Chronic health condition of Asian migrants to Australia: A longitudinal investigation

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Abstract

Present study investigates chronic health condition of Asian migrants to Australia and changes in their health as their length of stay increases in Australia, in comparison to other foreign-born and the native people. Data on four chronic health conditions - cardio vascular disease (CVD), respiratory problems, cancer and diabetes mellitus - collected in waves 3, 7 and 9 of Household Income and Labour Dynamics in Australia (HILDA) survey have been for this purpose. Random effects logistic regression models were used for the analysis. Study findings showed that Healthy immigrant effect (HIE) exists for Asian immigrants with respect to cancer, CVD and respiratory problems, and they do not have HIE with respect to diabetes. Except for respiratory problems, their health advantage with regard to various chronic health conditions erodes as their length of stay increases in Australia.

Introduction

Pattern of migration to Australia have changed radically since the abandonment of the white immigration policy during the 1970s. Currently, most of the immigrants to Australia are from non-English speaking countries. Of them, Asians are the majorities. They account for more than 40% of all the immigrants to the country during 2011-12 (Australian Government 2012). As a result of increased migration from Asian countries in the last four decades, the size of Asian born population in Australia has changed significantly (Hugo 1992). While the size of Asians was less than 2% of Australia's population during 1970, now they account for slightly above 8% of Australia's total population, which is a four-fold increase in the percentage of Asian population in Australia, during the last four decades (ABS 2011). In spite of the fact that Asians are the fastest growing immigrant community in Australia, there were apparently very little efforts to study the health of Asian immigrants in Australia (Anikeeva et al. 2010).

Asian migration to Australia

Asian migration to Australia has a long history and was dated back to the European exploration and settlement in Australia (Hugo 1992). Chinese are the first Asians that arrived Australia in huge numbers during the gold rush period beginning in 1851. Later, a considerable number of people from India, mainly Indian born children of British military and civil servants and few Indians from Sind, Bengal and Gujarat and a visible number of Sikhs and Muslims from Punjab arrived and settled in Australia (Price, Charles A 1987). Portions of these Indians worked in sugar and banana fields in New South Wales and as tropical labourers in Queensland. A considerable number of Afghans along with their camels were admitted to Australia during 1860's to develop the arid interior and to transport domestic supplies and pipes for wells (Price, Charles A 1987). In the later decades of the 19th century, significant number of immigrants from Sri Lanka, Malaysia, Indonesia and Philippines arrived and settled in Australia. During 1860s, Chinese account for more than 90% of all Asian immigrants to Australia. But, due slow but steady increase in inflow of immigrants from other parts of Asia, the share of Chinese immigrants in the total Asian immigrants reduced to 60% by 1901 (Hugo 2003). The size of non-white immigrants, particularly Chinese (38,500 people in 1880s) was sufficient that time in provoking white agitation which subsequently resulted in imposing restrictions on non-white immigrants. One of the first acts made after the formation of federal government in 1901 is the

Immigration restriction act, which is popularly known as white Australian Policy. This act was made to firmly discourage non-white immigrant settlement in Australia.

As a result of white immigration policy the share of Asian born population in the total foreign born population decreased from 5.23% in 1901 to 2.93% in 1954. Also, their per cent in the total population size of Australia fell from 1.21% to 0.42% during the same period (Price, C.A. & et al. 1984). Following second world, there was a fundamental shift in the thinking of Australian policy makers. They believed that the country is too sparsely populated to ensure its safety and its economic development. Slowly, more immigrants from various corners of the world were allowed to enter into Australia. As a result, again, Asian flow slowly started increasing. With the abandonment of white immigration policy during 1970's and with the adoption of multiculturalism policy that neutralised over preference for immigrants from 'traditional source' (mainly European) countries, Asian immigration got accelerated. The increased flow of Asians is such their population increased by seven times in between 1971 and 1991 and then doubled in between 1991 and 2011 (ABS 2011). Even after changes in immigrant selection criteria, on the basis of immigrant skills, the flow of Asian immigrants continued to increase. The accelerated increase in immigrants from various corners of Asia decreased the dominant share of Chinese among Asian immigrants to about 12% in 2001 from above 60% in 1901 (Hugo 2003). At present, Asian born people account for slightly above 8% of the total Australian population. Asian immigrants are ethnically and culturally diverse among them-selves and contributed to the overall diversity in Australia.

Migration and health

The relationship between migration and health is complex and is generally intertwined. I.e. migration can affect health outcomes and health can play significant role in migratory decisions (Lu 2008). Earlier studies conducted in Australia and elsewhere found that immigrants, in general, are better in their health upon their arrival (Donovan 1992; Fennelly 2007; McDonald & Kennedy 2004) and their health declines as their length of stay increases in the host country (Donovan 1992; Fennelly 2007; Kennedy, McDonald & Biddle 2006; McDonald & Kennedy 2004; Stephen et al. 1994). The better health of immigrants upon their arrival is widely referred as Healthy Immigrant Effect (HIE). Although health requirements and health screening practices of the host countries play a role in ensuring good health of immigrants at the time entry into the host country, but health was also found playing a significant role in migration selection (Lu 2008). Earlier studies conducted in various parts of the world showed that health of immigrants and the existence of HIE are likely to vary from one immigrant group to another and also from one health condition to another (Bruce Newbold & Danforth 2006; Newbold 2006; Setia et al. 2012).

In case of Australia, most of the existing literature on health differentials to date is mainly focussed on the health of general Australian population and the aboriginal (including Torres and straight islanders) population. Most of the studies that have focussed on the health of Foreign-Born (FB) people were mainly focussed on the health of immigrants from Europe, and from Mediterranean countries like Greece, Italy and the former Yugoslavia (Gibberd et al. 1984; McCredie, Coates & Ford 1990; McMichael & Bonett 1981; Young 1987). Only very few studies have only focussed on Asians. Among them, couple of studies only focussed on the chronic health condition of Asian immigrants (Brock et al. 2007; Gray, Harding & Reid 2007; Grulich, McCredie & Coates 1995; Leung, R et al. 1994; McCredie, Williams & Coates 1999). Two of these studies had only considered duration of residence in Australia as an explanatory factor effecting prevalence of chronic health condition of Asian immigrants (Grulich, McCredie & Coates 1995; Leung, RC et al. 1994).

Existing knowledge indicates mortality rates for CVD and diabetes were more among Asian immigrants as compared to Australian-born people. However, the mortality for both health conditions were found to decline as their duration of stay increases in Australia (Gray, Harding & Reid 2007). The prevalence of high bold pressure is lower among Chinese immigrants than the Australian-born counterparts (Hsu-Hage & Wahlqvist 1993). However, whatever the studies that were conducted in

Australia on the health of Asian immigrants were conducted long back. And quite for a long time, there are no studies to assess the health of Asians in Australia, particularly with respect to various chronic conditions such as cancer, CVD, chronic respiratory problems and diabetes. These four chronic health conditions are among the leading causes of death and disability in Australia and are also part of the National Health Priority (NHP) areas. These four chronic conditions, together, account for half of the total burden of disease and injury (TBDAI) in Australia (Begg et al. 2007). Individually, cancer alone account for 19% of the TBDAI. Of this burden, 82% is fatal and 18% is non-fatal. CVD, on the other hand, account for 18% of TBDAI, of which 78% is fatal and 22% is non-fatal. Chronic respiratory problems and diabetes account for 7% and 5% of the TBDAI in Australia. Fatal burden due to chronic respiratory problems is 38%, and for diabetes it is 22% (AIHW 2013).

Due to the limited data availability there has been very little attention given to understand the health of Asian immigrants in Australia. Since knowledge on the health of Asian-born immigrants in Australia is very patchy, particularly on their chronic health conditions and changes in their health as their length of stay increases in Australia, present study investigates the health of Asian immigrants in Australia. As a part of that present study investigates the existence of healthy immigrant effect and subsequent changes in the health of Asian immigrants, with their length of stay in Australia, with respect to the four chronic conditions Cancer, Cardiovascular disease (CVD), diabetes mellitus and respiratory problems. Very precisely, the present study is aimed at addressing the following two specific research questions.

(i) Whether Asian immigrants are in better health upon their arrival to Australia, than the NB people?
(ii) What happens to chronic health conditions of Asians as their duration of residence increases in Australia?

Methodology

Data

Data from annually conducted Household Income and Labour Dynamics in Australia (HILDA) survey was used in this study. HILDA is a longitudinal survey of Australian residents occupying private dwellings. The survey was started in the year 2001, with a nationally representative sample of 7,682 households. All the members of these households form the basis of HILDA panel to be interviewed in all the subsequent waves of HILDA. In all HILDA waves interviews were taken from all people aged 15 years and above. While information on general health, income, and various socio-demographic characteristics were collected from all the respondents in all the waves, information on various chronic health conditions like Cardio Vascular Disease (CVD), respiratory problems, arthritis and diabetes, on which present study is based, was obtained only in waves 3, 7 and 9. All the respondents, based on the country of birth, were categorised into four groups namely Asian born, Australian born, born in English Speaking (ES) countries, and born in other countries. All the FB subgroups were further subdivided into three groups namely those with less than 10 years of stay in Australia, those with 10 to 19 years of stay in Australia and those with 20 or more years of stay in Australia, based on their duration of residence in Australia. A total of 9,249 respondents have responded in all the three waves – i.e. waves 3, 7 and 9 - of HILDA survey. These respondents form the basis of the balanced panel used in this study. Out of the 9,249 respondents, 7,238 were NB, 956 were born in ES countries, 441 were born in Asian countries and the remaining 614 respondents were born in other countries. Information collected from these respondents on their chronic health condition, socio-demographic characteristics and health related behaviours was used in this study.

As part of HILDA self-completion questionnaire, each respondent was asked whether he/she was ever told by a doctor or nurse that they had any of the long-term chronic health condition that have lasted or likely to last for six months. The asked chronic conditions included cancer, chronic bronchitis,

asthma, heart/ coronary disease, high blood pressure/anxiety, circulatory conditions such as stroke, hardening of artery and etc., and diabetes mellitus.
A respondent was considered suffering from CVD if he/she had one or more of the following problems: heart/ coronary disease, high blood pressure/anxiety, circulatory conditions such as stroke, hardening artery and etc. Similarly, a respondent was considered suffering from respiratory problems if he/she was suffering from asthma or chronic bronchitis. In waves 7 and 9 information was collected from each respondent on type 1 and type II diabetes. Such detailed information on diabetes was not obtained in wave 3. Rather, simply whether respondent was ever diagnosed with diabetes or not was obtained in wave 3. So, to maintain consistency with the information provided in wave 3, we have combined the information on type I and type II diabetes, collected in waves 7 and 9, to obtain whether a respondent was suffering from diabetes (i.e. either of type I or type II diabetes) or not.

Dependant variables:

The dependant variables for this study are the outcomes on various chronic conditions such as cancer, CVD, respiratory problems and diabetes mellitus.

Independent variables:

The main exposure variables in this study are the country of birth and the duration of residence in Australia. Age, sex, place of residence, state, household income level, current marital status, level of education, type of employment and English speaking ability are the socio-demographic control variables used in the regression analysis. Wave effects were also included the regression model, in the form of wave dummy variables. Physical activity, smoking habit and drinking habit are the health behaviour variables that are used in the regression analysis.

Statistical analysis:

To begin the analysis, wave and age wise estimates of prevalence of cancer, CVD, respiratory problems and diabetes were obtained for Asian immigrants and were compared with those of other FB subgroups and the NB people. In the next step, the study proceeds step by step using random effects logistic regression models to determine whether country of birth and the duration of residence in Australia have any influence on the outcome of various chronic health conditions, after controlling for various factors that were well proved or are hypothesized to have association with various health outcomes. In the first step, the effect of country of birth and the duration of residence in Australia on various chronic health conditions were determined, just by adjusting age and sex. In the second step, in addition to the variables in model I, results were adjusted for the effects of various socio-demographic factors. In the final step, in addition to the variables in model II, role of health behaviour variables such as physical activity, smoking and drinking was assessed on the relationship between country of birth and duration of residence with the prevalence various chronic conditions.

Data analysis was carried out using SAS version 9.3. Although both cross-sectional as well as longitudinal weights were provided with the HILDA data, longitudinal weights were only used as per the requirement of the study. To assess the extent of bias due to missing values, multiple imputations were performed using proc mi (subsequently results were summarised using proc mianalyze) and the results were compared with the results that were obtained without imputing missing values. The results, however, were not found changing significantly between the two methods. Therefore, present study proceeds with the results that were obtained without multiple imputation. Effects of various factors were provided in the form of odds ratios and their confidence intervals. Statistical significance and the confidence limits were obtained using Wald statistics.

It is known that differential pattern of misreporting of health problems among various FB and the NB people can influence the results and conclusions. Therefore, the extent of misreporting and their differentials across various FB and the NB subgroups need to be assessed. One of the advantages with

longitudinal data is that such an assessment is possible, particularly when the information is obtained on the ever experience of a particular sort of event/health problem. However, this is not possible with cross-sectional data. Before proceeding to the main analysis, the pattern of misreporting among various FB and the NB people was studied.

Results

Demographic characteristics of the respondents

Table 1 shows socio-demographic characteristics of the study respondents. In this study there are more female respondents than males. In particular, female respondents are slightly more among Asians (57%) than the NB people (54%) and other foreign-born subgroups. Most of the Asians (39.5%) are in the age group 30-44 and only few (10.4%) were in the age group 60 and above. More than 80% of the Asian respondents are living in three states namely New South Wales (43.8%), Victoria (30.6%) and Western Australia (10.7%), while only 63% of Australian born people, 69% among respondents from ES countries live in these three states. Education levels of Asians are slightly better than the NB people and the FB people from other countries. Most of the Asians (88%) live in major urban areas in Australia, while only 56% of the NB people live in major urban areas. Majority of the respondents (above 60%) are either married or in de-facto relation. Per cent separated/widowed is least among Asians (9.3%), in comparison to other FB groups and the NB people. The per cent having full time employment is same among Asian immigrants (42.9%) and the NB people (44.1%). Only one fourth of Asian immigrants are proficient in English, while it is universal (roughly 98%) among the NB people and among FB people from ES countries. Most of the Asian respondents (41.5%) in this study have arrived Australia only after 1990, while the same among FB people from ES countries is 11.6% and for FB people from other countries is 15.6%. Income levels of Asians is same as the income levels of NB Australians and are slightly better than the income levels of people from other countries.

Pattern of misreporting

In longitudinal studies, pattern of misreporting can be of two ways. 1) Regular misreporting (i.e. misreporting in all the waves) and 2) irregular misreporting (i.e. misreporting in only in some waves). Although both types of misreporting are problematic, it is not possible to estimate magnitude of misreporting of either kind. However, magnitude of misreporting of second kind is easy to measure with certain assumptions, which may or may not hold in reality. In the following section, the second type of misreporting is studied for different health conditions and by country of birth of respondents. For convention, from here on misreporting we mean misreporting of second kind.

If a respondent, in a particular wave (say wave 3), reports that he/she was ever diagnosed with a particular chronic condition (for instance say diabetes) then he/she must report the same in all the subsequent waves (i.e. in waves 7 and 9). If this did not happen, then the respondent can be considered as misreporting. On the other hand, if a person did not report a particular chronic condition in wave 3 and reported it in all the subsequent waves he can be considered as ‘may be not reporting’ as that particular chronic condition might have developed after wave 3. The following Table 2 shows how respondents were classified as misreporting/correctly reporting, based on their responses to the question whether he/she was ever diagnosed with a particular chronic conditions asked in waves 3, 7 and 9 of the survey. For this particular section, we have used balanced panel (i.e. respondents who responded in all the three waves 3, 7 and 9), which is basically a subset of the unbalanced panel used in this study.

(Table 2 here)

After classifying all the responds as misreported or not, the per cent misreporting various health problems were calculated by country of birth and were provided in the form the following Table 3.

Additionally, statistical tests were performed whether there is any difference in misreporting patterns across people by their country of birth. Some important observations that can be made from Table 3 are the following. First, there is statistically significant difference in the pattern of misreporting cancer and CVD, among various FB and the NB people. Second, generally misreporting increases with magnitude of disease prevalence (see Figure 1 in the next section). Third, the misreporting is least among Asians with the exception of diabetes. Fourth, overall misreporting is more for CVD and respiratory problems than for cancer and diabetes. In general, these results should be kept in mind while interpreting the disease prevalence and the regression results. However, as the extent of misreporting is small (though significant for some chronic conditions such as cancer and CVD), pattern misreporting is less likely to influence final results.

(Table 3 here)

Analysis for outcome variables

The Figure 1 below shows trends in per cent of Asian born and the other FB immigrants and the NB people who were ever diagnosed with cancer, CVD, respiratory problems and diabetes, across waves 3, 7 and 9 of HILDA survey.

(Figure 1 here)

It is clear from this figure that except for diabetes Asians are in better health than all other FB and the NB people. Also it is clear from this figure that prevalence of various chronic health conditions increases with the length of stay in Asian migrants. Asian migrants are disadvantaged to the NB people and the FB people from ES countries with respect to diabetes, particularly when their length of stay is above 20 years in Australia.

Results of regression analysis

Effect of country of birth and the duration of residence on Cancer, CVD, respiratory problems and diabetes, after adjusting for age and sex, after adjusting for age, sex and other socio-demographic characteristics, and after adjusting for age, sex, socio-demographic factors and health behaviour variables, are shown in Tables 4, 5, 6 and 7 respectively.

We can see from Table 4, irrespective of duration of residence in Australia, Asians are least likely to have cancer in comparison to other FB subgroups and the NB people, after adjusting for age and sex. Even after controlling for other socio-demographic factors, the results remained same. This clearly shows that Asian born immigrants have health advantage with respect to cancer, irrespective of their length of stay in Australia. However, after controlling for health behaviour variables, alongside age, sex and other socio-demographic factors, Asian born people with more than twenty years of duration of stay in Australia were found no way different from NB people in terms of odds having of cancer. This indicates health behaviour variables can explain part of health advantage among Asian immigrants. Results also showed that older respondents than the younger respondents, widowed/separated persons than the currently married persons, males than females are more likely to get affected by cancer.

Age and sex adjusted logistic regression results shows that Asian with less than 10 years of stay in Australia are least likely to have CVD than the FB people from ES countries and the NB Australians. Same result persisted even after adjusting for other socio-demographic factors. In fact, the advantage slightly increased (odds ratio decreased from 0.54 to 0.51). After additionally adjusting for health behaviour variables, the Asians advantage further increased (odds ratio further decreased to 0.46). Overall, the results suggests that the health advantage of Asians and other FB people from other countries, with respect to CVD, erodes after 10 years of their stay in Australia. The other factors that showed strong association with CVD were age, marital status, sex, employment status, household income, smoking and physical activity. (Table 5)

Age and sex adjusted results showed that the prevalence of respiratory problems is less likely among all FB people, in comparison to the NB people, particularly when their duration of residence in Australia is less than 10 years. Asians with 10 to 19 years of duration of residence in Australia were also less likely to have respiratory problems than NB Australians. However, after 20 years of stay in Australia, Asian born people are found no way different from the NB people in the prevalence of respiratory problems. The same results persisted even after adjusting for other socio-demographic and health related variables. Irrespective of their duration of residence, FB people from other countries have significantly low levels of respiratory problems than the NB people. Age, sex, level of education, smoking, and physical activity are the other important factors that have shown association with respiratory problems. (Table 6)

Unlike cancer and CVD, prevalence of diabetes is high among Asians than the NB Australians and remaining FB subgroups, particularly when their duration of residence is above 20 years in Australia. This result persisted even after adjusting for other socio-demographic factors. However, after further adjusting for health behaviour variables, interestingly, there was no significant difference in prevalence of diabetes between Asians and the NB people. This shows change in health behaviours among Asian immigrants is uplifting the prevalence of diabetes among them. Results even indicate that gender, age, education level, smoking habit and physical activity were associated with the likelihood of prevalence of diabetes (Table 7).

Discussion

Health of Asian immigrants with respect to four chronic conditions - CVD, cancer, respiratory problems and diabetes mellitus - was investigated in this study, in comparison to the other FB and the NB people. Main findings of this study are the following: First, Asians, upon their arrival to Australia, are better in their health than the NB people, except for diabetes. Second, the health of Asian immigrants declines with increase in their duration of residence in Australia. But, the extent of decline and the persistence of health advantage depend upon the types of chronic condition. For instance; although prevalence of cancer increased among Asians with their duration of residence in Australia they always remain advantageous to the NB people with respect to cancer. Prevalence of CVD and respiratory problems, on the other hand, increased with length of stay for Asians and their levels converges with the levels of NB people, after about 10 years and 20 years respectively. Unlike other chronic health conditions, Asians do not have any advantage with respect to diabetes, upon their arrival, and after 20 years of stay in Australia they become disadvantaged to the NB people.

Present study findings provide solid evidence for increase in the prevalence of chronic respiratory problems among Asian immigrants as their length of stay increases in Australia. This finding provides support to the finding of an earlier study conducted in Australia that showed increase in the prevalence of Asthma with increase in duration of residence among Asian immigrants living in Melbourne (Leung, R et al. 1994). Even though strong familial (genetic) link was found in the prevalence of chronic respiratory problems such as Asthma among Asian immigrants (Leung & Jenkins 1994), researchers argued that it may not completely explain the increased prevalence of respiratory problems with increase in duration of residence in Australia (Leung 1996). Rather, presence of certain pollutants and allergens in the Australian environment was thought of as contributing factor, alongside the genetic factors, to the increase in the incidence of respiratory problems (particularly Asthma) in this community (Hill, Smart & Knox 1979; Leung 1996).

Even though the prevalence of cancer was significantly less among Asian immigrants, in comparison to the NB people, magnitude of prevalence of cancer was found to increase among Asians with their length of stay in Australia. Other studies conducted in United States of America (USA) also showed lower prevalence of cancer among Asian immigrants (Huh, Prause & Dooley 2008) and an increase in the prevalence of it with increases in their length of stay in USA (Ziegler et al. 1993). So, all of these previous and our study clearly indicates the negative effect of duration of stay on the incidence of cancer among Asian immigrants. Earlier studies conducted in Australia, on the other hand, found that

despite of low overall prevalence of cancer among Asian immigrants, they are more prone to certain types of cancers. For instance, nasopharyngeal cancer was found high among Asian immigrants than the NB people (Grulich, McCredie & Coates 1995). Also, deaths due to nasopharyngeal cancer are 30 folds higher among Asian immigrants than the NB people (McCredie, Williams & Coates 1999). Certain unknown genetic and lifestyle related factors, alongside low BMI among Asian immigrants might be acting as protective factors against cancer. However, some studies suggests the possibility of underestimation of cancer prevalence among Asian immigrants, due to less screening practices among this community, cannot be overlooked (Lesjak, Ward & Rissel 1997; Taylor, RJ et al. 2001; Taylor, RJ et al. 2003).

The findings of the present study also highlight the health advantage of Asians with respect to CVD and the subsequent loss of it with in the first 10 years of their stay in Australia. Studies conducted in various parts of the world showed mixed results in the incidence of CVD among Asian immigrants, and a substantial variability in CVD risk factors, incidence, hospitalization rates and deaths due CVD among Asian subgroups (Fang et al. 2004; Huh, Prause & Dooley 2008; Klatsky et al. 2005; Klatsky et al. 1994). Earlier studies also found that, in general, level of acculturation is associated with the development of CVD and risk factors that are associated with it, particularly among Asian immigrant subgroups(Marmot & Syme 1976; Taylor, VM et al. 2007).

High prevalence of diabetes among Asian immigrants, found in this study, is consistent with the findings of many earlier studies, conducted throughout the world. For instance, studies conducted in United Kingdom found that around 20% of South Asian immigrants living in United Kingdom who were ever diagnosed with diabetes, which was nearly five times the prevalence of diabetes among the NB UK people (Simmons, Williams & Powell 1989; Weber et al. 2012). Another study conducted in US showed that the incidence of diabetes among Asian Indians in New York is twice among these populations than the native-born non-Hispanic white population (Gupta et al. 2011). A study conducted in Australia also showed that the incidence of type-2 diabetes is about 11.1% among Asian Indians living in Melbourne (Ibiebele et al. 2000), which is more than three folds higher than the prevalence of general population in Australia (ABS 2008). Incidence of diabetes was also high among Asians living in Asia and in fact the risk of diabetes has been increasing in many Asian countries in the last three decades (Weber et al. 2012). Few researchers have viewed that migration will accelerate the risk factors related to the development of diabetes (Weber et al. 2012). In particular, Asian immigrants are found at higher risk of developing diabetes than other immigrant ethnic groups (McBean et al. 2004; Shai et al. 2006). Inadequate physical activity, which is a risk factor for many chronic conditions including cancer, CVD and diabetes, is more among Asian immigrants (Dassanayake et al. 2011).

Results of the present study contribute to the existing knowledge base on the chronic health of immigrants in Australia. Most of the prior existing knowledge on the health of immigrants, particularly in the context of Australia, came from cross-sectional studies only. Although cross-sectional studies are informative and provide a snapshot of health at a particular point of time, interpretation of their results is problematic and the results are likely to be confounded by cohort and time effects (Beiser 2005). HILDA survey data have provided very nice opportunity to study how immigrants to Australia adopt to the conditions in Australia and how their health status varies with their length of stay in Australia. This in turn will help to better understand changes in the overall health of immigrants. Further studies can be build up based on the findings of this study in a number of ways. First, gender variations in the prevalence of various chronic conditions can be studied. Second, health of Asian subgroups (like south Asians, east Asians and etc.) can be studied in the same way as was done in this study. Third, health of Asians at regional or state level in Australia could be studied to understand the contextual effects on their health.

Strengths and limitations of this study

The main strength of the present study is relatively large sample size than the earlier studies on this subject area conducted in Australia and the other strength is the assumption that the effect of duration

of stay on the health of immigrants vary by immigrant subgroups. This assumption was indeed very valid and quite useful in differentiating the effect of duration of stay on the health of various immigrant groups. However, this study also had some limitations. The major limitation of this study is combining all the Asian immigrants into a single group. But, actually there may be a considerable variation between Asian countries in terms of health profiles. Asian countries are very heterogeneous among themselves in terms of culture, race, food, social, economic, occupational, linguistic, political, and living styles. Therefore, the health outcomes are likely to vary among Asian subgroups. But, due to our suspicion of possible inconsistent results associated with small sample size, we did not split Asians into smaller subgroups. Another limitation of the present study is that it is based on self-reported health of respondents, where reporting bias may exist in case of some respondents.

Conclusion: Healthy immigrant effect (HIE) exists for Asian immigrants with respect to chronic conditions like cancer, CVD and respiratory problems. However, no HIE is found for them with respect to diabetes. Health advantage with respect to cancer persists among Asians, while they eventually lose their health advantage with respect to CVD and respiratory problems after about 10 and 20 years of stay in Australia. The prevalence of diabetes is significantly higher among Asian immigrants than the NB people, particularly after 20 years of stay of former in Australia.

Tables to be inserted in the main text

Table 1: Socio-demographic characteristics all the survey respondents

Socio-demographic characteristic	Categories if any	NB (Australia)	FB			
			ES	Asia	Others	All FB
Sex	Male	46.04	49.37	42.86	47.56	47.39
	Female	53.97	50.63	57.14	52.44	52.61
	15-29	25.53	8.37	22.68	10.91	12.28
	30-44	32.30	29.29	39.46	23.45	29.74
Age group	45-59	24.65	35.04	27.44	31.27	32.22
	60+ years	17.52	27.30	10.43	34.36	25.76
	NSW	30.34	28.87	43.76	27.52	31.73
	VIC	24.37	17.99	30.61	31.27	24.81
	QLD	21.69	20.71	5.90	13.19	15.17
State	SA	9.59	10.67	3.85	11.89	9.55
	WA	8.44	16.11	10.66	12.54	13.82
	TAS	3.34	2.30	0.68	1.14	1.59
	NT	0.61	0.94	1.81	0.65	1.04
	ACT	1.62	2.41	2.72	1.79	2.29
	<=12 years of schooling	52.11	42.05	43.54	51.63	45.30
Level of education	Bachelor or diploma	40.52	46.13	43.99	39.09	43.51
	Graduation and above	7.36	11.82	12.47	9.28	11.19
	Major Urban	56.19	68.83	87.98	78.99	76.13
Type of place of	Other Urban	26.04	17.68	9.30	12.05	14.12
residence	Rural Balance	17.77	13.49	2.72	8.96	9.75
	Married/in de-facto	62.75	75.10	72.11	73.62	73.99
Marital status	Separated/Widowed	13.51	15.27	9.30	17.26	14.57
	Never married/in de-facto	23.74	9.62	18.59	9.12	11.44
	Full time employ	44.18	46.23	42.86	35.02	42.07
Current employment	Part time employ	21.51	15.80	16.33	16.45	16.11
status	Un employed	2.83	2.20	5.22	2.93	3.08
	Not in labour force	31.47	35.77	35.60	45.60	38.74
	Proficient	97.65	98.12	24.94	42.02	64.94
English speaking	Good	2.35	1.88	61.68	48.05	29.09
ability	Not good	0.00	0.00	13.38	9.93	5.97
	Not known	0.00	5.86	8.16	6.68	6.61
	<1960		15.48	3.40	31.76	17.80
Year of arrival into	1961-1980		45.29	17.23	29.97	34.46
Australia	1981-1990		21.76	29.71	15.96	21.73
	>= 1991		11.61	41.50	15.64	19.39
	<=20,000	12.85	13.60	12.24	21.17	15.61
Household income	(20,000-40,000]	19.32	20.82	17.91	21.50	20.39
level	(40,000-60,000]	18.97	15.69	22.68	17.92	17.90
	>60,000	48.87	49.90	47.17	39.41	46.10
Sample size (unweighted)		**7238**	**956**	**441**	**614**	**2011**

Table 2: Classification of responds as misreporting or not, based on their responses to a particular chronic condition (say diabetes mellitus), asked in waves 3, 7 and 9.

Response in wave 3	Response in wave 7	Response in wave 9	Decision
yes	yes	Yes	May be correctly reporting
yes	yes	No	Misreporting
yes	no	Yes	Misreporting
yes	no	No	Misreporting
no	yes	Yes	May be correctly reporting
no	yes	No	Misreporting
no	no	Yes	May be correctly reporting
no	no	no	May be correctly reporting

Table 3: Misreporting percentages FB and the NB Australians with respect to chronic conditions

country	Cancer*	CVD*	diabetes	Respiratory problems
Asia	0.64	2.74	1.01	3.16
Australia	3.17	5.11	0.97	4.64
Main ES	2.01	6.30	0.30	3.32
Others	1.77	5.52	0.73	3.70

*Statistically significant at 5% level of significance.

Table 4: Effect of various factors on cancer

Duration of residence at wave 3 (in years) by country of birth	**Model I**		**Model II**		**Model III**	
	Estimate	***CI***	***Estimate***	***CI***	***Estimate***	***CI***
ES < 10	0.57	(0.23,1.40)	0.57	(0.23,1.42)	0.58	(0.24,1.44)
ES 10 to 19	0.67	(0.34,1.30)	0.71	(0.36,1.37)	0.70	(0.36,1.37)
ES >= 20	0.78	(0.60,1.03)	0.79	(0.59,1.04)	0.78	(0.59,1.03)
Asians < 10	0.08**	(0.01,0.42)	0.08**	(0.01,0.42)	0.10*	(0.02,0.54)
Asians 10 to 19	0.21**	(0.08,0.54)	0.18**	(0.06,0.50)	0.21*	(0.07,0.64)
Asians >= 20	0.41*	(0.19,0.87)	0.45*	(0.21,0.96)	0.51	(0.23,1.11)
Others < 10	0.29	(0.08,1.05)	0.27*	(0.07,0.99)	0.34	(0.09,1.30)
Others 10 to 19	0.51	(0.21,1.19)	0.44	(0.18,1.10)	0.53	(0.20,1.38)
Others >= 20	0.69*	(0.48,0.97)	0.66*	(0.46,0.95)	0.72	(0.47,1.09)
Australia ®						

Note: ***Model I:*** adjusted for age and sex.
Model II: adjusted for control variables in Model I+ additionally adjusts for state, level of education, marital status, employment status, household annual income, English language proficiency and wave effect.
Model III: adjusted for control variables in Model II + additionally adjusts for health behaviour variables such as smoking, drinking and physical activity.

Table 5: Effect of various factors on CVD

Duration of residence at wave 3 (in years) by country of birth	Model I		Model II		Model III	
	Estimate	*CI*	*Estimate*	*CI*	*CI*	*Factor*
ES < 10	0.66	(0.40,1.08)	0.69	(0.42,1.14)	0.70	(0.42,1.15)
ES 10 to 19	0.69*	(0.47,1.00)	0.73	(0.50,1.06)	0.73	(0.50,1.07)
ES >= 20	0.93	(0.79,1.10)	0.95	(0.80,1.13)	0.96	(0.81,1.14)
Asians < 10	0.54**	(0.34,0.85)	0.51**	(0.32,0.80)	0.46**	(0.28,0.75)
Asians 10 to 19	0.77	(0.54,1.10)	0.74	(0.52,1.06)	0.69	(0.46,1.03)
Asians >= 20	0.97	(0.66,1.41)	0.96	(0.65,1.41)	0.92	(0.61,1.37)
Others < 10	0.53*	(0.30,0.95)	0.48**	(0.26,0.86)	0.43**	(0.23,0.80)
Others 10 to 19	0.79	(0.51,1.22)	0.77	(0.49,1.21)	0.74	(0.46,1.20)
Others >= 20	1.01	(0.82,1.24)	0.98	(0.79,1.21)	0.95	(0.75,1.22)
Australia ®	1.07	(0.97,1.18)	1.06	(0.96,1.18)	1.08	(0.97,1.20)

Note: ***Model I:*** adjusted for age and sex.
Model II: adjusted for control variables in Model I+ additionally adjusts for state, level of education, marital status, employment status, household annual income, English language proficiency and wave effect.
Model III: adjusted for control variables in Model II + additionally adjusts for health behaviour variables such as smoking, drinking and physical activity.

Table 6: Effect of various factors on respiratory problems

Duration of residence at wave 3 (in years) by country of birth	Model I		Model II		Model III	
	Estimate	*CI*	*Estimate*	*CI*	*Estimate*	*CI*
ES < 10	0.47*	(0.24,0.92)	0.49*	(0.27,0.88)	0.48*	(0.27,0.87)
ES 10 to 19	0.86	(0.54,1.36)	0.85	(0.56,1.30)	0.85	(0.55,1.29)
ES >= 20	0.84	(0.65,1.08)	0.87	(0.69,1.09)	0.88	(0.70,1.10)
Asians < 10	0.21**	(0.10,0.44)	0.18**	(0.10,0.34)	0.14**	(0.07,0.28)
Asians 10 to 19	0.38**	(0.21,0.67)	0.36**	(0.22,0.57)	0.29**	(0.17,0.49)
Asians >= 20	0.83	(0.46,1.48)	0.79	(0.47,1.33)	0.69	(0.40,1.18)
Others < 10	0.28**	(0.11,0.71)	0.20**	(0.09,0.47)	0.16**	(0.07,0.38)
Others 10 to 19	0.60	(0.32,1.14)	0.61	(0.35,1.05)	0.51*	(0.28,0.91)
Others >= 20	0.59**	(0.41,0.83)	0.53**	(0.39,0.73)	0.49**	(0.34,0.69)
Australia ®	1.56**	(1.37,1.77)	0.72**	(0.64,0.81)	0.72**	(0.64,0.82)

Note: ***Model I:*** adjusted for age and sex.
Model II: adjusted for control variables in Model I+ additionally adjusts for state, level of education, marital status, employment status, household annual income, English language proficiency and wave effect.
Model III: adjusted for control variables in Model II + additionally adjusts for health behaviour variables such as smoking, drinking and physical activity.

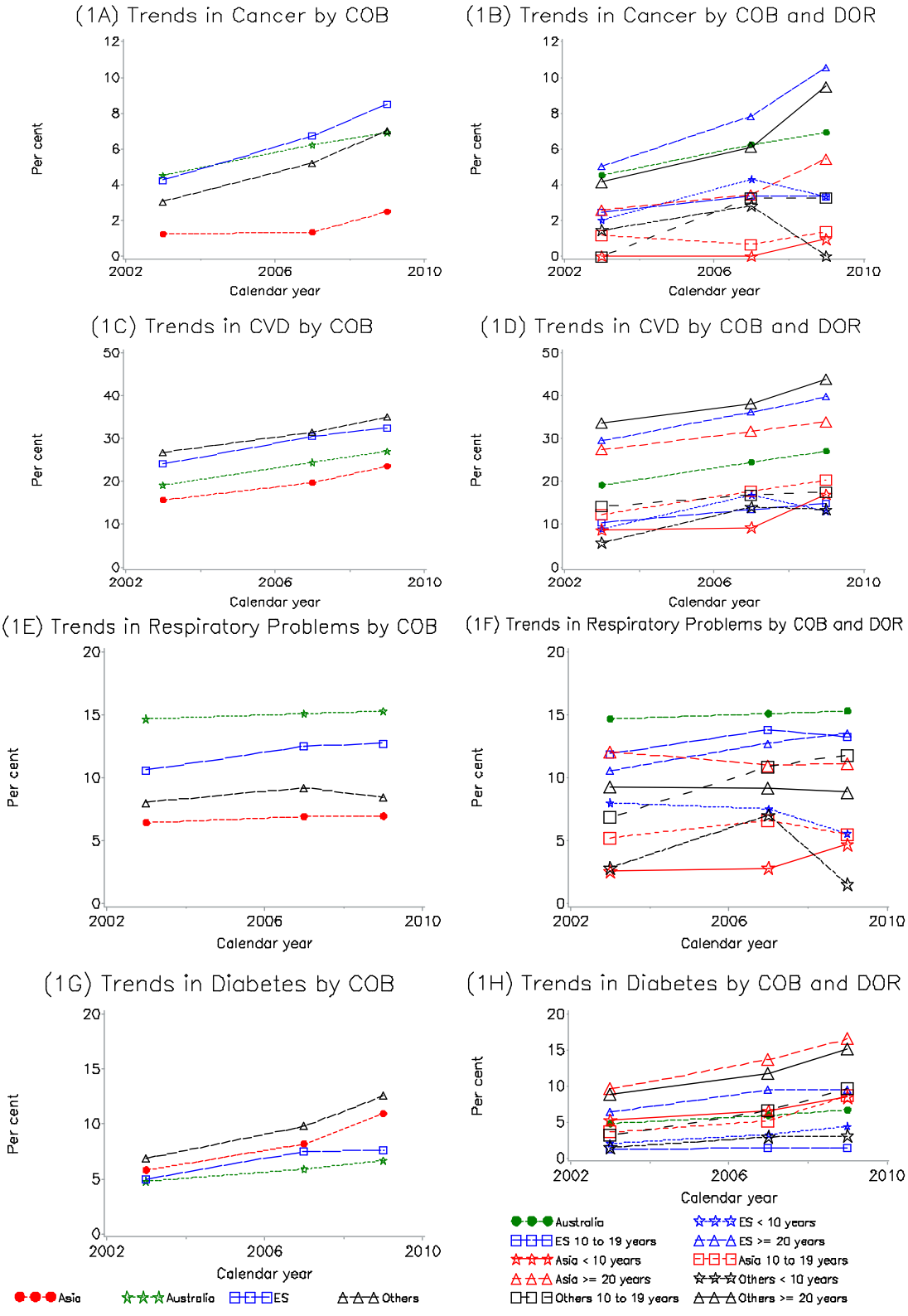
Table 7: Effect of various factors on diabetes mellitus

Duration of residence at wave 3 (in years) by country of birth	**Model I**		**Model II**		**Model III**	
	Estimate	***CI***	***Estimate***	***CI***	***Estimate***	***CI***
ES < 10	0.64	(0.24,1.73)	0.50	(0.17,1.52)	0.49	(0.16,1.53)
ES 10 to 19	0.30*	(0.12,0.75)	0.25*	(0.09,0.71)	0.26**	(0.09,0.75)
ES >= 20	0.95	(0.70,1.29)	0.94	(0.68,1.29)	0.96	(0.70,1.33)
Asians < 10	1.50	(0.72,3.13)	1.70	(0.84,3.43)	1.20	(0.55,2.61)
Asians 10 to 19	1.44	(0.76,2.72)	1.43	(0.77,2.64)	1.10	(0.55,2.18)
Asians >= 20	2.06*	(1.08,3.91)	2.25**	(1.18,4.31)	1.72	(0.87,3.43)
Others < 10	0.73	(0.23,2.31)	0.38	(0.10,1.40)	0.30	(0.08,1.13)
Others 10 to 19	1.41	(0.65,3.05)	1.24	(0.56,2.75)	0.96	(0.41,2.24)
Others >= 20	1.23	(0.85,1.77)	1.11	(0.75,1.65)	1.04	(0.67,1.61)
Australia ®	0.86*	(0.73,1.03)	1.46**	(1.20,1.77)	1.59**	(1.31,1.94)

Note: ***Model I:*** adjusted for age and sex.
Model II: adjusted for control variables in Model I+ additionally adjusts for state, level of education, marital status, employment status, household annual income, English language proficiency and wave effect.
Model III: adjusted for control variables in Model II + additionally adjusts for health behaviour variables such as smoking, drinking and physical activity.

Figures to be inserted in the main text

Figure 1: Per cent having various chronic health conditions across the waves of HILDA and by country of birth and duration of residence in Australia



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