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Non-home discharge after cardiac surgery in Australia and New Zealand: a cross-sectional study

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ABSTRACT

Objective To determine the proportion of patients surviving their cardiac surgery who experienced non-home discharge (NHD) over a 16-year period in Australia and New Zealand (ANZ).

Design Retrospective, multicentre, cross-sectional study over the time period 01 January 2004 to 31 December 2019.

Setting Adult patients who underwent cardiac surgery from the Australia New Zealand Intensive Care Society Adult Patient Database (APD).

Participants Adult patients (age 18 and above) who underwent index coronary artery bypass grafting, cardiac valve surgery or combined valve/coronary surgery.

Exposure The primary exposure variable was the calendar year during the which the index surgery was performed.

Outcome The primary outcome was NHD after the index surgery. NHD included discharge to locations such as nursing home, chronic care facility, rehabilitation and palliative care.

Results We analysed 252 924 index cardiac surgical admissions from 101 discrete sites with a median age of 68 years (IQR 60–76), of which 74.2% (187 662 out of 252 920) were males. Of these, 4302 (1.7%) patients died in hospital and 213 011 (84.2%) were discharged home, 18 010 (7.1%) were transferred to another hospital and 17 601 (7%) experienced NHD. In Australia, 14 457 (6.4%) of patients progressed to NHD, compared with 3144 (11.7%) in New Zealand. The rate of NHD increased significantly over time (adjusted OR per year=1.06, 95% CI, 1.06 to 1.07, p<0.001). Increasing age, female sex, non-elective surgery, surgery type and Acute Physiology and Chronic Health Evaluation III Score were all associated with significant increase in NHD.

Conclusions There was significant increase in NHD after cardiac surgery over time in ANZ. This has significant clinical relevance for informed consent discussions between healthcare providers and patients, and for healthcare services planning.

Strengths and limitations of this study

- ► This is the largest study to evaluate non-home discharge (NHD) after cardiac surgery and used data from a high-quality registry.
- ► Limitations include its retrospective observational design, reliance on benchmarking data collected for purposes other than this study and possibility of unmeasured confounders not recorded in the registry.
- ► The primary outcome, NHD, was a composite outcome with the individual components possibly having different implications for patients, their families and clinicians

INTRODUCTION

Mortality from cardiac surgery for coronary revascularisation and valve operations in high-income countries such as Australia, Canada and the USA is low.[1–3] However, It is increasingly recognised that non-mortality patient-centred outcomes such as functional and quality-of-life outcomes are very important[4 5] and should be considered as part of the informed consent process[6 7] for medical interventions. Disability or impaired function, either transient or permanent, that leads to discharge to another hospital for extended care, transitional care or nursing home, collectively termed 'non-home discharge' (NHD) as opposed to discharge home, is one such outcome. NHD has been shown to be associated with decreased overall survival,[8] and significant healthcare and social costs.[9]

Relatively small studies from the USA[10] and Denmark[11] have shown that a substantial proportion of patients who survive cardiac surgery experience NHD. In the setting of an ageing population in many high-income countries and associated increase in cardiac surgery, we hypothesised that the rates of NHD after cardiac surgery have increased over time.

The primary objective of this study was to describe the trends in NHD after cardiac surgery over the 16-year period from 2004 to 2019 in Australia and New Zealand (ANZ). Secondary objectives were to evaluate preoperative and early postoperative risk factors for NHD.

METHODS

Study design

We conducted a retrospective cross-sectional study, analysing data from the Australia New Zealand Intensive Care Society (ANZICS) Adult Patient Database (APD) run by the Centre for Outcome and Resource Evaluation over the time period extending from 01 January 2004 to 31 December 2019. The APD includes data on over 85% of admissions to ANZ intensive care units (ICU). This study is reported using the relevant sections of the Strengthening the Reporting of Observational Studies in Epidemiology statement.[12]

The inclusion criteria were adult patients (age 18 and above) undergoing coronary artery bypass surgery, valvular surgery or combinations of valve and coronary artery surgeries. The exclusion criteria were patients who were nursing home residents prior to undergoing cardiac surgery, patients who underwent heart transplantation, ventricular assist device placement, aortic surgery and surgery for congenital heart disease and patients admitted to ICU after their cardiac surgery with treatment limitations. In the APD, a treatment limitation is any constraint on escalation of medical treatment imposed either by patient wishes or medical futility at the time of admission to ICU. Only the index admission with a cardiac surgical diagnosis during the study period was considered.

Data extraction

We extracted records for all patients in the APD during the study period who satisfied our inclusion and exclusion criteria. Demographic information, admission diagnosis, physiological variables used in Acute Physiology and Chronic Health Evaluation (APACHE-III)[13] scoring including APACHE-II comorbidities, Australia and New Zealand Risk of Death (ANZROD),[14] vital status at hospital discharge, lengths of stay in ICU and hospital, readmission rates and hospital discharge location were extracted.

The APD records discharge destination in numerous categories. For the purposes of this study, we categorised discharge destination into the following four categories: death, transferred to other hospital alive, home alive and NHD. NHD included discharge to chronic care facilities (such as nursing home), rehabilitation, palliative care and other non-home locations.

Outcome

The primary outcome was the proportion of patients surviving their cardiac surgery who experienced NHD.

Statistical analysis

Where appropriate, data were converted into numerical formats to facilitate analysis and subsequently checked for completeness. Normality was assessed in continuous data by employing normal quantile (probit) plots. Variables thus identified were described using their mean (SD). Variables showing significant deviation from normality were described using their median (IQR). Categorical and dichotomous data were described using percentages. Correlations between continuous predictor variables were checked using Pearson's correlation coefficient (r) with values greater than ±0.7 signifying a significant degree of collinearity. Postestimation variance inflation factor (VIF) was used with values greater than 10.0 signifying significant predictor colinearity. As the dataset represented a cross-sectional series reported from 101 discrete contributing institutions, it was analysed using mixed effect, logistic regression models. Site (or institution) was treated as a random effect, with individual patients nested within sites. All other variables were treated as fixed effects. Following initial univariate regression with discharge destination as the outcome variable, predictor variables, including age, surgery type (ie, coronary artery bypass grafting (CABG) and valve surgery) and elective surgery (vs non-elective surgery), were selected based on knowledge of significant association with NHD. Hospital type (public vs private) and sex were also included because they were judged to be important confounding variables by the authors. In addition to these, a second model was created with the inclusion of the APACHE-III Score. This model was created to test the effect of illness severity in the first 24 postoperative hours on NHD. Temporal trends in age, comorbidities, APACHE-3 scores, ICU and hospital lengths of stay were analysed using descriptive statistics and univariable linear regression. These were performed to explore whether the complexity of the patients undergoing cardiac surgery in ANZ over the 16-year study period had changed over time.

Results for the final model were reported as ORs with the relevant 95% CI and p value. The level of significance was set at $\alpha<0.05$ throughout. STATA (V.15.1) was used for all analyses.

Patient and public involvement

No patient involved.

Data availability statement

All data relevant to the study are included in the article or uploaded as online supplemental information.

RESULTS

Over the 16-year period from January 2004 to December 2019, 252 924 index cardiac surgical admissions were recorded in ANZ in the ANZICS APD from 101 discrete sites. Overall, 4302 (1.7%) patients died in hospital and 213 011 (84.2%) were discharged home from hospital (table 1). Of the remainder, 18 010 (7.1%) were transferred to another hospital, and 17 601 (7%) experienced NHD. In Australia, 14 457 (6.4%) of patients progressed to NHD, compared with 3144 (11.7%) in NZ. A detailed breakdown of NHD locations for the year 2019 is provided in online supplemental table 1.

The demographic details of the patients are summarised in table 1. The median age of the cohort was 68 years (IQR 60–76). NHD patients were older (median age 76

Table 1 Patient baseline characteristics

Variable	Died	Discharged home	Discharged to other hospital	Non-home discharge	Total
n	4302 (1.7%)	213 011 (84.2%)	18 010 (7.1%)	17 601 (7.0%)	252 924
Age, year					
Mean (SD)	72.3 (11.1)	65.8 (11.9)	73.9 (10.4)	70.8 (11.8)	66.8 (12.0)
Median (IQR)	75 (67, 80)	67 (59, 74)	76 (69, 81)	73 (65, 79)	68 (60, 76)
Sex					
Female	1632 (37.9%)	50 763 (23.8%)	6831 (37.9%)	6009 (34.1%)	65 235 (25.8%)
Male	2670 (62.1%)	162 223 (76.2%)	11 177 (62.1%)	11 592 (65.9%)	187 662 (74.2%)
Country					
Australia	3529 (82%)	191 427 (89.9%)	16 895 (93.5%)	14 457 (82.1%)	227 270 (89.5%)
New Zealand	773 (18%)	21 584 (10.1%)	1183 (6.5%)	3144 (17.9%)	26 771 (10.5%)
Usual residence					
Home	2957 (72.9%)	162 960 (81.8%)	14 508 (82.7%)	9031 (55.4%)	190 221 (80%)
Nursing home	8 (0.2%)	248 (0.1%)	87 (0.5%)	46 (0.3%)	394 (0.2%)
Other*	1091 (26.9%)	35 906 (18%)	2951 (16.8%)	7225 (44.3%)	47 308 (19.9%)
Hospital type					
Metropolitan (public)	37 (0.9%)	1391 (0.7%)	148 (0.8%)	36 (0.2%)	1604 (0.6%)
Tertiary (public)	3105 (72.1%)	130 156 (61.1%)	7617 (42.1%)	12 706 (72.2%)	153 120 (60.7%)
Private	1162 (27%)	81 464 (38.2%)	10 313 (57%)	4859 (27.6%)	97 569 (38.7%)
Surgery status					
Elective	3507 (81.7%)	200 146 (94.2%)	16 855 (93.4%)	15 688 (89.6%)	237 107 (93.6%)
Non-elective	784 (18.3%)	12 353 (5.8%)	1200 (6.6%)	1819 (10.4%)	16 257 (6.4%)
Surgery type					
Valve surgery	1430 (33.2%)	63 179 (29.7%)	6024 (33.3%)	5421 (30.8%)	76 398 (30.1%)
CABG	1893 (44%)	128 422 (60.3%)	8847 (48.9%)	9218 (52.4%)	148 961 (58.6%)
Valve+CABG	979 (22.8%)	21 410 (10.1%)	3207 (17.7%)	2962 (16.8%)	28 682 (11.3%)
Comorbidities					
Respiratory†	305 (17.7%)	6821 (16.1%)	673 (13.9%)	765 (18%)	8564 (16.1%)
Cardiac‡	1092 (63.4%)	32 155 (75.7%)	3633 (75.1%)	2800 (65.9%)	39 680 (74.5%)
Renal§	42 (2.4%)	399 (0.9%)	57 (1.2%)	56 (1.3%)	554 (1%)
Hepatic¶	283 (16.4%)	3076 (7.2%)	472 (9.8%)	625 (14.7%)	4456 (8.4%)
Illness severity scores					

Continued

Table 1 Continued

Variable	Died	Discharged home	Discharged to other hospital	Non-home discharge	Total
APACHE-II, median (IQR)	21 (16, 26)	14 (10, 17)	16 (13, 19)	16 (12, 19)	14 (11, 17)
APACHE-III, median (IQR)	73 (58, 92)	48 (39, 58)	57 (48, 68)	57 (47, 67)	50 (41, 60)
ANZROD, median (IQR)	0.040 (0.012, 0.172)	0.004 (0.002, 0.009)	0.009 (0.004, 0.020)	0.008 (0.004, 0.021)	0.005 (0.002, 0.010)
Lengths of stay, hours					
ICU, median (IQR)	87 (39, 201)	45 (24, 67)	58 (42, 101)	49 (25, 96)	46 (24, 70)
Hospital, median (IQR)	294 (137, 581)	222 (171, 322)	326 (232, 489)	294 (188, 461)	229 (176, 344)
ICU readmission					
Yes	172 (4%)	1886 (0.9%)	397 (2.1%)	311 (7%)	2766 (1.1%)
No	4130 (96%)	211 125 (99.1%)	18 730 (97.9%)	4130 (93%)	251 275 (98.9%)

*Other: patients who were admitted to the hospital where the index cardiac surgery occurred from one of the following locations: inpatient at another hospital (either in the emergency department, an inpatient ward or an ICU), rehabilitation facility or mental health facility.

†Respiratory: presence of chronic restrictive or obstructive disease resulting in severe exercise restriction (unable to climb stairs or perform household duties); or documented chronic hypoxia, hypercapnia, secondary polycythaemia, severe pulmonary hypertension (mean>40 mm Hg); or ventilator dependency.

‡Cardiac: Presence of New York Heart Association Class 4 symptoms.

§Renal: requirement for chronic haemodialysis or peritoneal dialysis.

¶Hepatic: biopsy proven cirrhosis and documented portal hypertension; or episodes of past upper gastrointestinal bleed attributed to portal hypertension.

ANZROD, Australia and New Zealand Risk of Death; APACHE, Acute Physiology and Chronic Health Evaluation; CABG, coronary artery bypass grafting; ICU, intensive care unit.

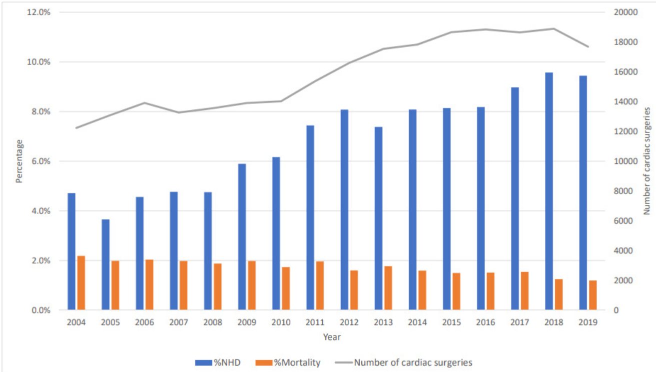

Figure 1 Raw trends in non-home discharge and mortality. NHD, non-home discharge.

years, IQR 69–81) than patients who were discharged home (median age 67 years, IQR 59–74). The overall proportion of male patients was 74.2% (187 662/252 920). Female patients had a higher crude mortality rate of 2.5% (1632/65 235) compared with 1.4% (2670/187 662) for male patients and a higher NHD rate of 9.4% (6009/65 235) compared with 6.2% (11 592/187 662).

Comparing surgery types, 148 961 (58.6%) patients underwent CABG, 76 398 (30.1%) had valvular surgery, and 28 682 (11.3%) underwent combined CABG and valvular surgery. The highest proportion of patients who experienced NHD were those who underwent combined valvular and CABG surgery (2962/28 682, 10.3%), followed by isolated valve surgery (5421/76 398, 7.1%) and CABG alone (9218/148 961, 6.2%). Rates of NHD in elective surgery were 6.6% (15 688/237 107) and 11.1% (1819/16 257) in non-elective surgery. The crude rates of NHD in private and public hospitals were 5.0% (4859/97 569) and 8.2% (12 742/154 724), respectively.

Compared with those discharged home, patients undergoing NHD had a higher median APACHE-III Score of 57 (IQR 48–68) versus 48 (IQR 39–58) and a greater median ANZROD (median 0.009, IQR 0.004–0.02 vs 0.004, IQR 0.002–0.009). NHD patients had longer ICU and hospital length of stay (LOS) compared with those patients who were discharged home (table 1).

Figure 1 shows raw trends for NHD after cardiac surgery alongside raw mortality and total number of cases. The total number of cases have increased from 12 235 to 17 685 per annum from 2004 to 2019. A progressive decrease in raw mortality was observed from 2.2% (267/12 235) to 1.2% (211/17 685). This was accompanied by an increase in the NHD rate starting at 4.7% (12 235) in 2004 to 9.4% (1670/17 685) of patients in 2019. The unadjusted OR for NHD per year was 1.06 (95% CI 1.06 to 1.07, p<0.001). Raw trends in NHD and mortality by surgery type are presented in online supplemental figures 1–3.

Online supplemental table 2 displays the temporal trends in APACHE-II comorbidities over the study period. The mean age did not change by a clinically significant amount during the study period (66.4 (SD 11.7) in 2004 to 66.8 (SD 11.7) in 2019). However, the APACHE-III

Table 2 Risk of non-home discharge (NHD) in patients undergoing cardiac surgery: univariable analyses

Univariable logistic regression analyses	OR	95% CI	P value
Year (per 1 year)	1.06	1.06 to 1.07	<0.001
Age (per 1 year)	1.07	1.07 to 1.07	<0.001
Sex (female vs male)	1.93	1.90 to 2.00	<0.001
Surgery type			
CABG	1	Reference	
Valve	1.34	1.30 to 1.39	<0.001
CABG+ valve	2.01	1.92 to 2.10	<0.001
Surgical status (non-elective vs elective)	1.42	1.34 to 1.52	<0.001
Hospital type (private vs public)	2.63	1.61 to 4.31	<0.001
APACHE-III Score (per 1 point)	1.03	1.03 to 1.03	<0.001
ANZROD (per 1%)	1.03	1.02 to 1.03	<0.001

ANZROD, Australia and New Zealand Risk of Death; APACHE, Acute Physiology and Chronic Health Evaluation; CABG, coronary artery bypass grafting.

scores increased significantly from a mean of 45.9 (SD 17.6) in 2004 to 49.5 (SD 17.6) in 2019 (p<0.001). The ICU and hospital LOS both increased significantly: from a median of 43 hours (IQR 23–53) in 2004 to 48 hours (IQR 27–74) in 2019 for ICU LOS (p<0.001) and 8.7 days (IQR 6.6–13.3) in 2004 to 10.0 days (IQR 7.8–14.2) in 2019, respectively.

The results of univariable analysis of factors associated with NHD are presented in table 2. Increasing age, female sex, non-elective surgery, surgery type, hospital type and increasing APACHE-III Score and ANZROD were all found to be significantly associated with NHD.

In the multivariable model (table 3), year of surgery was strongly associated with NHD. For every year from 2004, the OR of NHD was 1.06 (95% CI 1.06 to 1.07, p<0.001) after adjustment for age, sex, type of surgery, non-elective surgery, hospital type and APACHE-III Score (both ANZROD and APACHE-III Score were not only highly significant, but also highly collinear, therefore, APACHE-3 Score was retained). The multivariable models with and without the APACHE-III Score produced very similar results as shown in table 3. Regression models stratified by surgery type are presented in online supplemental tables 3 and 4.

Comparison of patients admitted to public and private hospitals is presented in online supplemental table 5. The patients were different in several aspects including higher age, lower rates of non-elective surgery and more valve surgery in private hospitals. The crude mortality rate was lower (1162/97 569, 1.2% vs 3142/154 724, 2.1%) and almost all private cardiac surgery in our cohort was performed in Australia (98 050, 99.7%). The adjusted OR

Table 3 Risk of non-home discharge (NHD) in patients undergoing cardiac surgery: multivariable analyses

Variable	OR	95% CI	P value
Multivariable logistic regression analysis using preoperative variables			
Year (per 1 year)	1.07	1.06 to 1.07	<0.001
Age (per 1 year)	1.07	1.07 to 1.07	<0.001
Sex (female vs male)	1.74	1.68 to 1.81	<0.001
Surgery type			
CABG	1		
Valve	1.13	1.08 to 1.17	<0.001
CABG+ valve	1.51	1.44 to 1.59	<0.001
Surgical status (elective vs non-elective)	0.69	0.64 to 0.74	<0.001
Hospital type (private vs public)	2.05	1.13 to 3.72	0.02
Multivariable logistic regression analysis using preoperative variables and APACHE-III Score			
Year (per 1 year)	1.06	1.06 to 1.07	<0.001
Age (per 1 year)	1.06	1.06 to 1.06	<0.001
Sex (female vs male)	1.73	1.66 to 1.79	<0.001
Surgery type			
CABG			
Valve	1.11	1.07 to 1.16	<0.001
CABG+ valve	1.44	1.37 to 1.51	<0.001
Surgical status (elective vs non-elective)	0.72	0.67 to 0.77	<0.001
Hospital type (private vs public)	2.21	1.22 to 3.99	0.009
APACHE-III Score (per 1 point)	1.01	1.01 to 1.02	<0.001

APACHE, Acute Physiology and Chronic Health Evaluation; CABG, coronary artery bypass grafting.

for NHD for patients in private hospitals compared with public hospital was 2.05 (95% CI 1.13 to 3.72, p=0.02).

VIFs for the multivariable models are presented in online supplemental table 6.

DISCUSSION

Key findings

This large retrospective cross-sectional study of discharge destination after cardiac surgery has demonstrated that there has been a significant yearly increase in NHD among cardiac surgical patients in ANZ from 2004 to 2019. This has coincided with a decline in hospital mortality. Preoperative variables significantly associated with NHD were increasing age, female sex, redo cardiac surgery and performance of surgery in a private institution. Illness severity, as measured by the APACHE-III score at 24 hours of ICU admission, was also a highly significant risk factor for NHD.

Why is NHD important?

Cardiac surgery has an established role in the management of coronary artery and cardiac valvular disease; however, it can also be associated with significant morbidity, and requires hospital and ICU admission for perioperative support. It can lead to a cascade of events, resulting in prolonged hospitalisation and functional decline, due to inactivity and immobility, with weakness, contractures and atrophy.[10 15 16] Furthermore, cardiac surgery can cause postoperative cognitive dysfunction, which can persist after hospital discharge.[17] This combination of factors may contribute to risk of NHD after cardiac surgery.

Survival to hospital discharge, though important, is an incomplete measure of outcome.[18] Patients often prioritise quality of life over quantity, with QOL reflecting a combination of physical function, emotional well-being and social functioning. If expected to live in long-term care, many patients would forego an operation and live out the natural history of their disease at home. Patients discharged to places other than home have poorer outcomes than those discharged to home. Thus, NHD not only has implications for QOL, but also for intermediate-term outcomes, heralding a persistent increased risk of mortality. It has been shown that among cardiac surgical patients discharged to an extended care facility, only 55% returned to independent living, and of those admitted to a long-term care facility, only 30.8% were alive at 1 year[8]. Similar reviews[10 19] found that patients with NHD had lower 1-year and 2-year survival, and increased risk of readmission. In ANZ, patients transferred to another hospital after cardiac surgery are usually those who cannot safely be discharged home. Instead, they are often transferred to another hospital close to their usual residence or to family supports. Assistance services, or placement in a chronic care facility, nursing home, rehabilitation or respite care can then be organised from this hospital.

In addition to the quality-of-life impacts, NHD is associated with significant financial implications for healthcare services. Goldfarb *et al*[20] demonstrated that frail patients undergoing cardiac surgery incurred a sizeable cost difference to non-frail patients, related to postoperative complications, prolonged ventilation and longer hospital LOS, all of which are associated with an increased likelihood of NHD.[9 10 15 16]

Implications/importance of findings

This is the first study that clearly demonstrates a significant increase in NHD after cardiac surgery over time after adjustment for important covariates. This has occurred over a time period where mortality after cardiac surgery has steadily fallen. This decline in mortality may reflect refinements in the process of cardiac surgery, improving quality of postoperative care and successful provision of prolonged periods of intensive care support in those who suffer complications. It is possible that an increase in NHD is one of the collateral 'costs' associated with declining mortality.

During this period of increasing NHD rates, the APACHE-3 scores and hospital and ICU LOS have all increased significantly, suggesting increasing patient complexity. Thus, the observed increase in NHD, despite adjustment for important available covariates, may be reflective of changing indications for cardiac surgery and increasingly complex patients being offered surgery.

The variables significantly associated with increased NHD were increasing age, female sex, higher illness severity (as measured by APACHE-III Score), non-elective surgery and non-CABG surgery. These are all, with the exception of APACHE-III Score, preoperative variables that can assist in early identification of patients at high-risk of NHD and facilitate better informed consent discussions, resource allocation and discharge planning processes.

The overall NHD rate of 7.1% in our large cohort was somewhat lower than the reported incidence of NHD after cardiac surgery in the international literature. Rates of 11%–30% were reported in studies much smaller than ours.[8–10 18 21] Thorsteinsson *et al*[11] reviewed 38 387 patients, and found significant risk factors to be increasing age, female sex, heart failure, previous myocardial infarct and previous stroke. Pattakos *et al*[9] found the need for an intra-aortic balloon pump, emergency surgery, aortic surgery, multiple comorbidities and increasing age to be risk factors for NHD in a cohort of 4031 patients. In a review of 5900 patients, Stuebe *et al*[10] reported age, sex, marital status, body mass index, vascular disease, pulmonary disease, operation type, emergency and redo surgery as risk factors for NHD and also developed a prediction score for NHD. Overall, our study confirms that NHD after cardiac surgery is a substantial healthcare problem and the temporal increase has major implications for resource allocation and planning of future healthcare services. The trend towards increasing rates of NHD could be due to the fact that cardiac surgery is being performed on older patients, with greater incidence of frailty and other comorbidities.[11]

The strong association between female sex and NHD was similar in magnitude to that reported in smaller studies.[10 11] It should be considered a consistent association that necessitates further investigation.

Strengths and limitations

This is the largest study to evaluate NHD after cardiac surgery. It used data from a high-quality registry that has been extensively used for research purposes. However, it is limited by its retrospective observational design and reliance on benchmarking data collected for purposes other than this study. The registry data could only be used to categorise patients into CABG, valve surgery and CABG+ valve surgery groups. Further categorisation (eg, aortic vs mitral valve, single vs double vs triple valve) was not possible. The APACHE-III Score was not specifically designed nor validated for the cardiac surgical population and its capacity for risk adjustment in this population may be limited. Comparative data for non-operative intervention in patients with heart disease was not available. Treatment data, including intraoperative and postoperative treatments were not available. The primary outcome, NHD, was a composite outcome and not all component outcomes may have the same meaning or weighting for patients, families and clinicians. Data specifying nursing home discharge specifically versus transitional care and rehabilitation were unavailable.

Future research

Further research is required in the field of NHD after cardiac surgery. A simple score to predict risk of NHD that can be calculated at the bedside during or prior to a consent discussion would be valuable for clinicians and patients alike. Scores of this nature have been developed in the past using data from smaller datasets.[9 10] Further research is needed to identify the barriers to implementation of such scores, and their incorporation into clinical practice, particularly to improve the depth of informed consent discussions and shared decision-making. Whether the early (ie, preoperative) identification of NHD risk can be used to apply targeted interventions such as 'prehabilitation'[22] and lead to better patient outcomes requires further evaluation. The effect of cardiac specific preoperative information (for example, using the EuroScore-II[23] intraoperative and postoperative variables other than APACHE-III on NHD needs to be studied. Economic analysis would be beneficial in quantifying the burden of NHD and targeting resources appropriately. Preoperative identification of patients at risk of NHD postcardiac surgery could facilitate investigation of interventions that may reduce NHD and assist with early discharge planning.

CONCLUSIONS

NHD after cardiac surgery is increasing over time with important implications for informed consent discussions, discharge planning, resource allocation and healthcare expenditure. Future research should focus on accurate identification of at-risk patients and interventions to arrest the rise and potentially reduce NHD.

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