# Ischaemic heart disease and Australian immigrants:

## the influence of birthplace and language skills on treatment and use of health services[1]

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### Abstract

Admission rates for ischaemic heart disease (IHD), and the use of invasive cardiovascular procedures, separation mode and length of stay (LOS) were compared between Australians from non-English speaking background (NESB; n=8627) and English speaking background (ESB; n=13162) aged 20 years and over admitted to Victorian urban public hospitals. The study covered the period from 1993 to 1998. It was found that, compared with their ESB counterparts, the incidence of admission for acute myocardial infarction was significantly higher for NESB men and women before and after controlling for confounding factors. The age-adjusted ratios for NESB women compared with their ESB counterparts ranged from 1.23 to 1.89 for cardiac catheterisation, from 0.23 to 0.27 for percutaneous transluminal coronary angioplasty (PTCA), and from 1.04 to 1.80 for coronary artery bypass grafting (CABG). Procedure rates were comparable in men for cardiac catheterisation and CABG but higher for PTA rates in NESB men (OR: 1.29, 95%CI: 1.11-1.50) than their ESB counterparts. Both NESB men ($\beta$=0.04, 95%CI: 0.01-0.07) and women ($\beta$=0.03, 95%CI: 0.02-0.08) experienced significantly longer hospital stays than their ESB counterparts. These findings indicate there may be systematic differences in patients' treatment and service utilisation in Victorian public hospitals. The extent to which physicians' bias and patients' choice could explain these differences requires further investigation.



### Key Words (MeSH):

*Ethnicity; Non-English Speaking Background, Language Barriers; Invasive Procedures, Ischaemic Heart Disease; Cross-Cultural Comparison; Length of Stay; Physician-Patient Relations*


### Introduction

Cardiovascular diseases (CVDs) together with diseases of circulatory vessels remain the leading causes of death in Australia (Australian Bureau of Statistics 1999; Australian Institute of Health and Welfare 2000b; Taylor et al. 1999) and in other developed countries (Health Policy and Public Health Directorate, 1995). Overseas studies have shown that migrants are more affected by CVDs and their risk factors than the host population (Erens, Primatesta & Prior 2001; Fang et al. 1996; Wild & McKeigue 1997). For example, a cross sectional analysis of mortality by country of birth over a 22-year period in England and Wales (Wild & McKeigue 1997) found that, in comparison with the general population, South Asian men and women had the highest standardised mortality ratios for IHD, while the lowest ratios were observed among Caribbean and West African migrants. The same study found that mortality ratios for cerebrovascular diseases among migrants were higher than national averages and the highest ratios were observed among West African migrants. In the United States, black Americans have been reported to have threefold greater prevalence of CVD risk factors, namely hypertension, left ventricular hypertrophy and smoking, than their white counterparts (Lee et al. 2003).

In Australia, epidemiological studies of the health of migrants have concluded that migrants

1 The study was undertaken as part of the author's thesis for the Master of Public Health at the University of Melbourne.

generally have lower rates than the general population for a number of causes of death including CVDs (Young 1986) (see Table 1). One of the rare studies examining inequalities in risk factors and cardiovascular mortality among Australia's immigrants concluded that the incidence of risk factors known to be associated with CVDs (systolic and diastolic blood pressure, total plasma cholesterol, high-density lipoprotein cholesterol, triglyceride, low-density lipoprotein, body mass index, smoking status, alcohol consumption, leisure-time physical activity and high-density lipoprotein cholesterol to triglyceride ratio) was not sufficiently different to explain the lower than expected standardised mortality ratios among migrants in Australia. Although various studies have provided the 'healthy-migrant effect'[2] as one of the possible explanations, what is not known is whether access to and utilisation of public health services could help explain mortality differentials between migrants and Australian-born populations.

Despite the migrants' superior health profile, various studies have reported that African and Hispanic migrants in the United States (Daumit et al. 1999; Kravitz 1999; Paterson et al. 1997), migrants of South Asian background in the United Kingdom (Feder et al. 2002; Lowry et al. 1984; Shaukat, de Bono & Cruickshank 1993) and the Australian Indigenous population (Cunningham 2002) undergo fewer invasive cardiac procedures than their white counterparts. It is established that these ethnic differences in the use of cardiac procedures are not due to physician bias in recommending patients for revascularisation (Feder et al. 2002), clinical features or severity of the disease, access to hospitals in which these procedures are performed, or the ability to pay (Ford & Cooper 1995), but rather are due to patients' preferences for treatment (Whittle et al. 1997). Personal factors such as the patient's unwillingness to accept referral for surgery (Ford & Cooper 1995) and lack of language skills remain unexplored as barriers of access to cardiac health services (Renzaho 2002).

The effect of poor language ability as a barrier to access to health services among migrants is well documented worldwide (Ahmad, Kernohan & Baker 1989; Andrea & Renner 1995; Baker, Hayes & Fortier 1998; Baker et al. 1997). In the United States, initiatives aimed at increasing the fluency of health providers in non-official languages through provision of language training have been put in place (Binder et al. 1988; Flores et al. 2000; Koff & McGowan 1999; Prince & Nelson 1995). However, the majority of studies of ethnic differences in the receipt of invasive procedures defined ethnicity based on colour (Lee et al. 2003) or country/region of birth (Feder et al. 2002). Despite this wealth of knowledge, the effect of language ability in relation to

**Table 1: Cardio-vascular disease age-standardised mortality ratios among Australians, 1987–1989**

| COUNTRY OF BIRTH | MEN | WOMEN |
|---|---|---|
| **ESB countries** | | |
| United Kingdom and Ireland | 92* | 91* |
| South Africa | 89 | 85 |
| Canada | 96 | 66 |
| United States | 96 | 109 |
| New Zealand | 109 | 105 |
| Australia | 103* | 104* |
| **NESB countries** | | |
| Greece | 62* | 55* |
| Italy | 67* | 55* |
| Yugoslavia | 87* | 79* |
| Malta | 103 | 124* |
| Germany | 95 | 90 |
| Netherlands | 91 | 84* |
| Poland | 124* | 117* |
| Lebanon | 80* | 118 |
| Egypt | 90 | 122 |
| Vietnam | 30* | 35* |
| Malaysia | 71* | 59* |
| Philippines | 81 | 56* |
| China | 62* | 61* |
| Other Oceania (a) | 137* | 165* |
| Central and Southern America | 54* | 69* |

* Ratio statistically significant from 100; $p<0.05$.
Source: Adapted from (Young, 1986)

2 The 'healthy migrant effect' refers to situations where migrants are seen as inherently healthier due mainly to selection prior to migration; those who migrate have better health profiles than those who stay in their country of birth. Australian immigration policy dictates that healthier settlers are selectively prioritised (Dunt 1982), a policy which has been in place for over 50 years. Additionally, the upheaval of moving to another country, in this case Australia, implies that migrants feel (and probably are) fit enough to cope with the pressures resulting from the move (Australian Bureau of Statistics 1998).

treatment-seeking behaviour at the onset of CVD symptoms, receipt of invasive procedures and CVD treatment outcome remains unexplored. The uses of the dichotomy ESB/NESB as a measure of ethnicity has been widely used by the Australian government for planning purposes (Australian Government Department of Family and Community Services 2000; Multicultural Disability Advocacy Association of NSW 2004), and in the Australian medical literature to document ethnic differences in health outcomes (Comino et al. 2001; Hassett & George 2002; Knox & Britt 2002; LoGiudice et al. 2001).

The current study aimed to contribute to the body of knowledge about CVD by examining ethnic differentials in health service utilisation and treatment outcomes. It was hypothesised that, as a result of language barriers and poor compliance with treatment:

- NESB patients would undergo fewer invasive procedures than ESB patients
- NESB patients would have longer LOS in hospital than their ESB counterparts
- NESB patients would be more likely than ESB patients to die while in care and to discharge themselves against medical advice.

## Methods

### *Source of data and participants*

The primary source of data was the Australian Institute of Health and Welfare (AIHW), a national body that collects hospital morbidity data for all States and Territories. The ESB/NESB dichotomy was created using data on country of birth. Although such a categorisation has become customary practice (Comino et al. 2001; Knox & Britt 2002) and assumes that migrants from NESB countries are illiterate in English, it is nevertheless worth acknowledging that some NESB migrants may have learned English before being admitted to hospital and such a limitation is discussed in detail in this paper.

ESB represented 60.4% (n=13162) of the dataset and included patients from Australia, New Zealand, Oceania and Antarctica, North America, Canada, Ireland (Eire and Northern Ireland), South Africa, England, Scotland and other British Isles. NESB represented 39.6% (n=8627) of the dataset and included patients from the Middle East and North Africa, Southeast Asia, Asia, Europe (excluding England, Ireland, Scotland and other British Isles), Central and South America and sub-Saharan Africa. Separation mode and principal procedures for patients admitted to Victorian urban public hospitals for angina and/or AMI, for the period 1993 to 1998 were analysed.

### *Study outcomes*

The dataset recorded diagnostic and procedural categorisation data on the basis of the Ninth Edition of the International Classification of Disease (ICD-9-CM) (National Center for Health Statistics 2000). Admission diagnosis (angina and AMI) was considered and AMI was taken as a clinical outcome of late presentation. Angina and AMI were defined as ICD-9-CM codes 411-414 and 410.0-410.9 respectively. Invasive procedures considered for this study were catheterisation (defined as ICD-9-CM codes 37.21-37.23 and 88.57-88.59), percutaneous transluminal coronary angioplasty-PTCA (defined as ICD-9-CM 36.01, 36.02, 36.05) and coronary artery bypass grafting–CABG (defined as ICD-9-CM 36.10-36.19). Mortality rate and discharge type were extracted from hospital separation data (discharged to another institution, e.g. nursing home/health care for rehabilitation or after care; discharged at own risk, i.e. against medical advice; discharged to go home, i.e. improved condition; and died in hospital). Readmission rates were defined based on the patient's readmission to the same hospital.

### *Statistical methods*

Data were analysed using the statistical program Stata, Version 5[3]. At the exploratory phase, we performed the $\chi^2$ test to investigate differences in demographic and clinical characteristics – diagnosis, receipt of procedures and separation modes – between ESB and NESB. In order to control for study variables, we compared LOS in hospital between these two groups using standard multiple regression while rates of receipt of invasive procedures and separation mode were compared using logistic regression. On inspection of data, LOS was found to be highly skewed based on the SKTEST (D'Agostino et al. 1990). Such

3 See Statacorp website: http://www.stata.com/

a trend was consistent with current literature suggesting that LOS tends to be a highly skewed distribution, with many patients having a short or moderate LOS but a smaller group of patients having a much longer length of stay (Eaton & Whitemore 1977). Therefore, we employed the log transformation procedure (Box & Cox 1964) to normalise LOS. The following transformation formula was used:

$$\text{Transformed LOS} = \{Log[LOS]^{0.7985381} - 1\}/0.7985381$$

Multiple regression analysis was complemented by a sensitivity analysis of effect sizes using KnowledgeSeeker (ASI 1993; Biggs, de Ville B & Suen 1991; McKenzie et al. 1993) to determine good predictors of LOS and mortality. This approach was used to find the optimal groupings of categories for each variable (e.g. the optimum grouping of age categories, with age categories with similar LOS being grouped together).

## Results

Table 1 summarises the demographic and clinical characteristics by ethnicity. Table 2 summarises ethnic differences in admission diagnosis, receipt of invasive procedures and separation mode. A total of 21789 patients were admitted to eight Victorian metropolitan public hospitals for angina and/or AMI for the financial years 1993-94 through 1997-98. Of these 9464 (43.4%) were admitted for angina and 12325 (56.6%) were

**Table 2: Patients' demographic and clinical characteristics of ESB and NESB patients admitted in Victorian public hospitals, 1993–1998**

| | ESB N=13162 | NESB N=8627 |
|---|---|---|
| **Gender** | | |
| Male | 63.80% | 56.70% |
| Female | 36.20% | 43.30% |
| **Admission diagnosis** | | |
| Angina | 48.00% | 36.40% |
| AMI | 52.00% | 63.60% |
| **Admission age** | | |
| 49 years or less | 12.40% | 8.90% |
| 50-59 years | 18.50% | 17.20% |
| 60-69 years | 25.70% | 26.30% |
| 70+ years | 43.40% | 47.60% |
| **Primary procedure** | | |
| Catheterisation | 7.60% | 6.10% |
| PTA | 30.10% | 43.90% |
| CABG | 5.50% | 4.60% |
| **Separation mode** | | |
| Discharged to another institution (a) | 12.60% | 11.40% |
| Discharged at own risk (b) | 0.50% | 0.50% |
| Died in hospital | 5.40% | 4.90% |
| Discharged to go home (c) | 81.50% | 83.20% |

(a) Another hospital/nursing home/health care for rehabilitation or after care,
(b) Self discharge against medical advice and
(c) Improved condition

**Figure 1: Receipt of an invasive procedure by diagnosis: angina**

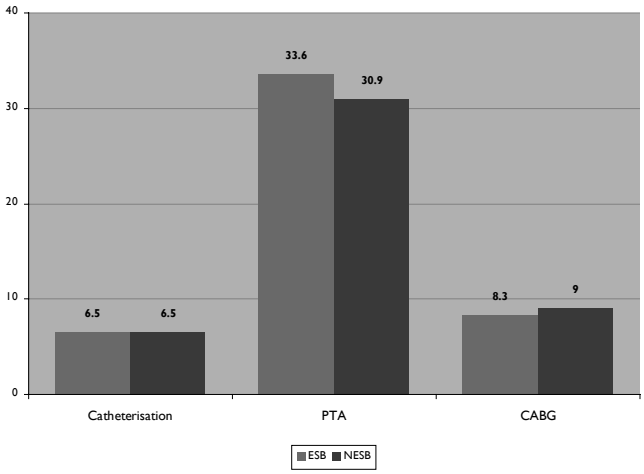
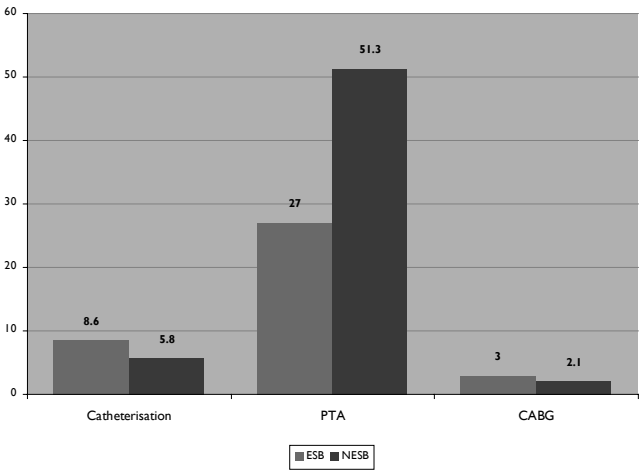



**Figure 2: Receipt of an invasive procedure by diagnosis: AMI**



admitted for AMI. Almost half of the sample (47.7%) had received an invasive procedure. ESB men were generally more likely than ESB women to have received revascularisation (47.1% vs.36.5%, p<0.001). For NESB patients, women were more likely than men to have undergone revascularisation (67.8% vs. 44.5%, p<0.001). In both clusters, the difference in revascularisation rates was significantly more pronounced for PTA (ESB men = 32.5% vs. ESB women=26.0%, and NESB women =62.1% vs. NESB men = 29.9%). In addition, ethnic differences existed in the receipt of invasive procedures by diagnosis, with NESB patients diagnosed with AMI more likely to undergo PTA than their ESB counterparts (51.3% versus 27%, P<0.001). Such differences were not evident for angina (Figures 1 and 2). Admission to hospital for angina and AMI was a function of age across clusters, with the number of admitted patients increasing significantly with age (p<0.001).

NESB patients had higher admission rates at older ages for both angina and AMI than their ESB counterparts (P<0.001). Compared with their ESB counterparts, the likelihood of being admitted for AMI was significantly higher for NESB men and women before and after controlling for confounding factors (Table 3). Ethnic differences in receipt of cardiac procedures and separation mode were more pronounced in women than men. The adjusted odds ratios for NESB women compared with their ESB counterparts ranged from 1.23 to 1.89 for cardiac catheterisation, from 0.23 to 0.27 for PTA, and from 1.04 to 1.80 for CABG. Procedure rates were comparable in men for cardiac catheterisation and CABG but PTA rates were higher in NESB men than their ESB counterparts. NESB women were more likely to be transferred to another institution (OR: 1.29, 95%CI: 1.11-1.50) for rehabilitation and/or after care than ESB women. No ethnic differences in separation mode for men were found. Ethnic differences in the receipt of invasive procedures were not associated with differences in mortality. After controlling for age, admission diagnosis and gender, the odds ratios (ORs) for NESB patients to die in hospital following revascularisation compared with ESB

**Table 3: Unadjusted and adjusted odds ratios (OR) and 95% confidence interval (CI) of admission diagnosis, separation mode and invasion procedures by ethnicity (ESB=reference)**

| | MALE | | | | | | FEMALE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UNADJUSTED | | | ADJUSTED | | | UNADJUSTED | | | ADJUSTED | | |
| | OR | (95%CI) | | OR | (95%CI) | | OR | (95%CI) | | OR | (95%CI) | |
| **Admission diagnosis** [1] | | | | | | | | | | | | |
| AMI (a) | 1.18 | (1.10 | 1.26) | 1.21 | (1.13 | 1.30) | 2.57 | (2.34 | 2.82) | 2.28 | (2.07 | 2.50) |
| **Primary procedure** [2] | | | | | | | | | | | | |
| Catheterisation (b) | 0.99 | (0.87 | 1.13) | 1.05 | (0.92 | 1.20) | 2.01 | (1.63 | 2.48) | 1.53 | (1.23 | 1.89) |
| PTA (b) | 1.13 | (1.04 | 1.22) | 1.12 | (1.03 | 1.21) | 0.21 | (0.20 | 0.23) | 0.25 | (0.23 | 0.27) |
| CABG (b) | 1.02 | (0.88 | 1.17) | 1.00 | (0.87 | 1.16) | 1.78 | (1.36 | 2.34) | 1.37 | (1.04 | 1.80) |
| **Separation mode** [3] | | | | | | | | | | | | |
| Transferred to another institution * (b) | 1.00 | (0.90 | 1.11) | 0.99 | (0.89 | 1.10) | 1.33 | (1.16 | 1.53) | 1.29 | (1.11 | 1.50) |
| Discharged at own risk # (b) | 0.82 | (0.50 | 1.34) | 0.84 | (0.51 | 1.38) | 0.91 | (0.49 | 1.68) | 0.74 | (0.39 | 1.43) |
| Died in hospital (b) | 0.95 | (0.81 | 1.11) | 0.95 | (0.81 | 1.11) | 1.43 | (1.17 | 1.74) | 1.18 | (0.96 | 1.47) |
| Discharged to go home § (b) | 1.02 | (0.93 | 1.12) | 1.03 | (0.94 | 1.13) | 0.72 | (0.64 | 0.81) | 0.8 | (0.70 | 0.91) |

1 Adjusted for age

2 Adjusted for age and admission diagnosis

3 Adjusted for age, admission diagnosis and primary procedure

(a) Angina is the reference.

(b) The referent category is 'No' for all predictors.

* Hospital/nursing home/health care for rehabilitation or after care; # Patients discharge themselves against medical advice; § Improved condition

patients were 1.16 (95%CI: 0.93-1.44) for cardiac catheterisation, 0.99 (95%CI: 0.88-1.12) for PTA and 1.03 (95%CI: 0.77-1.38) for CABG.

Analysis of effect sizes of mortality predictors indicated that primary procedures and language (NESB/ESB) were poor predictors of death, but primary diagnosis remained the best predictor of death followed by age group and gender (Figure 3). The difference in LOS in hospital between ESB and NESB patients was assessed by multiple linear regression. The model adjusted for age, diagnosis and procedure explained 31.6% in women ($P<0.001$, *ANOVA*) and 34.4% in men ($P<0.001$, *ANOVA*) of the variance in LOS in hospital. When individual correlates were assessed, NESB men ($\beta=0.04$, 95%CI: 0.01-0.07) and women ($\beta=0.03$, 95%CI: 0.02-0.08) had significantly longer hospital stay than their ESB counterparts. Overall, there was no difference in LOS across clusters between those who die in hospital versus those who did not, but difference existed within clusters. The mean LOS ($\overline{\chi} \pm$ se) was lower among those who did die in hospital than those who die not for both NESB ($1.09 \pm 0.09$ vs. $1.36 \pm 0.01$, $p<0.001$) and ESB ($1.11 \pm 0.04$ vs. $1.30 \pm 0.01$, $p<0.001$). However, ESB/NESB was a poor predictor of LOS in hospital ($F_{(1,19972)} = 1.159$, $p=0.305$), while primary diagnosis was the best in predicting differences in LOS, followed by primary procedures and establishment/hospital ($F_{(6,19979)} = 137.982$, $p<0.001$) (Figure 4). These findings suggest that there were differences between hospitals in LOS regardless of ethnicity.

The analyses presented here attempted to evaluate ethnicity-related discrepancies in acute public hospital health service delivery and health service utilisation with regard to IHD using the ES/NESB dichotomy based on patients' country of birth (Comino et al. 2001; Knox & Britt 2002). The data used in the study covered the period 1993 through 1998. The findings suggest that NESB makes a difference in patient outcomes in IHD.

### *Seeking early treatment*

It was hypothesised that NESB patients would be less likely to seek early treatment at the onset of CVD when compared to ESB patients. This hypothesis was confirmed as it was found that NESB patients were more likely to be admitted for AMI than ESB patients. This may be a result of late presentation due to language barriers contributing to the inability to effectively communicate symptoms or to comply with treatment in the early stage of angina (or it may reflect the fact that angina does not always precede AMI). Angina is mostly a clinical diagnosis, which requires the patient to provide an accurate clinical history as opposed to AMI which can corroborated by a combination of laboratory, electrocardiograph and imaging tests (Boufous et al. 2003; Fitzpatrick et al. 1999). This ethnic difference in admission diagnosis could therefore be due to language barriers. If one cannot express oneself sufficiently clearly in English there would be a tendency for late presentation (hence the higher rates for AMI), or to provide inadequate

**Figure 3: Effect sizes of predictors of mortality**

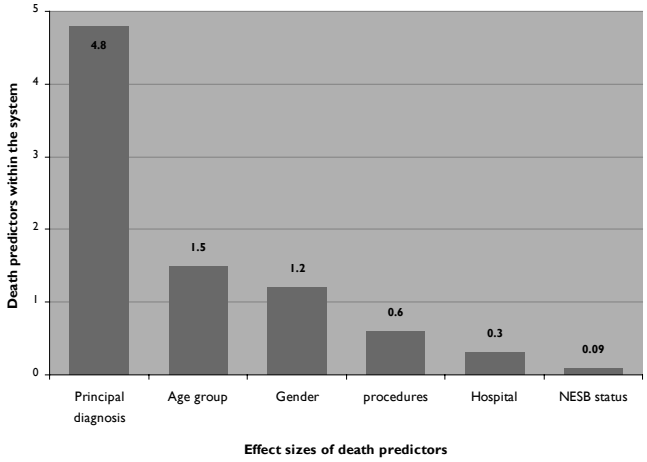
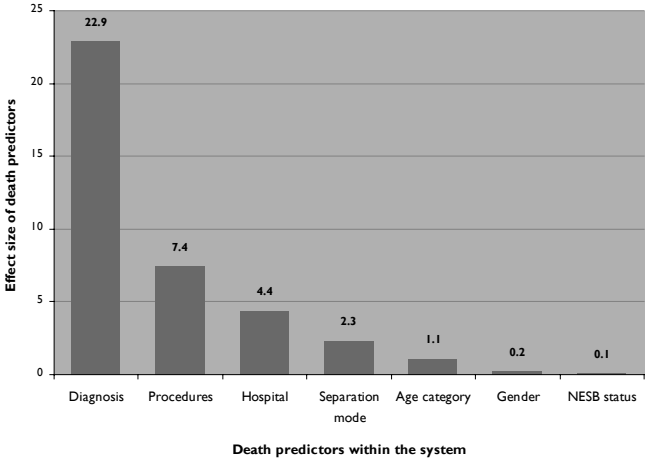



**Figure 4: Effect size of predictors of LOS**



information to guide the clinician at the early stage of angina, leading to misdiagnosis of angina at the onset. Even where language is not a barrier it is estimated that one third of patients presenting to emergency departments with chest pain will not be admitted to hospital, up to 5% of whom will have a missed AMI (Herren et al. 2001; Lee et al., 1987). Other factors that come into play may include NESB patients' lack of knowledge of the healthcare system and the socioeconomic differential due to the fact that some sectors of the population, mainly ESB patients, may have private health insurance, thus skewing the profile of ESB in public hospitals.

***Invasive procedures***

The second hypothesis was that NESB patients would undergo fewer invasive procedures than ESB patients. The findings do not support this hypothesis. The current study found that NESB women were more likely to undergo cardiac catheterisation and CABG and less likely to receive PTA than their ESB counterparts. For men, procedure rates were comparable for cardiac catheterisation and CABG but NESB men had significantly higher rates for PTA than their ESB counterparts. Such findings are inconsistent with previous studies in the United States (Daumit et al. 1999; Kravitz 1999; Paterson et al. 1997) and the United Kingdom (Feder et al. 2002; Lowry et al. 1984; Shaukat, de Bono & Cruickshank 1993) which suggest less likelihood of undergoing invasive procedures among African Americans, Hispanic Americans and migrants of a South Asian background. Although the data used in this study did not have patient-specific measures of socioeconomic status (SES) for adjustment in the analysis, the Australian universal health system (Medicare) decreases the effect of income (ability to pay) on access to invasive procedures that exists in most developed countries and is more pronounced in the United States (Anderson et al. 1993). In addition, the Australian Institute of Health and Welfare has put in place measures to monitor variations in sentinel surgical procedure rates in public hospitals (Australian Institute of Health and Welfare 2000a) following current evidence suggesting that invasive procedures does not necessarily yield better health outcomes than non invasive treatments (Cunningham 2002), and pointing to the increase in the rates of unnecessary surgery (Leape 1992). Thus, it is likely that the observed pattern and ethnic differences in revascularisation rates is in actual fact real.

***Death and/or discharge***

It was also hypothesised that NESB patients would be more likely than ESB patients to die in the system or discharge themselves against medical advice. The findings do not support this hypothesis. In the unadjusted model, NESB women were more likely to die in hospital than ESB women. After controlling for age, admission diagnosis and primary procedure, this difference disappeared. However, the finding that ethnic differences in the receipt of invasive procedures were not associated with differences in mortality is consistent with the international literature (Feder et al. 2002). No difference was found between the ESB and NESB patients in terms of hospital discharge, except that ESB women were more likely than NESB women to be discharged to another institution for rehabilitation. Current data in Australia indicate that Australian Indigenous people are more likely than other patients to discharge themselves against medical advice due to communication difficulties resulting from doctor-patient differences in language and cultural values (Cunningham & Beneforti 2000), and this has lead to high mortality rates among this target population (Australian Bureau of Statistics and Australian Institute of Health and Welfare 1999; Cunningham & Paradies 2000). Although NESB patients are likely to experience language difficulties, there are a significant number of NESB doctors covering more than 50 languages across Victorian public hospitals (Poynter 2002). While these doctors represent a broad spectrum of languages, the unanswered question is whether they would be in the right place and time to service patients when required. Nevertheless, current evidence suggests that NESB is associated with morbidity management and is a predictor of medical encounters (Knox & Britt 2002).

Overall, the results of separation mode and receipt of invasive procedures contradict overseas studies and this is consistent with Australian studies of health outcomes among migrants (Australian Bureau of Statistics 1998; Bennett

1993). Unlike data in the international literature, which suggest that migrants in developed countries (Erens, Primatesta & Prior 2001; Fang et al. 1996; Wild & McKeigue 1997), especially those of South Asian background (Wild & McKeigue, 1997) have higher standardised mortality ratios for IHD than national averages, CVD age-standardised mortality ratio in Australia has been found to be consistently lower among Australians from a NESB compared to their Australian-born counterparts (Australian Bureau of Statistics 1998; Australian Institute of Health and Welfare 2000b; Bennett 1993). The lowest SMR was reported among those of Asian origin with death rates 39% lower among Asian-born males and 30% lower among Asian-born females than their Australian counterparts (Australian Institute of Health and Welfare 2000b). Further research is needed to explore whether ethnic differences in hospital utilisation could account for these differentials.

Finally, it was hypothesised that NESB patients would have longer LOS in hospital than their ESB counterparts. This hypothesis was confirmed after controlling for age, diagnosis and primary procedures. Such findings are consistent with the literature both in Australia (Falconer & Ziguras 1994; Trauer 1995) and overseas (Morgan & Andrushko 1977). The study by Trauer (1995) reported that the median hospital stay for NESB patients was 46% greater than that of ESB patients. These ethnic differences in hospital LOS are moderated by differences in English ability and/or differences in service utilisation between clusters. It is likely that the longer LOS in hospital reported in this study is due to complications associated with late presentation. That is consistent with the current literature suggesting that the establishment of chest pain protocols leads to appropriate admission/discharge decisions and early identification of multiple coronary risk factors and risk of adverse events, resulting in shorter hospital stays (Boufous et al. 2003; Gomez, Anderson & Karagounis 1996; Roberts, Zalenski & Menash 1997).

The current study has several methodological limitations associated with interpreting the results. The Victorian Department of Human Services introduced the casemix funding system on 1 July 1993, which resulted in significant funding cuts to the health budget (Davies & Senes 2001). This factor may confound the findings reported in this study as there may have been a likelihood of reduced access to cardiac procedures due to reduced funding. The impact of casemix in explaining ethnic differentials in terms of treatment and service utilisation warrants further research.

Our dataset did not have data on the SES of the studied population, physician's recommendation or patient's choice for revascularisation. The extent to which these factors could explain the observed ethnic differences in revascularisation rates or pattern of separation mode is unknown. Further research is needed to ascertain why in the current study NESB patients are more likely than ESB patients to be transferred to another institution for rehabilitation, and to explore the clinical implications of late presentation among NESB patients. While the study by Feder and associates (2002) found that physician bias could not explain the low revascularisation rates observed among migrant patients of a South Asian background living in the UK when compared to their white counterparts, further research is needed to establish whether the higher than expected revascularisation rates observed among NESB Australians could be explained by physician bias or patient's choice. Studies seeking to establish the factors that drive these differentials would need to take into account consumer satisfaction and predictors that influence consumer decisions (such as variation in practice style, insurance status, and patient and health provider attitudinal characteristics).

In addition, LOS may not be a good measure of service delivery and service utilisation, although it may be a good tool for administrators to justify their resource utilisation. There are many reasons to suggest that much more research is needed in the field of hospital data collection, management, classification and coding systems to allow for an evaluation of services provided. This is particularly important as LOS is influenced by many factors; for example, clinicians may have different views in deciding whether or not the patient meets the discharge criteria. From the administrative perspective, there is an inter-institution variability in LOS for the same disease due, perhaps, to differences in policy guidelines

regarding admission and discharge criteria. Because LOS is directly related to resource utilisation in terms of funding and spending, some guidelines may be restrictive in terms of time spent in hospitals to ensure adequate availability of bed space. Finally, patients who are likely to stay longer in hospital may be subject to 'statistical discharge'; that is, when a patient is deemed to no longer need acute care but to require rehabilitation or other non-acute care which the same hospital will provide. In this case, the acute episode is ended and a new episode is started of the appropriate care level.

Another limitation is that the traditional ESB/NESB dichotomy as a measure of ethnicity may not perform particularly well. The categories 'NESB' and 'ESB' both include a wide range of cultures and ethnic identities, hence limiting the applicability of the study findings to any specific cultural, language or ethnic group. For example, English and South Africans were both categorised as ESB. However, an ESB person from England and an ESB person from South Africa (where the official languages include Afrikaans, Bantu and English) may perceive health differently or have different health-seeking behaviours. Likewise, NESB persons from Africa may well be different to NESB persons from Southern Europe or Asia in terms of understanding disease, seeking services and in their health risk profile. Further studies of specific NESB communities are required to explore the extent to which the ethnic differences identified in this study apply to individual groups.

## Conclusion

Overseas studies have shown that migrants are more affected by CVDs and their risk factors than the host population. While the 'healthy-migrant effect' has been suggested as one of the possible explanations, risk factors known to be associated with CVDs have been found not sufficient to explain the lower than expected standardised mortality ratios among migrants in Australia. What is not known is whether access to and utilisation of public health services could help explain mortality differentials between migrants and Australian-born populations.

The overall salient outcome from this study is that ethnicity measures were significantly associated with health service delivery and health service utilisation. The study findings suggest that earlier diagnosis of anginal symptoms in those from a NESB may prevent some later presentations with AMI. . The study also found that there may be systematic differences in patients' treatment and service utilisation in Victorian public hospitals, with NESB more likely than their ESB counterparts to receive invasive procedures and to stay longer in hospital. The extent to which physicians' bias and patients' choice could explain these differences requires further investigation. Further empirical studies are required to investigate whether the extra care associated with the high likelihood of being transferred to another institution, longer hospital stay and revascularisation observed among NESB results in better outcomes and quality of life. However, it is of no doubt that more research into the division and categorisation of country of birth needs to be performed, subject to limitations related to complexity of analysis (large number of groups) and rarity of cases within sub-groups (small group size) that may affect the power, data analysis and interpretation of the data. The problem of inequalities in health service utilisation and health outcomes may remain inadequately explored in the absence of a more effective way of categorising hospital data.

## Acknowledgements

Our thanks are extended to Mr. Dean McKenzie and Mr. Jim Lewis at the Victorian Transcultural Psychiatry Unit (St Vincent's Hospital, Melbourne) and Dr Graeme Hawthorne at the Department of General Practice and Public Health (University of Melbourne) for their statistical advice and assistance during data analysis. This study received financial assistance from the Centre for Health Program Evaluation (The University of Melbourne).

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