events. Two hospitals from New Zealand participated in the study and reported primary events. Australian and New Zealand data were grouped together and are, hereafter, referred to as ANZ. For hospitals that reported their number of acute beds, the mean number (±SD) of hospital beds was 629 ± 252 (UK, $N = 62$) and 474 ± 154 (ANZ, $N = 20$), $P = 0.002$. Similarly, the mean (±SD) totals of ICU and HDU beds were 9.84 ± 6.50 (UK, $N = 66$) and 16.18 ± 8.41 (ANZ, $N = 20$), $P = 0.005$. The ratio of ICU and HDU beds to hospital beds (for those hospitals reporting both) was 0.016 ± 0.007 (UK, $N = 62$) and 0.034 ± 0.012 (ANZ, $N = 20$), $P < 0.001$. The mean numbers (±SD) of in-patient admissions per hospital in 1999 were 32461 ± 36132 (UK, $N = 38$) and 33857 ± 16439 (ANZ, $N = 19$), $P = 0.842$.

The total number of primary events was 638 (627 unique patients). Of these events, 383 (60.0%) had documented antecedents. The patients' ages ranged from 16 to 101 years. There were 326 (52.0%) males. The gender of four patients (0.6%) was not recorded. Table 1 lists patient demographics and adverse events. The UK and ANZ study populations were similar for gender ($P = 0.112$), but patients in the UK were older (UK median age 76, ANZ median age 72).

The primary events were 308 (48.3%) deaths, 141 (22.1%) cardiac arrests and 189 (29.6%) unanticipated ICU admissions. Antecedents were documented for 168 deaths, 112 cardiac arrests and 103 unanticipated ICU admissions (Fig. 1 and Table 1). There was a significant difference in the pattern of primary events between the UK and ANZ ($P < 0.001$; Chi-squared): there were more deaths in the UK and a higher number of unplanned ICU admissions in ANZ (Table 1). This pattern was maintained irrespective of the presence or absence of antecedents (presence $P < 0.001$; absence $P < 0.001$, Chi-squared).

3.1. Primary events

3.1.1. Deaths

Three hundred and eight (48.3%) of the primary events were deaths (Table 1). Of these, 272 (88.3%) had either a "do not attempt resuscitation" (DNAR) order or a plan that limited future medical intervention. Therefore, 36 deaths (11.7%) were unexpected (UK 31 deaths 12.2%, ANZ 5 deaths 9.4%).

One hundred and sixty eight (54.5%) deaths had recorded antecedents (UK 135 deaths 52.9%; ANZ 33 deaths 62.3%). A DNAR order was not recorded for 20 of these deaths (11.9%) (UK 17 deaths, 12.6%; ANZ 3 deaths, 9.1%). For 2 of these 20 deaths, there was no record of the doctor having been notified of the abnormal physiology within the prior 24 h. A further ten patients' records indicate that a doctor

Table 1
Primary events, with and without antecedents and with and without DNAR orders

	Total	UK	ANZ	*P* value
Intensive care units	68	50	18	
Age range (median) in years	16–101 (75)	16–101 (76)	17–101 (72)	$P = 0.005$
Male	326	239	87	$P = 0.112$
Female	297	234	63	
Primary events	638 (=*N*)	488 (=100%)	150 (=100%)	$P < 0.001$
Cardiac arrests	141 (22.1)	115 (23.6)	26 (17.3)	
Deaths	308 (48.3)	255 (52.3)	53 (35.3)	
ICU admissions	189 (29.6)	118 (24.2)	71 (47.3)	
Primary events with antecedents (% of *N*)	383 (60.0)	290 (59.4)	93 (62.0)	$P = 0.634$
Cardiac arrests (% of primary events with antecedents)	112 (29.2)	91 (31.4)	21 (22.6)	$P < 0.001$
Deaths (% of primary events with antecedents)	168 (43.9)	135 (46.6)	33 (35.5)	
ICU admissions (% of primary events with antecedents)	103 (26.9)	64 (22.1)	39 (41.9)	
Primary events without antecedents (% of *N*)	255 (40.0)	198 (40.6)	57 (38.0)	$P = 0.634$
Cardiac arrests (% of primary events without antecedents)	29 (11.4)	24 (12.1)	5 (8.8)	$P < 0.001$
Deaths (% of primary events without antecedents)	140 (54.9)	120 (60.6)	20 (35.1)	
ICU admissions (% of Primary Events without antecedents)	86 (33.7)	54 (27.3)	32 (56.1)	
Cardiac arrests				
With DNAR order	23 (16.3)	16 (13.9)	7 (26.9)	$P = 0.139$
Without DNAR order	118 (83.7)	99 (86.1)	19 (73.1)	
Deaths				
With DNAR order	272 (88.3)	224 (87.8)	48 (90.6)	$P = 0.814$
Without DNAR order	36 (11.7)	31 (12.2)	5 (9.4)	

DNAR = "Do Not Attempt Resuscitation".

was informed of abnormal physiology at least 4 h before the patient's death.

One hundred and forty (45.5%) deaths did not have recorded antecedents (UK 120 deaths 47.1%; ANZ 20 deaths 37.7%). No DNAR order was recorded for 16 of these deaths (11.4%) (UK 14 deaths, 11.7%; ANZ 2 deaths, 10.0%).

3.1.2. Cardiac arrests

One hundred and forty one (22.1%) of the primary events were cardiac arrests (Table 1). Of these, 23 (16.3%) had either a DNAR order or a plan that limited future medical intervention, but cardiopulmonary resuscitation was attempted.

The majority (112, 79.4%) of the cardiac arrests had evidence of abnormal physiology prior to the event. A DNAR order was not recorded for 96 of these (85.7%) (UK 80, 87.9%; ANZ 16, 76.2%). For 13 of these 96 cardiac arrests, there was no record of the doctor having been notified of the abnormal physiology within the prior 24 h. A further 12 patients' records indicate that a doctor was informed of abnormal physiology at least 4 h before the arrest. Only 7 of the 29 cardiac arrests that did not have recorded antecedents had a DNAR order.

3.1.3. ICU admissions

One hundred and eighty nine (29.6%) of the primary events were unanticipated ICU admissions of which 103 (54.5) had recorded antecedents (Table 1). For 12 of these 103 there was no record of the ward doctor having been notified of the abnormal physiology within the prior 24 h. A further 39 patients' records indicate that a ward doctor was informed of the abnormal physiology at least 4 h before the event.

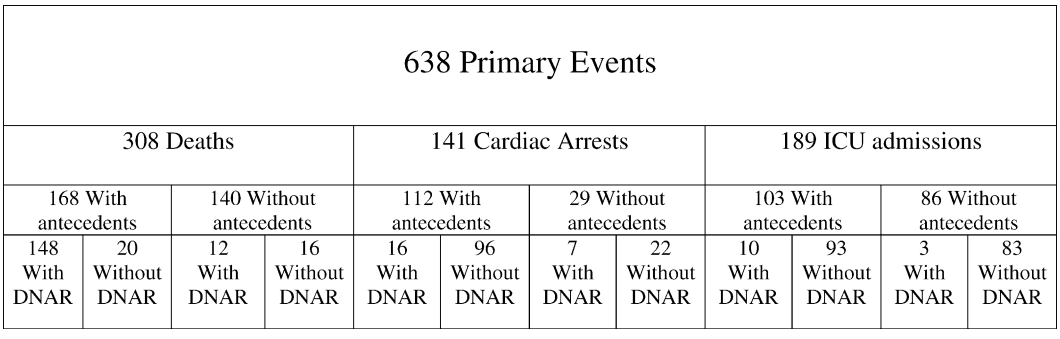

Fig. 1. Primary events with and without antecedents and DNAR orders.

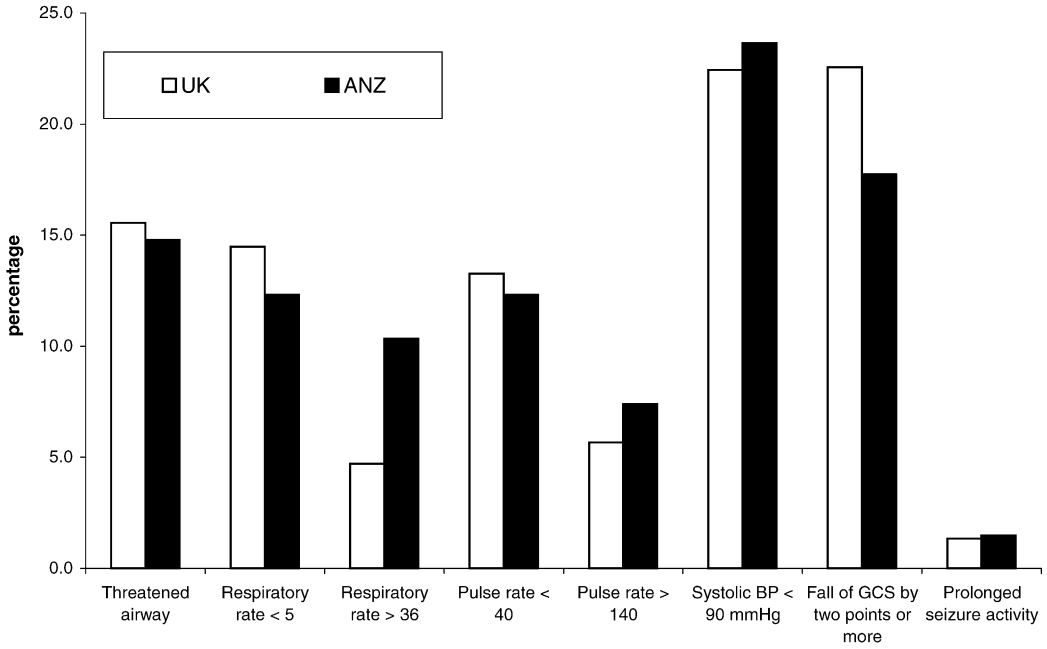

Fig. 2. Total antecedents present prior to primary events, given as a percentage of the total antecedents for UK ($N = 829$) and ANZ ($N = 203$).

3.2. Antecedents

A total of 1032 antecedents were recorded (Table 2). Of these, the most frequently recorded abnormalities were a low systolic blood pressure, and a fall in GCS. Table 3 shows the effect of removing antecedent data that occurred in the 15 min prior to the primary event, as it may be argued that in the process of dying there will be an inevitable reduction in respiratory rate, heart rate and level of consciousness.

Twenty-nine (13.9%) of the patients with antecedents and without a DNAR order had antecedents documented to be continuous over consecutive time periods. Seventeen patients had antecedents for up to 4 h, 9 for up to 8 h, and 3 for the whole 24 h prior to an adverse event. There was no statistically significant difference in the pattern of individual antecedents (e.g., threatened airway, low systolic blood pressure) between the UK and ANZ ($P = 0.090$) (Fig. 2). When antecedent data that only occurred in the 15 min prior

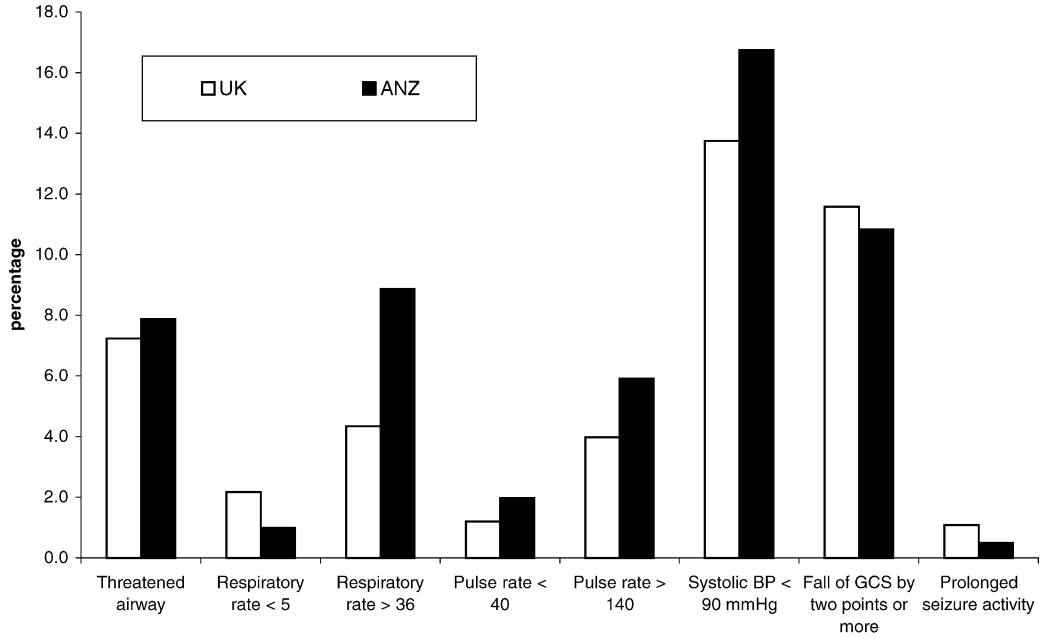

Fig. 3. Antecedents present in the period from 15 min to 24 h prior to primary events, given as a percentage of the total antecedents present in the same period for UK ($N = 376$) and ANZ ($N = 109$).

Table 2
Total antecedents present prior to primary events

	Total	UK	ANZ
Antecedents (total recorded for all events)	1032	829	203
Threatened airway	159	129	30
Respiratory rate < 5	145	120	25
Respiratory rate > 36	60	39	21
Pulse rate < 40	135	110	25
Pulse rate >140	62	47	15
Systolic blood pressure < 90 mmHg	234	186	48
Fall of GCS by two points or more	223	187	36
Prolonged seizure activity	14	11	3

Table 3
Antecedents present in the period from 15 min to 24 h prior to primary events

	Total	UK	ANZ
Antecedents (total recorded for all events)	485	376	109
Threatened airway	76	60	16
Respiratory rate < 5	20	18	2
Respiratory rate > 36	54	36	18
Pulse rate < 40	14	10	4
Pulse rate >140	45	33	12
Systolic blood pressure < 90 mmHg	148	114	34
Fall of GCS by two points or more	118	96	22
Prolonged seizure activity	10	9	1

to the primary event were removed, there was again no statistically significant difference in the pattern of individual antecedents between the UK and ANZ ($P = 0.316$) (Fig. 3).

3.3. Response to acute medical emergencies

In the UK, at the time of the study, the majority of hospitals (19 of 69 who provided the necessary data; 72.5%) employed a team that was only activated by a cardiac arrest call. This was in contrast to ANZ where 70.0% (14 of 20) of teams responded to both cardiac arrests and medical emergencies ($P = 0.001$).

4. Discussion

This three-day "snap-shot" of acute care has examined the incidence of serious physiological abnormalities preceding cardiac arrests, deaths and unanticipated ICU admissions in participating hospitals in the UK, Australia and New Zealand. Serious physiological abnormalities were documented to be present in 60%. This study produces the first and largest multi-centre, international, prospective report of antecedents to death, cardiac arrest and ICU admission.

We identified significant differences in the pattern of primary events between the UK and Australia/New Zealand. In the UK, death is more commonly recorded as the primary event, whereas in Australia and New Zealand unanticipated ICU admission is the most commonly observed. The mean number of hospital beds was greater in the UK than in ANZ, but there were, on average, more ICU/HDU beds in ANZ hospitals than those in the UK. Consequently a greater proportion (approximately double) of ANZ hospital beds were ICU/HDU beds and, therefore, ANZ hospitals had a greater capacity for ICU admissions. ANZ hospitals were also more likely to have teams that responded pre-emptively to medical emergencies (e.g. Medical Emergency Teams (MET) [11]), rather than restricting their response to cardiac arrests, as is common in the UK. These findings may suggest a relationship between acute care structures and the observed pattern of adverse events. One of the other activities of a MET is that it may facilitate early clarification of a patient's resuscitation status [17]. This may influence the pattern of adverse events; however, we did not find a difference between UK and ANZ in terms of documented DNAR orders, which were present for 88.3% of patients who died.

Our data confirms previous findings of potentially treatable antecedents prior to death, cardiac arrest and ICU admission [6–10]. Several patients studied had exhibited antecedents that were recorded continuously for periods of up to 24 h prior to a primary event. Seventeen patients without a DNAR order had at least one antecedent present continuously for up to 4 h prior to the primary event. There were two deaths and 13 cardiac arrests, all without prior DNAR orders, in which there is no record of a doctor being informed of the physiological abnormality in the 24 h preceding the primary event. These findings suggest that a review of practices of patient observation, documentation and the response system of hospital professionals to acute medical crises is required.

A major weakness of a case-record based study, such as this, is its reliance on relevant data being recorded. The real incidence of potentially reversible, physiological abnormalities prior to these events is potentially higher than we have discovered. There may also be differences in the quality of observation chart and note keeping in the countries studied, which could influence our analysis. We also did not explore demographic differences other than age and gender (e.g. illness demographics, hospital characteristics) within our study population, which potentially could have contributed to the differences in the pattern of adverse events.

5. Conclusions

We have confirmed previous findings that antecedents to death, cardiac arrest and unanticipated ICU admission are common and have identified differences in the pattern of these primary events between the UK and ANZ. In the UK, cardiac arrest appears to be more common and, as this is a devastating event with a poor outcome [16], further assessment of preventative strategies are warranted. We have also shown differences in the availability of ICU/HDU beds and medical emergency teams, each of which may be expected to influence outcome from critical illness. An increase in

the number of critical care beds was recommended in the UK Department of Health document, "Comprehensive Critical Care" [12]. Despite the absence of large multi-centre trials to support the use of MET-like teams [18–21], it also recommended the use of early warning systems [22] and MET-like teams [11,14]. Other factors that may be important in explaining the apparent differences observed in our study include variations in medical and nursing education, postgraduate training, staffing, vital signs charting and differences in healthcare delivery. More work is required to clarify the importance of causative factors and preventative strategies.

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Appendix A. Participating hospitals and investigators

ANZ: Alfred—Andrew Davies, Auckland—John Beca, Austin and Repat—Rinaldo Bellomo/Donna Goldsmith, Bankstown—Graham Reece, Canberra—Joy Whiting, Charles Gairdner—Mary Pinder/Brigit Roberts, Concord—Liz Fugaccia, Epworth—John Reeves, Flinders—Tamara Hunt, Geelong—David Green, Hobart and Cavalry—Tony Bell, Liverpool—Juliane Kause, Mater Private—David Ulyatt, Mater Public—David Ulyatt, Middlemore—Paul Frost, Nepean—Louise Cole, Port Macquarie—Craig Hore, Royal Adelaide—Marianne Chapman, Royal North Shore—Simon Finfer, Royal Prince Alfred—Dorothy Breen, St. George—Michael O'Leary, Wollongong—Sunny Rachakonda/Grant Simmons.

UK: Airedale General—John Scriven, Addenbrookes—Kevin Gunning, Ayr—Iain N. Taylor, Barnet General—E. Shanthakumar, Bedford—David Niblett, Birmingham Heartlands/Solihull—Samia Fayek, Bishop Auckland General—P. Siivayokan, Borders General—N.P. Leary, Bradford Royal Infirmary—Paul Cramp, Broomfield—Kevin Kiff, Burnley General—E.R.J. van der Heiden, Cheltenham General—Guy Routh, City General—Nigel Eastwood, Colchester General—S.P.J. MacDonnell, Countess of Chester—R.A. Nelson, Derby General—G.F.C. MacLeod, Derriford—Pam Nelmes, Dorset County—J.N. Hollis, Dumfries Royal Infirmary—Dewi Williams, Edinburgh Royal Infirmary—Simon Mackenzie, Friarage—M.C. Thompson, Glan Glwyd Hospital—V.M. O'Keeffe, Gloucester Royal—Liz Spencer, Hammersmith—Stephen Brett, Harrogate District—J. Gasser, Hereford County—John Hutchinson, Ipswich—A. Kong, James Paget—Maggie Wright, Kent and Sussex—P. Sigston, Kettering General—L.C. Twohey, King George—D.G. Martin, Kings College—J. Wendon, Leeds General Infirmary—Ben Barry, Leicester Royal Infirmary—Andrew Hall, Lincoln County—C.K.G. Tyler, Lister—J. Thiagrajan, Macclesfield District General—John Hunter, Middlesbrough General—Andrew Lloyd, Milton Keynes General—Nicola Lester, Nobles—Mathew Biggart, Norfolk and Norwich—Patrick Furniss, North Manchester General—Ceri Brown, North Middlesex—R. Lo, Northampton General—Rae Webster, Prince Phillip—Jo Jaidev, Queen Alexandra—G. Smith, Queen Elizabeth/Gateshead—S. Digby, Queen Elizabeth/Kings Lynn—Mark Blunt, Queen Mary—Angela Cook, Royal Albert Edward's Infirmary—R.S.G. Saad, Royal Bolton—Diarmid Cochran, Royal Bournemouth—David Dickson, Royal Devon and Exeter—Julia Munn, Royal Halifax Infirmary/Halifax General—R. Bailie, Royal Liverpool University—Richard Wenstone, Royal London—David Goldhill, Royal Sussex County—M. Street, Royal United Hosp Bath—J.P. Nolan, Sandwell General—J.M. Bellin, Selly Oak—Mav Manji, South Cleveland—R. Tripathy, South Tyneside District—I. Krupe, Southampton General—J. Pappachan, St. Helier—M.A. Stockwell, Stobhill—Colin Miller, Watford General—M. Soskin, West Cumberland—I. Ulyatt, West Wales General—C.FC. Loyden, Whittington—Chris Hargreaves, Withington—P. Haji-Michael, Worthing—N.G. Lavies, Wrexham Maelor—David Southern.

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