

Trends in intensive care unit cardiac arrest admissions and mortality in Australia and New Zealand

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Cardiac arrest (CA) is a significant cause of mortality in Australia and throughout the developed world.^{1,2} Depending on the location of the arrest, CAs are typically divided into in-hospital CAs (IHCA) and out-of-hospital CAs (OHCA). Australian estimates of OHCA incidence range between 85 and 128.2 CAs per 100 000 person-years,¹ and global estimates of IHCA incidence range from one to five CAs per 1000 patient admissions.² Survival outcomes following CA are poor. Australian and New Zealand studies have estimated OHCA survival to hospital discharge to be 6%–13%.¹ There are no population-based IHCA outcome studies in Australia, but the large, multicentre National Registry of Cardiopulmonary Resuscitation in the United States has found survival to hospital discharge to be between 17% and 27% among adults.^{3,4}

OHCA patients surviving to hospital admission and IHCA patients will typically be transferred to intensive care units for postresuscitation care. Thus, increases in the proportion of OHCA patients surviving to hospital, or in-hospital practices that reduce the incidence of IHCA, will alter the casemix and volume of post-CA patients admitted to ICU. For example, in Victoria, survival to hospital for OHCA increased from 24% to 32% between 2002 and 2012.⁵ On the other hand, the introduction of medical emergency teams may be associated with a decline in the incidence of patients with IHCA being admitted to the ICU.⁶ It is of interest to understand how these changes affect the underlying temporal patterns in ICU CA admissions and mortality at a national level.

Through its adult patient database (APD), the Australian and New Zealand Intensive Care Society (ANZICS) coordinates the collection of ICU admission data, at the individual level, for patients admitted to ICUs throughout Australia and New Zealand.⁷ Started in 1997, the APD now includes over 1 300 000 patient episodes. Between 2000 and 2011, 168 ICUs (89% of all units in Australia and New Zealand) had contributed data.⁷ Non-contributing units are predominantly small regional and private ICUs.

Although detailed patient information is collected for adult patients admitted to most ICUs in Australia and New Zealand in the APD, current information does not distinguish IHCA from OHCA. Given that these represent distinct patient populations, we aim to develop an approach for

ABSTRACT

Objectives: To develop methods for distinguishing patients with in-hospital cardiac arrest (IHCA) from patients with out-of-hospital cardiac arrest (OHCA) in routinely collected intensive care unit registry data, and to explore the utility of the methods for describing trends in adult ICU cardiac arrest (CA) admissions and outcomes.

Design and setting: A retrospective observational analysis of all ICU admissions entered in the Australian and New Zealand Intensive Care Society adult patient database between 2000 and 2011. Trends in admission and survival rates to hospital discharge over time were examined using eight different methods of classifying patients with IHCA and OHCA.

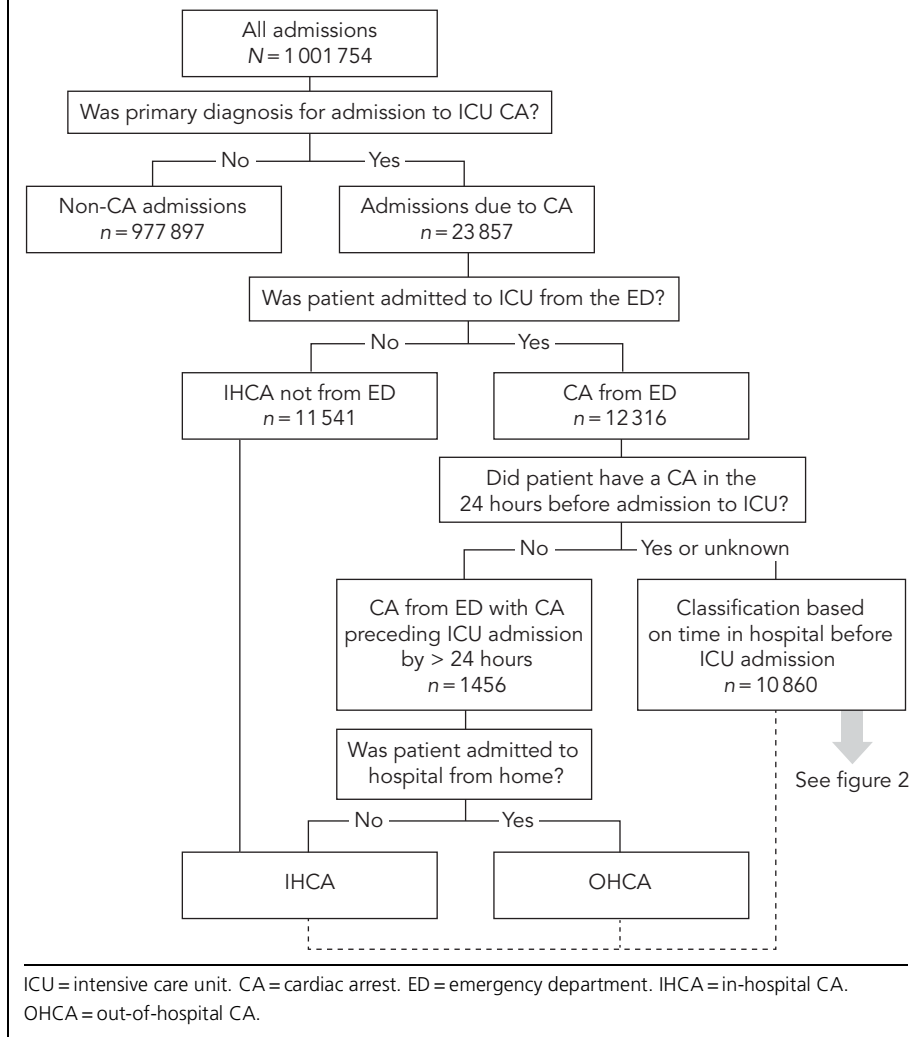
Results: There were 1 001 754 admissions to the ICUs between 2000 and 2011. Of these, postarrest admissions comprised 23 857 (2.4%), and increased annually by an average of 135 admissions (95% CI, 120–150 admissions). The annual volume of patients with IHCA as a fraction of total admissions declined by 0.4 patients/1000 admissions (95% CI, 0.3–0.5 patients/1000 admissions). In contrast, for patients with OHCA, each year was associated with an additional 0.2 patients/1000 admissions (95% CI, 0.1–0.4 patients/1000 admissions). This increase occurred in tertiary ICUs and declined in non-tertiary ICUs. Survival to hospital discharge for both groups improved, increasing annually by 1.2% (95% CI, 0.8%–1.6%) for patients with IHCA, and by 1.1% (95% CI, 0.7%–1.4%) for patients with OHCA.

Conclusions: Use of routinely collected registry data uncovered important trends in adult ICU admission and survival rates for patients with IHCA and OHCA. The improved survival rates and increased number of admissions to tertiary centres requires further study to understand mechanisms and related factors.

Crit Care Resusc 2014; 16: 104–111

distinguishing these groups. Our secondary objective is to describe the temporal trends in ICU admissions due to OHCA and IHCA and to examine the temporal variation in hospital mortality for both.

Figure 1. Classification of patients entering the ICU as non-CA, OHCA or IHCA patients



that OHCA patients would exclusively enter the ICU through the emergency department (ED) and that patients entering from other sources were most likely to be IHCA patients.

Next we attempted to distinguish OHCA from IHCA occurring within the ED. We used data identifying whether the patient had had a CA in the 24 hours before ICU admission. For patients who had not had a CA in the 24 hours before ICU admission, we classified those admitted to hospital from home as likely to have had an OHCA, and all others, including hospital transfers, as more likely to have had an IHCA. If a patient was recorded as having had a CA within 24 hours or if the data were incomplete or missing, we estimated the classification based on the duration of time in ED before ICU admission. We calculated the time in hospital before ICU admission using the date and time of arrival at hospital and ICU admission. If the dates resulted in negative durations or data were missing, we recoded the pre-ICU hours as missing.

We also assumed that patients who had had an OHCA were likely to pass through the ED faster than patients who had had an in-ED CA. Figure 2 shows how we classified patients as having had an IHCA or an OHCA, based on eight different

time thresholds. The value a represents the number of hours spent in the ED before ICU admission, which we used to classify patients who had had an OHCA. Patients in hospital for 0 – a hours before ICU admission were considered to have had an OHCA. Likewise, we used b to define patients who had had an IHCA, such that patients staying in hospital $>b$ hours before ICU admission were considered to have had an IHCA. Patients with durations of stay between a and b were classified as unknown. For example, in method 1, patients who were admitted to the ICU within 2 hours of admission to the ED were coded as OHCA, patients who were in the ED for >6 hours before ICU admission were coded as IHCA, and patients admitted between 2 and 6 hours after admission to the ED and those with missing times were coded as unknown, and excluded. To derive estimates of volume, we assigned excluded

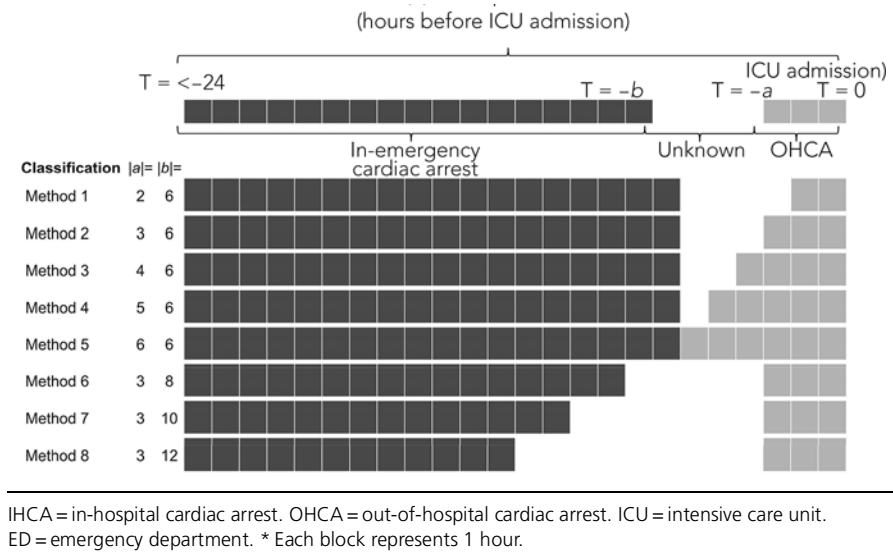
Methods

Data

We extracted de-identified data from the ANZICS APD for 2000 to 2011 for 1 001 754 patient episodes. Variables included patient sex, age, primary diagnosis for admission (assigned using the Acute Physiology and Chronic Health Evaluation [APACHE] III diagnostic codes),⁸ ICU admission source, ICU admission time and date, hospital admission time and date, hospital type (tertiary, metropolitan, rural or regional, or private) and a binary variable indicating whether or not the patient had suffered CA in the 24 hours preceding ICU admission.

We identified patients admitted to an ICU with CA as the primary diagnosis. To identify likely OHCA patients we first examined the ICU admission source (Figure 1). We proposed

Figure 2. Classification of IHCA and OHCA among patients admitted to ICU from ED, based on time in ED before admission to ICU*



patients as OHCA or IHCA based on the proportion of each that were classified using our *a* and *b* cut-points.

Sensitivity analysis

We tested the sensitivity of the OHCA and IHCA estimates for each of the eight classification methods (Figure 2). For both OHCA and IHCA, we calculated the mean age, the proportion of male patients and the survival rates. We examined the level of agreement between estimates to determine if the results were systematically affected by the classification method used.

We estimated the volume of OHCA and IHCA patients by assigning the data where the number of pre-ICU hours were missing, or where we had classified them as unknown. We classified patients that had spent <*a* hours in ED as OHCA, and patients that had spent >*b* hours as IHCA. Using these criteria, we defined *p* as the proportion of ED patients who had had an OHCA, such that $1-p=q$, where *q* is the proportion of patients admitted to the ICU from the ED after an IHCA. Patients not defined as having had an IHCA or an OHCA included those for whom the number of pre-ICU hours were between *a* and *b*, or for whom the dates or times of hospital or ICU entry were unknown or ill defined. We assumed that these patients could be assigned proportionately with the data that had previously been used to assign patients as as having had an IHCA or an OHCA.

Composition bias

There was potential for a composition bias caused by new ICUs joining the registry during the study period.⁹ To account

for this, we repeated all analyses using data only from ICUs that had contributed to every year of the study (ie, 2000–2011) and compared our results. We termed this subset of the data our all-year subset.

Data analysis

We examined the number of admissions to ICU due to IHCA and OHCA as fractions of the total ICU admissions, and we examined the number of admissions due to IHCA or OHCA by year to assess temporal trends. We then compared the number of CAs as a fraction of total admissions over time to account for changes in total ICU volume. We also assessed the change in admission patterns over time by sex and CA type, examined the trends in survival and compared

mortality between IHCA and OHCA. We used linear regression for trends in admission and survival over time.

We calculated the annual volume of CA admissions as a proportion of total admissions each year, and for individual ICUs in each year. The median value of site estimates in each year was compared with the annual estimates of OHCA admissions. We separately examined admission trends among tertiary and non-tertiary centres, as well as tertiary versus metropolitan, private and regional hospitals.

Estimates of the fraction of male patients, rates of survival to hospital discharge and mean age were calculated using only patients directly classified using the allocation method. To estimate the volumes, patients for whom the number of pre-ICU hours were unknown or whose pre-ICU hours were between the cut-off points were assigned to either OHCA or IHCA, based on the proportion of patients in each group already assigned.

Results

There were 1 001 754 admissions to 168 ICUs between 2000 and 2011. Sixty-seven ICUs contributed data for all 12 years (the all-year subset); they comprised 65.6% of the observations (657 121 admissions). Among all 168 ICUs, each year was associated with a 6140 (95% CI, 5497–6783) increase in the number of admissions captured by the registry (Table 1), and by 2321 (95% CI, 2058–2583) admissions when restricting to the all-year subset (Table 2).

Post-CA admissions comprised 23 857 admissions (2.4%), with the annual number rising from 1054 admissions in 2000 to 2684 admissions in 2011. On average,

Table 1. Data for all admissions to Australian and New Zealand adult intensive care units, 2000–2011, using method 7 to distinguish OHCA from IHCA

Admissions	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	β	95% CI
All															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140	5497 to 6783
Age*	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	0.1 to 0.2
Male (%)	61.1	60.4	60.4	60.1	59.7	59.3	59.9	59.4	59.0	58.5	58.3	58.0	–3.1	–0.3	–0.3 to –0.2
Survival†	84.2	84.8	85.4	85.9	86.4	87.3	87.8	87.9	88.1	88.6	89.3	89.5	5.3	0.5	0.4 to 0.5
CA															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	120 to 150
Vol/1000‡	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	–1.5	–0.2	–0.3 to 0.0
Age*	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	–2.3	–0.3	–0.5 to –0.2
Male (%)	62.8	61.2	62.5	63.2	62.9	64.0	66.4	66.9	66.2	65.1	66.5	68.4	5.6	0.5	0.4 to 0.7
Survival†	33.8	36.3	36.6	40.9	42.6	39.5	42.4	42.7	44.3	43.5	44.6	46.5	12.7	1.0	0.7 to 1.2
IHCA															
Volume	591	765	926	1045	1014	1031	1072	1113	1168	1128	1195	1179	589	44	30 to 59
Vol/1000‡	13.8	14.1	14.7	14.9	12.9	12.0	11.9	11.9	12.4	11.1	10.8	10.1	–3.6	–0.4	–0.5 to –0.3
Age*	66.0	66.8	68.4	68.6	67.0	68.3	67.0	67.1	65.7	66.3	65.8	64.8	–1.2	–0.2	–0.3 to 0.0
Male (%)	59.7	58.6	59.2	59.9	60.9	60.9	63.8	64.7	64.5	63.2	64.3	67.7	8.1	0.7	0.5 to 0.9
Survival†	32.7	39.9	38.7	40.4	45.3	39.5	43.6	46.3	46.5	44.7	47.6	50.6	17.8	1.2	0.8 to 1.6
OHCA															
Volume	463	609	614	681	937	963	968	1028	1194	1292	1376	1505	1041	91	82 to 100
Vol/1000‡	10.8	11.2	9.8	9.7	11.9	11.2	10.7	11.0	12.7	12.8	12.4	12.9	2.1	0.2	0.1 to 0.4
Age*	64.5	65.3	66.7	65.2	64.8	64.9	63.0	62.9	62.1	61.9	61.7	61.5	–3.0	–0.4	–0.6 to –0.3
Male (%)	66.7	63.9	65.6	67.7	64.5	67.7	69.1	68.3	68.0	66.7	67.4	70.4	3.8	0.3	0.09 to 0.58
Survival†	33.2	33.1	34.4	41.4	39.5	40.6	41.5	39.4	44.3	43.7	43.2	45.3	12.1	1.1	0.7 to 1.4

β = mean annual change. CA = cardiac arrest. IHCA = in-hospital CA. OHCA = out-of-hospital CA. * Mean (years). † Survival to hospital discharge (%). ‡ Volume/1000 admissions.

each year was associated with an additional 135 CA admissions (95% CI, 120–150 admissions). However, as a fraction of the total ICU admissions, CA admissions decreased slightly from 24.6 per 1000 admissions in 2000 to 23 per 1000 admissions in 2011 (Table 1).

Of the ICU admissions due to CA, 12 316 (51.6%) were admitted from the ED. Of these, 1456 patients (11.8%) had a CA more than 24 hours before admission to the ICU and were classified as IHCA, or OHCA if their hospital admission source was home. The remaining 10 860 admissions from ED (88.2%) were classified as OHCA or IHCA using the methods described in Figure 2. Comparing the survival rate estimates using the eight different approaches for distinguishing OHCA from IHCA, we found that all methods gave consistent results (Figure 3). The results presented here use method 7, in which patients in the ED less than 3 hours were classified as OHCA, and those in ED longer than 10 hours were

classified as IHCA. Full details of all results are shown in the Appendix (<http://www.cicm.org.au/journal.php>).

While the volume of OHCA versus IHCA was dependent on the time points used for classification, the trends over time were similar, irrespective of which classification was used. The volume of IHCA patients as a fraction of total admissions peaked in 2003 at 14.9/1000 admissions, and has since declined, reaching the lowest level in 2011, at 10.1/1000 admissions (Table 1). This decline in IHCA cases as a fraction of total admissions was also seen in the all-year subset. Based on the linear regression, each year was associated with a 0.4/1000 admissions decline (95% CI, 0.3–0.5/1000 admissions decline) in the fraction of total admissions among all units (Table 1). Similarly, there was a 0.2/1000 admissions decline (95% CI, 0.1–0.3/1000 admissions decline) in the all-year subset (Table 2). The mean age of IHCA patients was 66.8 years, and 62.6% of admissions were male. Survival for IHCA patients has increased, rising

Table 2. Descriptive statistics for the intensive care units that contributed to data for all years 2000–2011, using method 7 to distinguish OHCA from IHCA

Admissions	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	β	95% CI
All															
Volume	38472	45806	47882	50404	52437	53615	55646	58660	58304	62295	65781	67819	29347	2321	2058 to 2583
Age*	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1	0.0 to 0.2
Male (%)	61.1	60.3	60.1	59.6	58.8	58.5	59.2	58.9	58.8	57.9	58.3	57.9	-3.1	-0.3	-0.3 to -0.2
Survival†	83.9	84.6	84.6	85.1	85.6	86.2	86.4	86.6	87.0	87.5	88.2	88.6	4.7	0.4	0.4 to 0.4
CA															
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61	50 to 71
Vol/1000‡	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	-0.2	0.0	-0.1 to 0.2
Age*	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	-2.2	-0.3	-0.4 to -0.1
Male (%)	62.9	61.3	61.4	63.7	62.0	62.2	65.1	65.4	65.8	64.1	65.5	68.1	5.2	0.5	0.3 to 0.7
Survival†	33.0	36.4	36.6	40.1	42.0	39.6	38.6	40.1	42.3	43.0	43.4	44.4	11.4	0.8	0.6 to 1.1
IHCA															
Volume	541	649	747	777	701	704	712	785	846	808	838	822	281	20	12 to 29
Vol/1000‡	14.1	14.2	15.6	15.4	13.4	13.1	12.8	13.4	14.5	13.0	12.7	12.1	-2.0	-0.2	-0.3 to -0.1
Age*	66.0	66.2	68.4	68.1	66.4	67.6	67.1	67.3	65.7	66.2	65.6	64.5	-1.5	-0.2	-0.3 to 0.0
Male (%)	60.3	58.5	57.1	59.7	58.6	59.4	62.4	63.8	65.1	62.7	64.9	67.9	7.6	0.8	0.51 to 1.1
Survival†	31.8	38.6	38.4	39.3	44.4	39.4	40.1	41.6	43.7	44.6	46.3	47.1	15.3	1.0	0.7 to 1.4
OHCA															
Volume	430	541	498	467	624	628	606	657	757	860	824	877	447	40	32 to 49
Vol/1000‡	11.2	11.8	10.4	9.3	11.9	11.7	10.9	11.2	13.0	13.8	12.5	12.9	1.8	0.2	0.1 to 0.4
Age*	64.7	65.1	66.5	64.4	64.9	65.4	63.3	62.8	62.1	61.5	62.0	62.0	-2.7	-0.4	-0.5 to -0.3
Male (%)	66.8	63.1	66.6	69.2	65.1	65.5	69.9	66.6	67.1	65.4	65.8	70.6	3.8	0.2	-0.2 to 0.5
Survival†	32.8	35.0	34.1	39.8	38.2	40.6	38.2	38.7	42.7	43.6	42.2	44.2	11.4	0.9	0.7 to 1.2

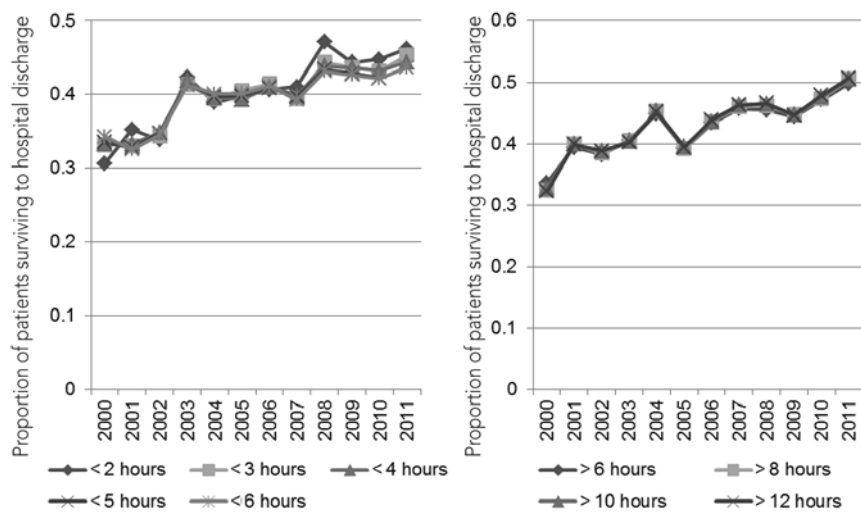
β = mean annual change. CA = cardiac arrest. IHCA = in-hospital CA. OHCA = out-of-hospital CA. * Mean (years). † Survival to hospital discharge (%). ‡ Volume/1000 admissions.

from 32.7% in 2000 to 50.6% in 2011, and the linear regression suggests that each year is associated with 1.2% increase in the survival rate (95% CI, 0.8%–1.6% increase) (Table 1). When restricted to the all-year subset, we found that the magnitude of association was weaker, although still statistically significant, with each year associated with an increase in the survival rate of 1% (95% CI, 0.7%–1.4%) (Table 2).

The number of patients admitted to the ICU in Australia and New Zealand after an OHCA has also increased, from 463 patients in 2000 to 1505 in 2011. Each year was associated with an average increase of 91 OHCA ICU admissions (95% CI, 82–100 admissions) and an increase of 40 admissions (95% CI, 32–49 admissions) seen in the all-year subset. The decline in the proportion of total admissions due to CA occurred at the same time as increases in the absolute volume of OHCA patients as well as an increase in their share of the total admissions.

Among all admissions, each year was associated with an additional two OHCA patients/10 000 admissions (95% CI, 1–4 patients/10 000 admissions) in the total data and the all-year subset. Men accounted for 67.5% of OHCA admissions. The mean age of OHCA admissions was lower than IHCA patients (63.2 years v 66.8 years). The age of OHCA patients declined over time, with each year being associated with a 0.4-year decline (95% CI, 0.3–0.6-year decline in the mean age among all patients, and 0.4-year decline (95% CI, 0.3–0.5-year decline) in our all-year subset. This was in contrast to all patients admitted to the ICU, for whom the average age remained relatively constant (a minimum of 60.3 years in 2000 to a maximum of 62.1 years in 2010). Survival to discharge among OHCA patients has increased over time, with each year associated with a 1.1% increase (95% CI, 0.7%–1.4%) in survival to hospital discharge from 33.2% in 2000 to 45.3% in 2011.

Figure 3. Proportion of patients surviving to hospital discharge. Left: OHCA-classified patients v IHCA-classified patients. Right: OHCA-classified patients v IHCA-classified patients, using different classification cut-points



OHCA = out-of-hospital cardiac arrest. IHCA = in-hospital cardiac arrest.

Among the ICUs contributing data to all 12 years, the annual volume of OHCA as a proportion of total admissions increased at the same time as the median volume/1000 admissions among sites tended to decline, although that trend was not statistically significant. Admission rates for OHCA increased among tertiary hospital ICUs but declined in non-tertiary sites (Figure 4, right). Among non-tertiary hospitals, the declines were driven by a decline in metropolitan hospitals. The rate in rural and regional hospital centres increased slightly and private hospitals remained stable. Admission rates for IHCA declined in tertiary and non-tertiary sites (Figure 4, left).

Discussion

The ability to distinguish OHCA from IHCA in routinely collected data has important implications for monitoring outcomes for these populations independently. Our study has shown that it is possible to obtain estimates of admission and survival rates for OHCA and IHCA in an Australian and New Zealand registry of ICU admissions, and that significant change has occurred over the past decade. Using our classification method, we found that the number of patients with OHCA entering ICU has increased steadily between 2000 and 2011. This increase may reflect improvements in pre-hospital care which have led to more patients with OHCA surviving to hospital admission,¹⁰ as well as increases in the total population and shifts in the age distribution. The increase may also reflect a greater propen-

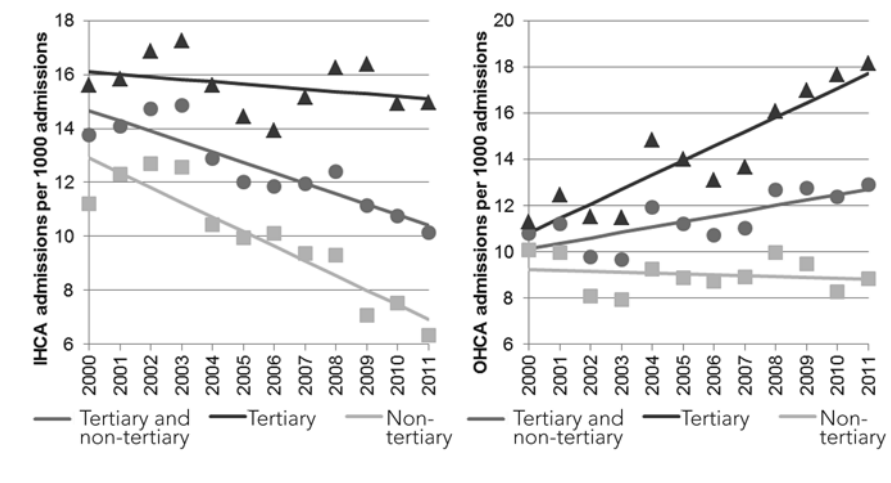
sity in recent years to transfer patients with OHCA to the ICU, because of improvements in postarrest care, such as therapeutic hypothermia.¹¹⁻¹⁴

Despite underlying population growth, we found only small increases in the number of patients being admitted to the ICU after an IHCA, and the rate of patients with IHCA declined as a proportion of total ICU admissions. Although it was not possible to directly calculate numbers of patients with IHCA as a rate of hospital admissions, the declines in IHCA admissions as a proportion of the admissions to the ICU suggest that the rate of patients with IHCA is declining. This theory is supported by previous research which found that the implementation of medical emergency teams in hospitals was associated with a decline in IHCA events.^{6,15}

This trend may also be explained by an increased use of advance care directives and “do not resuscitate” orders by hospitals.

We also found that, over time, patients with OHCA comprised a larger proportion of the total ICU postarrest patients. Over the same time, we found that the median proportion of patients with OHCA admitted among sites declined. This suggests that, over time, there has been a concentration of patients with OHCA to fewer sites. When we examined the rates of admissions of patients with OHCA in tertiary and non-tertiary centres separately, we found that patients with OHCA comprise an increasing fraction of ICU patients in tertiary centres, but a declining share in non-tertiary metropolitan hospitals. Taken together, these results suggest a concentration of patients with OHCA over time. The regionalisation of OHCA care and establishment of CA centres is controversial.^{16,17} However, our results suggest that centralisation of care for patients with OHCA may be occurring despite the lack of a clear consensus. While it is not possible, using the APD, to determine the cause of this regionalisation, a possible explanation is variations in the availability of postarrest treatment, such as percutaneous coronary intervention¹⁸ and therapeutic hypothermia. Emergency medical services may be more likely to transfer patients with OHCA, and EDs to admit them, to hospitals offering these services. A recent study from the United States found that hospital characteristics similar to those seen in Australian tertiary hospitals (ie, teaching hospitals and hospitals with percutaneous coronary intervention capabilities) were associated with patients

Figure 4. Trends in IHCA (left) and OHCA (right) admission rates among tertiary and non-tertiary hospital ICUs



OHCA = out-of-hospital cardiac arrest. IHCA = in-hospital cardiac arrest. ICU = intensive care unit.

ICU. We expect this number to be small, though it is not possible for us to quantify. Finally, patients were only classified as patients with CA if their primary reason for admission was coded as CA. Some patients may have suffered a CA before admission but were coded with a different primary diagnosis.

Ideally, prospectively collected data distinguishing patients with IHCA from patients with OHCA would be collected in the registry, as has been reported in single-site studies,²² but such changes to data collection require consensus among participating sites. Furthermore, decisions about collection of additional data must be balanced with consideration of the already large burden placed on clinicians by data collection. If

with OHCA surviving the ED to be admitted to hospital. The regionalisation may also explain some of the improvements in survival seen in our data.

Recent research in Australia¹⁸ and internationally¹⁹ has shown that hospital characteristics and capabilities are also associated with improved survival among patients with CA. These and other studies^{10,20} have also reported similar increases in CA survival rates over time for both OHCA and IHCA. Reasons for these gains in survival are likely to be multifactorial.²⁰ The methods described here will provide the ability for future studies to examine the factors associated with this improved survival at a national level, which is necessary to consolidate the survival gains.²⁰

The primary limitation of this study is that the registry does not explicitly identify patients with OHCA and IHCA. For this reason, it is likely that some patients have been misclassified in our study—in particular, patients who have a CA in the ED very soon after arriving, and patients with OHCA that may be transferred from another hospital through the ED. To address this, we tested the sensitivity of our survival estimates using various classification points and found that the rates were not sensitive to the time threshold. This suggests that our estimates of survival are likely to provide reasonable estimates of the rates among the true OHCA and IHCA populations. Previous research has reviewed case records to classify patients as having had an IHCA or an OHCA,²¹ but this approach is not feasible for retrospective analysis of the registry for several years. We assumed that all patients with OHCA would enter the ICU from the ED. It is possible that a patient with OHCA might become well enough to be transferred to the ward, then deteriorate and come to the

such data became available, future analyses would be strengthened by the ability to link with historical trends.

Conclusion

Routinely collected registry data can be used to make inferences about mortality and admission trends among patients with IHCA and OHCA. There were significant improvements in survival among patients with IHCA and OHCA admitted to the ICU between 2000 and 2011. Our study provides some evidence that patients with OHCA are being concentrated in fewer ICUs, but further research is required to understand the mechanisms and reasons for this trend as well as the increase in survival.

Competing interests

None declared.

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METHOD 1: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140	(5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	(0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5%	(0.4% to 0.5%)
Cardiac arrests															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	(120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2	(−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3	(−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5%	(0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0%	(0.7% to 1.2%)
IHCA															
Volume	674	890	1063	1195	1198	1242	1259	1413	1484	1472	1583	1539	864	72	(58 to 87)
Volume/1000 admissions	15.7	16.4	16.9	17.0	15.2	14.5	13.9	15.2	15.8	14.5	14.2	13.2	−2.5	−0.2	(−0.4 to −0.1)
Mean age (years)	66.2	67.0	68.4	68.5	67.3	68.3	67.0	67.3	66.5	66.6	66.1	65.4	−0.9	−0.1	(−0.3 to 0.0)
% Male	59.2%	58.2%	59.8%	61.0%	61.1%	60.2%	63.8%	65.2%	63.9%	62.2%	64.8%	66.6%	7.4%	0.7%	(0.5% to 0.9%)
Survival to hospital discharge	32.9%	39.7%	37.6%	40.3%	44.9%	39.6%	42.9%	45.5%	45.3%	45.1%	48.0%	49.3%	16.5%	1.2%	(0.8% to 1.5%)
OHCA															
Volume	380	484	477	531	753	752	781	728	878	948	988	1145	766	63	(53 to 73)
Volume/1000 admissions	8.8	8.9	7.6	7.5	9.6	8.8	8.6	7.8	9.3	9.4	8.9	9.8	1.0	0.1	(0.0 to 0.2)
Mean age (years)	64.5	64.2	66.3	64.2	64.3	64.5	62.7	61.5	59.4	60.9	59.8	58.9	−5.6	−0.6	(−0.8 to −0.4)
% Male	69.3%	62.2%	67.1%	68.2%	63.8%	72.4%	70.3%	66.3%	69.1%	68.3%	67.1%	70.1%	0.8%	0.2%	(−0.21% to 0.70%)
Survival to hospital discharge	31.9%	31.4%	36.3%	43.2%	37.0%	36.0%	40.5%	37.9%	47.3%	42.5%	43.4%	45.8%	13.9%	1.2%	(0.6% to 1.7%)

METHOD 1: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321 (2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1 (0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	–3.1%	–0.3% (–0.3% to –0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4% (0.4% to 0.4%)
Cardiac arrests														
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61 (50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	–0.2	0.0 (–0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	–2.2	–0.3 (–0.4 to –0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5% (0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8% (0.6% to 1.1%)
IHCA														
Volume	619	760	861	888	826	861	834	992	1074	1062	1090	1062	443	37 (27 to 48)
Volume/1000 admissions	16.1	16.6	18.0	17.6	15.7	16.1	15.0	16.9	18.4	17.0	16.6	15.7	–0.4	0.0 (–0.2 to 0.2)
Mean age (years)	66.2	66.5	68.4	68.2	66.8	67.6	67.0	67.5	66.1	66.3	65.8	65.2	–1.0	–0.1 (–0.3 to 0.0)
% Male	59.7%	58.2%	58.0%	60.8%	59.1%	58.4%	63.0%	64.0%	64.5%	61.7%	65.7%	66.7%	7.0%	0.7% (0.4% to 1.0%)
Survival to hospital discharge	32.2%	38.7%	36.9%	39.4%	44.0%	40.0%	40.2%	41.3%	42.6%	44.5%	46.4%	45.6%	13.4%	1.0% (0.6% to 1.3%)
OHCA														
Volume	352	430	384	356	499	471	484	450	529	606	572	637	285	23 (16 to 30)
Volume/1000 admissions	9.2	9.4	8.0	7.1	9.5	8.8	8.7	7.7	9.1	9.7	8.7	9.4	0.2	0.0 (–0.1 to 0.2)
Mean age (years)	64.8	64.0	66.0	63.5	64.2	65.8	63.5	61.3	59.1	60.2	60.5	59.0	–5.8	–0.6 (–0.8 to –0.4)
% Male	69.6%	61.0%	67.9%	72.3%	64.0%	71.0%	72.1%	65.2%	68.0%	67.6%	64.7%	70.5%	1.0%	0.1% (–0.52% to 0.69%)
Survival to hospital discharge	32.2%	32.8%	36.9%	44.0%	35.0%	35.6%	37.1%	37.7%	47.8%	44.5%	43.0%	46.1%	14.0%	1.1% (0.6% to 1.7%)

METHOD 2: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6 140	(5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	(0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5%	(0.4% to 0.5%)
Cardiac arrests															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	(120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2	(−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3	(−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5%	(0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0%	(0.7% to 1.2%)
IHCA															
Volume	647	855	1027	1140	1150	1187	1194	1328	1388	1372	1450	1424	776	63	(49 to 78)
Volume/1000 admissions	15.1	15.7	16.3	16.2	14.6	13.8	13.2	14.2	14.7	13.5	13.0	12.2	−2.9	−0.3	(−0.4 to −0.2)
Mean age (years)	66.2	67.0	68.4	68.5	67.3	68.3	67.0	67.3	66.5	66.6	66.1	65.4	−0.9	−0.1	(−0.3 to 0.0)
% Male	59.2%	58.2%	59.8%	61.0%	61.1%	60.2%	63.8%	65.2%	63.9%	62.2%	64.8%	66.6%	7.4%	0.7%	(0.5% to 0.9%)
Survival to hospital discharge	32.9%	39.7%	37.6%	40.3%	44.9%	39.6%	42.9%	45.5%	45.3%	45.1%	48.0%	49.3%	16.5%	1.2%	(0.8% to 1.5%)
OHCA															
Volume	407	519	513	586	801	807	846	813	974	1048	1121	1260	854	72	(63 to 81)
Volume/1000 admissions	9.5	9.6	8.2	8.3	10.2	9.4	9.4	8.7	10.3	10.4	10.1	10.8	1.3	0.1	(0.0 to 0.3)
Mean age (years)	64.4	64.5	66.4	64.6	64.0	64.6	62.5	61.9	60.1	61.1	60.3	59.8	−4.6	−0.5	(−0.7 to −0.4)
% Male	68.4%	65.4%	67.0%	66.8%	64.6%	69.4%	70.5%	67.9%	69.7%	66.6%	68.8%	71.9%	3.5%	0.3%	(0.01% to 0.62%)
Survival to hospital discharge	34.6%	29.7%	36.4%	41.7%	38.2%	38.0%	41.6%	36.5%	43.3%	42.2%	41.7%	44.7%	10.2%	0.9%	(0.5% to 1.4%)

METHOD 2: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321 (2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1 (0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	−3.1%	−0.3% (−0.3% to −0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4% (0.4% to 0.4%)
Cardiac arrests														
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61 (50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	−0.2	0.0 (−0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	−2.2	−0.3 (−0.4 to −0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5% (0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8% (0.6% to 1.1%)
IHCA														
Volume	595	729	834	851	800	821	794	936	1004	980	997	982	387	31 (21 to 41)
Volume/1000 admissions	15.5	15.9	17.4	16.9	15.2	15.3	14.3	16.0	17.2	15.7	15.2	14.5	−1.0	−0.1 (−0.3 to 0.1)
Mean age (years)	66.2	66.5	68.4	68.2	66.8	67.6	67.0	67.5	66.1	66.3	65.8	65.2	−1.0	−0.1 (−0.3 to 0.0)
% Male	59.7%	58.2%	58.0%	60.8%	59.1%	58.4%	63.0%	64.0%	64.5%	61.7%	65.7%	66.7%	7.0%	0.7% (0.4% to 1.0%)
Survival to hospital discharge	32.2%	38.7%	36.9%	39.4%	44.0%	40.0%	40.2%	41.3%	42.6%	44.5%	46.4%	45.6%	13.4%	1.0% (0.6% to 1.3%)
OHCA														
Volume	376	461	411	393	525	511	524	506	599	688	665	717	341	30 (23 to 37)
Volume/1000 admissions	9.8	10.1	8.6	7.8	10.0	9.5	9.4	8.6	10.3	11.0	10.1	10.6	0.8	0.1 (0.0 to 0.3)
Mean age (years)	64.6	64.2	66.2	63.3	64.0	65.8	63.2	62.0	60.2	60.6	60.6	60.1	−4.6	−0.5 (−0.7 to −0.3)
% Male	68.7%	64.5%	68.1%	68.9%	65.9%	67.7%	71.7%	67.3%	69.5%	65.3%	67.7%	72.4%	3.7%	0.2% (−0.17% to 0.59%)
Survival to hospital discharge	34.1%	31.4%	36.8%	40.7%	36.5%	37.3%	37.2%	35.7%	42.7%	43.0%	42.6%	43.5%	9.4%	0.9% (0.5% to 1.3%)

METHOD 3: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140	(5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	(0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5%	(0.4% to 0.5%)
Cardiac arrests															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	(120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2	(−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3	(−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5%	(0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0%	(0.7% to 1.2%)
IHCA															
Volume	632	838	1008	1110	1127	1158	1172	1288	1340	1322	1397	1381	749	60	(46 to 74)
Volume/1000 admissions	14.7	15.4	16.0	15.8	14.3	13.5	13.0	13.8	14.2	13.0	12.6	11.9	−2.9	−0.3	(−0.4 to −0.2)
Mean age (years)	66.2	67.0	68.4	68.5	67.3	68.3	67.0	67.3	66.5	66.6	66.1	65.4	−0.9	−0.1	(−0.3 to 0.0)
% Male	59.2%	58.2%	59.8%	61.0%	61.1%	60.2%	63.8%	65.2%	63.9%	62.2%	64.8%	66.6%	7.4%	0.7%	(0.5% to 0.9%)
Survival to hospital discharge	32.9%	39.7%	37.6%	40.3%	44.9%	39.6%	42.9%	45.5%	45.3%	45.1%	48.0%	49.3%	16.5%	1.2%	(0.8% to 1.5%)
OHCA															
Volume	422	536	532	616	824	836	868	853	1022	1098	1174	1303	881	75	(67 to 84)
Volume/1000 admissions	9.8	9.9	8.5	8.8	10.5	9.7	9.6	9.2	10.9	10.8	10.6	11.2	1.4	0.2	(0.0 to 0.3)
Mean age (years)	64.3	64.8	66.7	64.4	64.0	64.2	63.0	62.0	60.5	61.4	61.0	60.2	−4.0	−0.5	(−0.7 to −0.3)
% Male	68.5%	64.9%	68.3%	66.1%	64.6%	68.4%	70.1%	68.0%	69.7%	67.0%	68.8%	70.9%	2.3%	0.3%	(0.00% to 0.57%)
Survival to hospital discharge	34.4%	30.4%	36.7%	42.2%	38.5%	36.9%	41.1%	37.7%	42.9%	42.5%	42.0%	43.7%	9.3%	0.9%	(0.5% to 1.3%)

METHOD 3: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321	(2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1	(0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	–3.1%	–0.3%	(–0.3% to –0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4%	(0.4% to 0.4%)
Cardiac arrests															
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61	(50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	–0.2	0.0	(–0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	–2.2	–0.3	(–0.4 to –0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5%	(0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8%	(0.6% to 1.1%)
IHCA															
Volume	582	715	820	831	786	801	780	907	972	942	963	954	372	29	(19 to 38)
Volume/1000 admissions	15.1	15.6	17.1	16.5	15.0	14.9	14.0	15.5	16.7	15.1	14.6	14.1	–1.1	–0.1	(–0.3 to 0.0)
Mean age (years)	66.2	66.5	68.4	68.2	66.8	67.6	67.0	67.5	66.1	66.3	65.8	65.2	–1.0	–0.1	(–0.3 to 0.0)
% Male	59.7%	58.2%	58.0%	60.8%	59.1%	58.4%	63.0%	64.0%	64.5%	61.7%	65.7%	66.7%	7.0%	0.7%	(0.4% to 1.0%)
Survival to hospital discharge	32.2%	38.7%	36.9%	39.4%	44.0%	40.0%	40.2%	41.3%	42.6%	44.5%	46.4%	45.6%	13.4%	1.0%	(0.6% to 1.3%)
OHCA															
Volume	389	475	425	413	539	531	538	535	631	726	699	745	356	32	(25 to 39)
Volume/1000 admissions	10.1	10.4	8.9	8.2	10.3	9.9	9.7	9.1	10.8	11.6	10.6	11.0	0.9	0.1	(0.0 to 0.3)
Mean age (years)	64.7	64.3	66.3	63.3	63.7	65.2	63.9	62.0	60.8	61.1	60.9	60.6	–4.2	–0.5	(–0.6 to –0.3)
% Male	68.2%	64.3%	68.8%	68.3%	65.8%	66.7%	70.2%	66.5%	69.1%	65.4%	66.2%	70.6%	2.4%	0.1%	(–0.23% to 0.43%)
Survival to hospital discharge	33.3%	32.1%	37.2%	41.0%	37.1%	37.0%	35.5%	36.4%	42.1%	41.6%	42.2%	42.4%	9.1%	0.8%	(0.4% to 1.2%)

METHOD 4: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140 (5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1 (0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3% (−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5% (0.4% to 0.5%)
Cardiac arrests														
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135 (120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2 (−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3 (−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5% (0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0% (0.7% to 1.2%)
IHCA														
Volume	625	831	997	1096	1117	1145	1160	1265	1321	1301	1375	1360	735	58 (44 to 72)
Volume/1000 admissions	14.6	15.3	15.8	15.6	14.2	13.3	12.8	13.6	14.0	12.8	12.4	11.7	−2.9	−0.3 (−0.4 to −0.2)
Mean age (years)	66.2	67.0	68.4	68.5	67.3	68.3	67.0	67.3	66.5	66.6	66.1	65.4	−0.9	−0.1 (−0.3 to 0.0)
% Male	59.2%	58.2%	59.8%	61.0%	61.1%	60.2%	63.8%	65.2%	63.9%	62.2%	64.8%	66.6%	7.4%	0.7% (0.5% to 0.9%)
Survival to hospital discharge	32.9%	39.7%	37.6%	40.3%	44.9%	39.6%	42.9%	45.5%	45.3%	45.1%	48.0%	49.3%	16.5%	1.2% (0.8% to 1.5%)
OHCA														
Volume	429	543	543	630	834	849	880	876	1041	1119	1196	1324	895	77 (69 to 85)
Volume/1000 admissions	10.0	10.0	8.6	8.9	10.6	9.9	9.7	9.4	11.1	11.0	10.8	11.4	1.4	0.2 (0.0 to 0.3)
Mean age (years)	64.5	64.9	66.9	64.6	64.3	64.2	63.3	62.4	60.9	61.9	61.2	60.6	−3.9	−0.5 (−0.6 to −0.3)
% Male	68.4%	65.0%	67.9%	66.2%	64.8%	68.5%	70.1%	68.8%	69.0%	67.4%	69.0%	70.3%	1.9%	0.3% (0.03% to 0.54%)
Survival to hospital discharge	34.7%	29.9%	36.4%	41.7%	38.7%	37.7%	40.9%	37.7%	42.4%	41.6%	40.9%	43.2%	8.5%	0.8% (0.4% to 1.2%)

METHOD 4: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321	(2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1	(0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	–3.1%	–0.3%	(–0.3% to –0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4%	(0.4% to 0.4%)
Cardiac arrests															
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61	(50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	–0.2	0.0	(–0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	–2.2	–0.3	(–0.4 to –0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5%	(0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8%	(0.6% to 1.1%)
IHCA															
Volume	576	709	811	822	780	794	773	890	956	927	948	937	361	28	(19 to 37)
Volume/1000 admissions	15.0	15.5	16.9	16.3	14.9	14.8	13.9	15.2	16.4	14.9	14.4	13.8	–1.2	–0.1	(–0.3 to 0.0)
Mean age (years)	66.2	66.5	68.4	68.2	66.8	67.6	67.0	67.5	66.1	66.3	65.8	65.2	–1.0	–0.1	(–0.3 to 0.0)
% Male	59.7%	58.2%	58.0%	60.8%	59.1%	58.4%	63.0%	64.0%	64.5%	61.7%	65.7%	66.7%	7.0%	0.7%	(0.4% to 1.0%)
Survival to hospital discharge	32.2%	38.7%	36.9%	39.4%	44.0%	40.0%	40.2%	41.3%	42.6%	44.5%	46.4%	45.6%	13.4%	1.0%	(0.6% to 1.3%)
OHCA															
Volume	395	481	434	422	545	538	545	552	647	741	714	762	367	33	(26 to 40)
Volume/1000 admissions	10.3	10.5	9.1	8.4	10.4	10.0	9.8	9.4	11.1	11.9	10.9	11.2	1.0	0.2	(0.0 to 0.3)
Mean age (years)	65.0	64.6	66.5	63.8	63.9	65.3	64.0	62.5	61.2	61.8	61.2	61.0	–4.0	–0.4	(–0.6 to –0.3)
% Male	67.9%	64.7%	68.1%	68.4%	66.1%	66.5%	69.7%	67.3%	68.4%	66.0%	66.2%	69.8%	2.0%	0.1%	(–0.17% to 0.36%)
Survival to hospital discharge	33.3%	31.7%	37.4%	40.5%	37.6%	37.8%	35.7%	37.0%	41.3%	40.5%	40.6%	41.8%	8.5%	0.7%	(0.3% to 1.0%)

METHOD 5: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011		(95% CI)
All admissions															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140	(5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	(0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5%	(0.4% to 0.5%)
Cardiac arrests															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	(120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2	(−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3	(−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5%	(0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0%	(0.7% to 1.2%)
IHCA															
Volume	622	825	991	1088	1112	1139	1154	1257	1313	1292	1363	1353	731	58	(44 to 72)
Volume/1000 admissions	14.5	15.2	15.7	15.5	14.1	13.3	12.8	13.5	14.0	12.8	12.3	11.6	−2.9	−0.3	(−0.4 to −0.2)
Mean age (years)	66.2	67.0	68.4	68.5	67.3	68.3	67.0	67.3	66.5	66.6	66.1	65.4	−0.9	−0.1	(−0.3 to 0.0)
% Male	59.2%	58.2%	59.8%	61.0%	61.1%	60.2%	63.8%	65.2%	63.9%	62.2%	64.8%	66.6%	7.4%	0.7%	(0.5% to 0.9%)
Survival to hospital discharge	32.9%	39.7%	37.6%	40.3%	44.9%	39.6%	42.9%	45.5%	45.3%	45.1%	48.0%	49.3%	16.5%	1.2%	(0.8% to 1.5%)
OHCA															
Volume	432	549	549	638	839	855	886	884	1049	1128	1208	1331	899	77	(69 to 85)
Volume/1000 admissions	10.1	10.1	8.7	9.1	10.7	10.0	9.8	9.5	11.1	11.1	10.9	11.4	1.4	0.2	(0.0 to 0.3)
Mean age (years)	64.4	64.9	67.0	64.9	64.3	64.1	63.2	62.4	61.2	61.9	61.5	60.8	−3.6	−0.5	(−0.6 to −0.3)
% Male	67.8%	65.0%	68.7%	66.6%	65.3%	68.3%	70.0%	68.9%	69.1%	67.4%	69.2%	70.0%	2.2%	0.3%	(0.04% to 0.50%)
Survival to hospital discharge	35.4%	29.8%	36.1%	41.6%	39.2%	38.2%	41.2%	37.3%	42.2%	41.4%	40.9%	42.9%	7.5%	0.8%	(0.3% to 1.2%)

METHOD 5: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321	(2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1	(0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4%	(0.4% to 0.4%)
Cardiac arrests															
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61	(50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	−0.2	0.0	(−0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	−2.2	−0.3	(−0.4 to −0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5%	(0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8%	(0.6% to 1.1%)
IHCA															
Volume	573	704	806	817	777	789	768	885	950	920	939	931	359	27	(18 to 36)
Volume/1000 admissions	14.9	15.4	16.8	16.2	14.8	14.7	13.8	15.1	16.3	14.8	14.3	13.7	−1.2	−0.1	(−0.3 to 0.0)
Mean age (years)	66.2	66.5	68.4	68.2	66.8	67.6	67.0	67.5	66.1	66.3	65.8	65.2	−1.0	−0.1	(−0.3 to 0.0)
% Male	59.7%	58.2%	58.0%	60.8%	59.1%	58.4%	63.0%	64.0%	64.5%	61.7%	65.7%	66.7%	7.0%	0.7%	(0.4% to 1.0%)
Survival to hospital discharge	32.2%	38.7%	36.9%	39.4%	44.0%	40.0%	40.2%	41.3%	42.6%	44.5%	46.4%	45.6%	13.4%	1.0%	(0.6% to 1.3%)
OHCA															
Volume	398	486	439	427	548	543	550	557	653	748	723	768	369	33	(26 to 40)
Volume/1000 admissions	10.4	10.6	9.2	8.5	10.4	10.1	9.9	9.5	11.2	12.0	11.0	11.3	1.0	0.2	(0.0 to 0.3)
Mean age (years)	64.9	64.7	66.6	64.1	63.9	65.2	64.0	62.4	61.5	61.8	61.6	61.2	−3.7	−0.4	(−0.6 to −0.3)
% Male	67.3%	64.9%	68.8%	69.4%	66.3%	66.3%	69.0%	67.3%	68.6%	65.9%	66.6%	69.7%	2.4%	0.1%	(−0.19% to 0.34%)
Survival to hospital discharge	34.1%	31.6%	37.4%	41.4%	38.1%	38.3%	35.9%	37.2%	41.4%	40.6%	40.4%	41.7%	7.5%	0.6%	(0.3% to 1.0%)

METHOD 6: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140 (5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1 (0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3% (−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5% (0.4% to 0.5%)
Cardiac arrests														
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135 (120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2 (−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3 (−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5% (0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0% (0.7% to 1.2%)
IHCA														
Volume	612	831	1002	1115	1104	1147	1154	1255	1315	1263	1353	1335	723	56 (40 to 71)
Volume/1000 admissions	14.2	15.3	15.9	15.8	14.0	13.4	12.8	13.5	14.0	12.5	12.2	11.5	−2.8	−0.3 (−0.5 to −0.2)
Mean age (years)	66.0	67.0	68.4	68.6	67.4	68.2	67.1	67.3	66.5	66.6	66.1	65.2	−0.8	−0.1 (−0.3 to 0.0)
% Male	59.1%	58.1%	59.5%	60.5%	61.2%	60.4%	63.6%	64.8%	63.9%	62.7%	64.7%	67.0%	7.9%	0.7% (0.5% to 0.9%)
Survival to hospital discharge	31.7%	40.3%	37.8%	40.3%	45.1%	39.5%	43.2%	45.5%	46.0%	45.5%	48.5%	50.0%	18.3%	1.3% (0.9% to 1.7%)
OHCA														
Volume	443	543	538	611	847	847	886	886	1047	1157	1218	1349	907	79 (70 to 88)
Volume/1000 admissions	10.3	10.0	8.6	8.7	10.8	9.9	9.8	9.5	11.1	11.4	11.0	11.6	1.3	0.2 (0.0 to 0.3)
Mean age (years)	64.4	64.5	66.4	64.6	64.0	64.6	62.5	61.9	60.1	61.1	60.3	59.8	−4.6	−0.5 (−0.7 to −0.4)
% Male	68.4%	65.4%	67.0%	66.8%	64.6%	69.4%	70.5%	67.9%	69.7%	66.6%	68.8%	71.9%	3.5%	0.3% (0.01% to 0.62%)
Survival to hospital discharge	34.6%	29.7%	36.4%	41.7%	38.2%	38.0%	41.6%	36.5%	43.3%	42.2%	41.7%	44.7%	10.2%	0.9% (0.5% to 1.4%)

METHOD 6: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321 (2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1 (0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	−3.1%	−0.3% (−0.3% to −0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4% (0.4% to 0.4%)
Cardiac arrests														
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61 (50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	−0.2	0.0 (−0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	−2.2	−0.3 (−0.4 to −0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5% (0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8% (0.6% to 1.1%)
IHCA														
Volume	560	710	813	836	766	793	769	890	951	893	929	914	355	26 (15 to 36)
Volume/1000 admissions	14.5	15.5	17.0	16.6	14.6	14.8	13.8	15.2	16.3	14.3	14.1	13.5	−1.1	−0.2 (−0.3 to 0.0)
Mean age (years)	66.0	66.5	68.4	68.2	66.7	67.5	67.0	67.4	66.2	66.3	65.7	65.0	−1.0	−0.1 (−0.3 to 0.0)
% Male	59.7%	58.1%	57.5%	60.4%	59.0%	58.6%	62.6%	63.6%	64.7%	62.0%	65.5%	67.3%	7.6%	0.8% (0.5% to 1.0%)
Survival to hospital discharge	30.8%	39.2%	37.2%	39.1%	44.2%	39.8%	40.6%	41.7%	43.1%	44.8%	46.9%	46.5%	15.6%	1.1% (0.7% to 1.5%)
OHCA														
Volume	411	480	432	408	559	539	549	552	652	775	733	785	373	35 (26 to 43)
Volume/1000 admissions	10.7	10.5	9.0	8.1	10.7	10.0	9.9	9.4	11.2	12.4	11.1	11.6	0.9	0.2 (0.0 to 0.3)
Mean age (years)	64.6	64.2	66.2	63.3	64.0	65.8	63.2	62.0	60.2	60.6	60.6	60.1	−4.6	−0.5 (−0.7 to −0.3)
% Male	68.7%	64.5%	68.1%	68.9%	65.9%	67.7%	71.7%	67.3%	69.5%	65.3%	67.7%	72.4%	3.7%	0.2% (−0.17% to 0.59%)
Survival to hospital discharge	34.1%	31.4%	36.8%	40.7%	36.5%	37.3%	37.2%	35.7%	42.7%	43.0%	42.6%	43.5%	9.4%	0.9% (0.5% to 1.3%)

METHOD 8: All data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)	
All admissions															
Volume	42 916	54 369	62 913	70 392	78 630	85 822	90 420	93 219	94 145	101 292	111 176	116 460	73 544	6140	(5497 to 6783)
Mean age	60.3	61.0	61.5	61.8	61.8	61.7	61.9	61.8	61.8	61.8	62.1	61.9	1.6	0.1	(0.1 to 0.2)
% Male	61.1%	60.4%	60.4%	60.1%	59.7%	59.3%	59.9%	59.4%	59.0%	58.5%	58.3%	58.0%	−3.1%	−0.3%	(−0.3% to −0.2%)
Survival to hospital discharge	84.2%	84.8%	85.4%	85.9%	86.4%	87.3%	87.8%	87.9%	88.1%	88.6%	89.3%	89.5%	5.3%	0.5%	(0.4% to 0.5%)
Cardiac arrests															
Volume	1054	1374	1540	1726	1951	1994	2040	2141	2362	2420	2571	2684	1630	135	(120 to 150)
Volume/1000 admissions	24.6	25.3	24.5	24.5	24.8	23.2	22.6	23.0	25.1	23.9	23.1	23.0	−1.5	−0.2	(−0.3 to 0.0)
Mean age (years)	65.5	66.2	67.8	67.3	66.1	66.5	65.2	65.2	64.1	64.2	63.9	63.2	−2.3	−0.3	(−0.5 to −0.2)
% Male	62.8%	61.2%	62.5%	63.2%	62.9%	64.0%	66.4%	66.9%	66.2%	65.1%	66.5%	68.4%	5.6%	0.5%	(0.4% to 0.7%)
Survival to hospital discharge	33.8%	36.3%	36.6%	40.9%	42.6%	39.5%	42.4%	42.7%	44.3%	43.5%	44.6%	46.5%	12.7%	1.0%	(0.7% to 1.2%)
IHCA															
Volume	584	809	979	1076	1065	1099	1123	1206	1237	1191	1291	1288	704	52	(36 to 67)
Volume/1000 admissions	13.6	14.9	15.6	15.3	13.5	12.8	12.4	12.9	13.1	11.8	11.6	11.1	−2.6	−0.3	(−0.5 to −0.2)
Mean age (years)	66.1	67.0	68.4	68.6	67.3	68.3	67.3	67.4	66.5	66.6	66.3	65.4	−0.8	−0.1	(−0.3 to 0.0)
% Male	58.9%	58.2%	59.4%	60.1%	60.8%	60.0%	63.5%	64.6%	63.8%	62.7%	64.4%	67.2%	8.3%	0.7%	(0.5% to 0.9%)
Survival to hospital discharge	31.6%	40.1%	38.2%	40.1%	44.9%	39.7%	43.5%	45.6%	46.3%	45.4%	49.0%	50.2%	18.6%	1.3%	(0.9% to 1.7%)
OHCA															
Volume	470	565	561	650	886	895	917	935	1125	1229	1280	1396	926	83	(74 to 92)
Volume/1000 admissions	11.0	10.4	8.9	9.2	11.3	10.4	10.1	10.0	12.0	12.1	11.5	12.0	1.0	0.2	(0.0 to 0.3)
Mean age (years)	64.4	64.5	66.4	64.6	64.0	64.6	62.5	61.9	60.1	61.1	60.3	59.8	−4.6	−0.5	(−0.7 to −0.4)
% Male	68.4%	65.4%	67.0%	66.8%	64.6%	69.4%	70.5%	67.9%	69.7%	66.6%	68.8%	71.9%	3.5%	0.3%	(0.01% to 0.62%)
Survival to hospital discharge	34.6%	29.7%	36.4%	41.7%	38.2%	38.0%	41.6%	36.5%	43.3%	42.2%	41.7%	44.7%	10.2%	0.9%	(0.5% to 1.4%)

METHOD 8: All-year subset

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2000– 2011	(95% CI)
All admissions														
Volume	38 472	45 806	47 882	50 404	52 437	53 615	55 646	58 660	58 304	62 295	65 781	67 819	29 347	2321 (2058 to 2583)
Mean age	59.7	60.4	60.9	61.2	61.3	61.1	61.3	61.2	61.3	61.1	61.4	61.2	1.6	0.1 (0.0 to 0.2)
% Male	61.1%	60.3%	60.1%	59.6%	58.8%	58.5%	59.2%	58.9%	58.8%	57.9%	58.3%	57.9%	–3.1%	–0.3% (–0.3% to –0.2%)
Survival to hospital discharge	83.9%	84.6%	84.6%	85.1%	85.6%	86.2%	86.4%	86.6%	87.0%	87.5%	88.2%	88.6%	4.7%	0.4% (0.4% to 0.4%)
Cardiac arrests														
Volume	971	1190	1245	1244	1325	1332	1318	1442	1603	1668	1662	1699	728	61 (50 to 71)
Volume/1000 admissions	25.2	26.0	26.0	24.7	25.3	24.8	23.7	24.6	27.5	26.8	25.3	25.1	–0.2	0.0 (–0.1 to 0.2)
Mean age (years)	65.7	65.8	67.8	66.9	65.7	66.4	65.6	65.5	64.2	64.1	64.1	63.5	–2.2	–0.3 (–0.4 to –0.1)
% Male	62.9%	61.3%	61.4%	63.7%	62.0%	62.2%	65.1%	65.4%	65.8%	64.1%	65.5%	68.1%	5.2%	0.5% (0.3% to 0.7%)
Survival to hospital discharge	33.0%	36.4%	36.6%	40.1%	42.0%	39.6%	38.6%	40.1%	42.3%	43.0%	43.4%	44.4%	11.4%	0.8% (0.6% to 1.1%)
IHCA														
Volume	535	690	798	811	739	759	748	855	899	843	884	883	348	23 (13 to 34)
Volume/1000 admissions	13.9	15.1	16.7	16.1	14.1	14.2	13.5	14.6	15.4	13.5	13.4	13.0	–0.9	–0.2 (–0.3 to 0.0)
Mean age (years)	66.1	66.6	68.4	68.1	66.6	67.5	67.2	67.6	66.3	66.3	65.8	65.1	–1.1	–0.1 (–0.3 to 0.0)
% Male	59.5%	58.1%	57.4%	59.9%	58.5%	57.9%	62.4%	63.1%	64.5%	61.9%	65.4%	67.4%	8.0%	0.8% (0.5% to 1.1%)
Survival to hospital discharge	30.5%	39.0%	37.6%	38.7%	43.9%	40.3%	40.8%	41.5%	43.2%	44.9%	47.4%	46.5%	16.0%	1.1% (0.7% to 1.5%)
OHCA														
Volume	436	500	447	433	586	573	570	587	704	825	778	816	380	37 (28 to 46)
Volume/1000 admissions	11.3	10.9	9.3	8.6	11.2	10.7	10.2	10.0	12.1	13.2	11.8	12.0	0.7	0.2 (0.0 to 0.4)
Mean age (years)	64.6	64.2	66.2	63.3	64.0	65.8	63.2	62.0	60.2	60.6	60.6	60.1	–4.6	–0.5 (–0.7 to –0.3)
% Male	68.7%	64.5%	68.1%	68.9%	65.9%	67.7%	71.7%	67.3%	69.5%	65.3%	67.7%	72.4%	3.7%	0.2% (–0.17% to 0.59%)
Survival to hospital discharge	34.1%	31.4%	36.8%	40.7%	36.5%	37.3%	37.2%	35.7%	42.7%	43.0%	42.6%	43.5%	9.4%	0.9% (0.5% to 1.3%)