The longer you stay, the bigger you get- really? Evidence from an Australian longitudinal study

Abstract

Using multiple rounds of panel data from the Household Income and Labour Dynamics in Australia (HILDA) and multi-level hybrid logistic regression models, this study investigates the differences and changes in the levels of obesity among Foreign-Born (FB) from English Speaking Countries (ESC) and non-English Speaking Countries (NESC) relative to Native-Born (NB) Australian over time. Regression results showed that FB from NESC living in Australia for less than 10 years and 10-19 years are less obese as compared to the NB people, but, this advantage was lost for the FB from NESC staying in Australia for more than 20 years. On the other hand, irrespective of the duration of residence, the FB from ESC did not differ significantly from NB people in terms of their odds of being obese. This paper challenges the commonly held assumptions that migration and longer stay in the host country is associated with unhealthy weight gain.

Background and Introduction

Many observational studies have shown an association between nativity, duration of residence, health and health behaviour outcomes. For example, the longer stay in the host country has been shown to be associated with a decline in health (Gushulak, 2007; Hyman, 2001; Markides & Eschbach, 2005; Morales, Lara, Kington, & Valdez, 2002), adoption of unhealthy behaviour (Gushulak, 2007; Hyman, 2001; Markides & Eschbach, 2005; Morales et al., 2002), narrowing down the Body Mass Index (BMI) (Antecol & Bedard, 2006; McDonald & Kennedy, 2005) and other associations. This paper extends the current literature on obesity convergence, an area of research that has received little attention. We focus on obesity as it is considered as one of the five leading global risks for mortality in the world (World Health Organization, 2009) and one of the major determinant of cardiovascular disease, diabetes and certain types of cancer (World Health Organisation, 2006). Obesity is also a major public health concern world over due to enormous social, health and economic costs.

There is some research evidence that suggests an increase in obesity levels with duration of residence among Hispanic, Asian and other immigrants to the USA (Antecol & Bedard,

2006; Goel, McCarthy, Phillips, & Wee, 2004; Kaushal, 2009), among various immigrant groups in Canada (McDonald & Kennedy, 2005; Setia, Quesnel-Vallee, Abrahamowicz, Tousignant, & Lynch, 2009) and the BMI convergence for Asian and European immigrants in Australia (Hauck, Hollingsworth, & Morgan, 2011). Examining the issue of differences in obesity levels between immigrants and Australian born and how this difference changes over time is an important policy issue in Australia which has one of the highest proportions of immigrant population in the world: an estimated 24% of the total population of4.96 million people is born overseas, and net overseas migration is the major contribution to population growth in Australia (Australian Bureau of Statistics, 2008; Australian Bureau of Statistics (ABS), 2007a). As the number of immigrants in Australia continues to rise, it has becomes increasingly important to know how the health risk factors such as BMI, overweight, and or obesity differs between immigrants and native-born individuals and how it changes over time.

In Australia, the overall prevalence of overweight and obesity has increased over time. The recent national health survey in Australia suggests that about 64 per cent of Australians aged 18 years and over were either overweight or obese (35 per cent overweight and 29 per cent obese). Generally, men were more likely to be overweight or obese than women (70 per cent compared with 56 per cent) (ABS, 2012). In terms of body weight by country of birth, this survey also suggests that foreign-born people are less likely to be overweight or obese as compared to the native-born Australians. Among the foreign-born people South-East Asians are least likely group to be either overweight or obese (ABS, 2012). The research findings of (Hauck et al., 2011) also suggests that 1st generation of Asian immigrants in Australia converge their bodyweight to the host population once they become second generation. This means that as they stay longer in Australia, their bodyweight converges to the native-born people in Australia. However, much of the research evidence (with few exceptions) both internationally and nationally come from single or repeated cross-sectional datasets which provide only snapshot(s) in time of differences in the outcome between migrants and non-migrants

The present study advances the migrant health literature by providing the first estimates of nativity gap in obesity for Australia, based on an analysis of the Household Income and Labour Dynamics in Australia (HILDA) Survey, a nationally representative longitudinal dataset not yet utilised for migrant health purposes. Specifically, using a hybrid regression model (explained in the next section) that focusses on the associations of both within-person

and between person variations over time we examine how migrant obesity levels change relative to the Australian born over time.

Data

This study uses data from Household income and labour dynamics in Australia (HILDA) survey, which is a longitudinal survey of Australian residents occupying private dwellings. HILDA survey was commenced in the year 2001, with a large and nationally representative sample of 7,682 households, with at least one eligible member aged 15 years or above. All the individuals aged 15 years and above were interviewed in each of the subsequent waves. In addition to them, some of the non-respondents in wave 1 were successfully interviewed and followed in the later waves. Additionally, new individuals that were resulted from the structural changes of households (example all those who turned to 15 years, new households that were splitted from households covered in previous HILDA survey – may be as a result of children leaving their homes to have their own house or to live with their partner or due to breakup with partner or family member etc.) were added and were followed in all the subsequent waves.

Information on BMI was not collected in the first five waves. However, in all the subsequent waves (waves 6 onwards) information on height and weight was obtained from each of the respond person, as a part of respondent self-completion questionnaire. This information on weight and height was used to calculate BMI using the formula BMI=height/weight^2. Analyses were conducted on unbalanced panel of all those individuals who responded in wave 6 and in at least in one wave between waves 7 to 10. The reason why we choose to use unbalanced panel data is: (1) unlike balanced panel, we can make use of most of the information that was collected and (2), health selection bias can be controlled by including number of times a person responded out of the 5 waves between waves 6 and 10.

The outcome variable in this study is respondent's obesity level, which was calculated following World Health Organization's (WHO) definition of obesity, i.e., a respondent was considered as obese if he/she has a BMI of above 30. Country of birth and duration of residence in Australia are the exposure variable. Age, sex, marital status, employment status, level of education, household equivalised income, wave number and number of times a respondent responded in between waves 6 and 10 are the control variables.

All the respondents, based on their country of birth, were divided into three categories namely Native-born (NB), born in English speaking countries (ESC), and born in non-English speaking countries (NESC). Immigrants from United Kingdom, America, New Zealand, Canada, Ireland and South Africa were categorised as immigrants from ESC and other immigrants were categorised as immigrants from NESC. Each of the FB subgroup was further divided into three groups depending upon their duration of residence in Australia; those whose duration of residence is less than 10 years in Australia, with 10 to 19 years of stay in Australia, and with more than or equal to 20 years of stay in Australia.

Statistical methods

Initially, basic descriptive analysis was carried out separately by country of birth and duration of residence in Australia, to see whether there were differences in the levels of obesity by country of birth and by duration of residence Australia. We used multi-level hybrid logistic regression models to investigate the effect of country of birth and duration of residence in Australia on level of obesity. Three models were used. In model 1, country of birth (Table 2) and country of birth and duration of residence (Table 3) are the only explanatory variables. In model 2, in addition of country of birth (Table 2) and country of birth and duration of residence (Table 3), age, sex, wave number and number of times a person responded out of the five waves between waves 6 and 10 were also included. In model 3, in addition to variable in model 2, level of education, marital status, employment status and household equivalised income were added.

The multilevel hybrid logistic models used in this study have the following form.

$$\log it(P_{it}) = \alpha_i + \beta_1(X_{it} - \overline{X}_{i.}) + \beta_2 \overline{X}_{i.} + \gamma Z_i + \varepsilon_{it} \qquad (1)$$

where P_{it} is the probability for the ith respondent (i=1….n where is n is sample size) in the t^{th} wave (t=1 to 10) to have obesity. In the above regression models α_i represents a random effect to account for clustering at the individual level, $X_{it} - \overline{X}_{i.}$ represents within person variability of confounder X_{it}, $\overline{X}_{i.}$ is the corresponding person-level mean (over time) of X_{it}, Z_i is a vector of time-invariant covariates, and η, β_1, β_2 and γ are coefficient vectors. Wave (time) effects are included in X_{it}.The terms $\overline{X}_{i.}$ and Z_i only change between people and remain constant within people.

The novel features of hybrid model is that it gives better estimates for both the time-varying variables and the time-invariant variables, than those obtained by conventional random effects models in econometric literature (Allison, 2005). In case of linear mixed models, hybrid model produces coefficient estimates for time-varying variables that exactly match with those of the fixed effects model. In case of non-linear models, such as multi-level logistic regression models, mainly because of the convergence problems, the estimates of time-varying variables always may not match with those of the fixed effects models. However, since the main exposure variables in this study (country of birth and duration of residence at wave 1) are time-invariant, using hybrid logistic regression model instead of conventional random effects models of econometric literature produces better estimates. Present study is the first one that uses non-linear hybrid models in immigrant health research in Australia and elsewhere in the world.

Results & discussion

Characteristics of the study respondents at base-line (wave 6)

A total of 12,179 respondents have responded in wave 6 and at least in one subsequent waves between waves 7 and 10. Of them 9,624 respondents (79%) were NB, 1,170 (9.6%) were born in ESC and the remaining 1,385 (11.4%) were born in NESC (Table 1). There were more female respondents (6,467) in the sample than male respondents (5715). All the age groups were sufficiently represented in the sample. Most of the FB respondents had a length of stay of more than 20 years in Australia. Roughly two third of immigrants from NESC did not have English language proficiency. Half of the respondents had less than or equal to 12 years of schooling, at the time of wave 6. More than 80% of the respondents were living either in major urban or in other urban areas. At the time of wave 6, roughly 62% of respondents were either married or in de facto relation, 14% were either separated or widowed, and the remaining 34% of the respondents were never married or never in de facto relation. Only 2.8% of the respondents were unemployed and 64.7% of the respondents were employed. Household equivalised income levels of the most of the respondents were between $20,000 to $60,000. Roughly 22% of NB respondents, 20% of FB respondents from ESC and 17% of FB respondents from NESC had obesity at the time of wave 6.

Descriptive findings

Figure 1 shows proportion of people having obesity among various FB and the NB people, and by their duration of residence in Australia. In particular, Figure (1A) shows trends in

obesity during waves 6 to 10 by country of birth. Figure (1B) shows the same by duration of residence of FB people in Australia. Figure (1C), on the other hand, shows trends in obesity by duration of residence in Australia, segregated by country of birth of respondents. It can be observed from Figure (1A) that on the whole FB people had lower levels of obesity than the NB people. Also, FB from NESC had lower levels of obesity than those of immigrants from ES countries and the NB people.

Figure (1B), on the other hand, shows that levels of obesity among immigrants increase with their duration of residence in Australia and those who had been living in Australia for more than 20 years end up with a slightly higher levels of obesity than the NB people. A different pattern on the role of duration of residence can be seen from Figure (1C). In particular, unlike immigrants from ESC, immigrants from NESC had very lower levels of obesity when their duration of residence is between 10 to 19 years. However, with more than 20 years of stay in Australia both the immigrants from ESC and NESC had higher levels of obesity than the NB people.

Regression results

Table 2 (model 1) suggests no difference in the odds of being obese between FB people from ESC and the NB people (OR 0.68, CI 0.42 to 1.09), while the FB people from NESC have lower odds of being obese, in comparison to the NB people (OR 0.34, CI 0.22,0.52). Additionally controlling for all the confounders (age, sex, wave number and the number of times a person responded between waves 6 and 10, level of education, marital status, employment status and household equivalised income (model 3), there was still no difference in the odds of being obese between FB people from ESC and the NB people (OR 0.66, CI 0.40,1.0), while FB people from NES countries are still found to have lower odds of being obese than those of the NB people (OR 0.58, CI 0.36,0.94).

Table 3 shows regression results for obesity with duration of residence as the main explanatory variable. It is clear from this table that irrespective of duration of stay, there is no difference in the odds of being obese between immigrants from ESC and the NB people (model 1). But, the odds of reporting obese is low among immigrants from NESC, in comparison to the NB people, particularly when their length of stay is less than 10 years (OR 0.10, CI 0.04,0.25) and 10 to 19 years(OR 0.79, CI 0.44,0.14) (model 1). Additionally controlling for all the confounders (age, sex, wave number and the number of times a person responded between waves 6 and 10, level of education, marital status, employment status and

household equivalised income) (model 3), the difference in the odds of being obese between FB from ESC and the NB disappeared and the results became statistically insignificant. However, model 1 results still persisted (although with small change in magnitude) in case of FB from NESC.

In conclusion, we found no evidence of a relationship between nativity and obesity and between nativity, duration of residence and obesity for immigrants from ESC. We did, however, find a statistically significant association between nativity and obesity and nativity, duration of residence and obesity over time in Australia for immigrants from NESC. We observed that immigrants from NESC, had, on average, lower obesity levels as compared to the NB Australian. We also identified that immigrants from NESC living in Australia for less than 10 years and 10-19 years are less obese as compared to the NB people, but, this advantage was lost for the immigrants from NESC staying in Australia for more than 20 years. In short, the commonly held assumption that migrants are lighter when they arrive and become bigger as they stay longer in the host country, does not hold true for all migrants. Some migrants come with no health advantage and do not become disadvantaged with duration of time in the host country. On the other hand, some migrants come with lower levels of obesity and this advantage does not persist throughout their life. Future research should further investigate the complex relationship between nativity, duration of residence and overweight/obesity relationships and the reasons for those associations.

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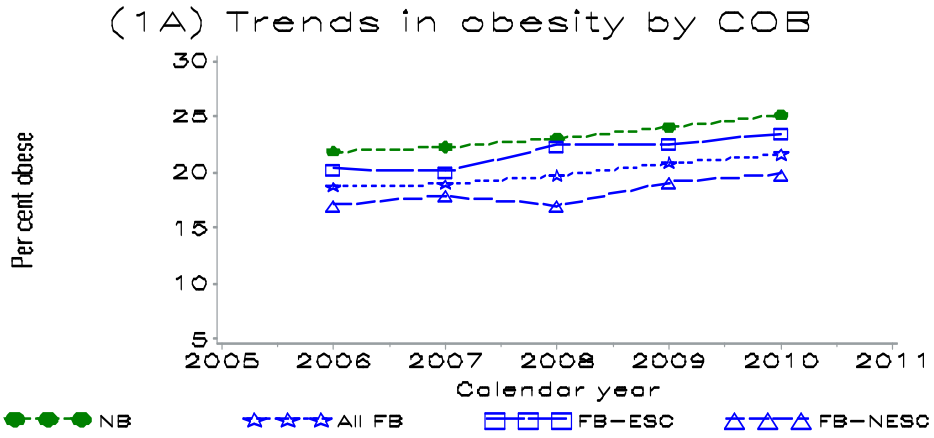
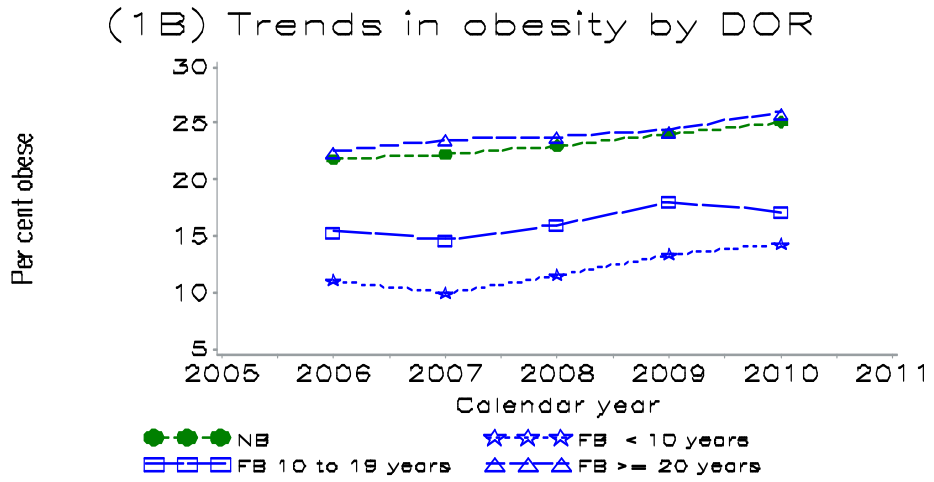
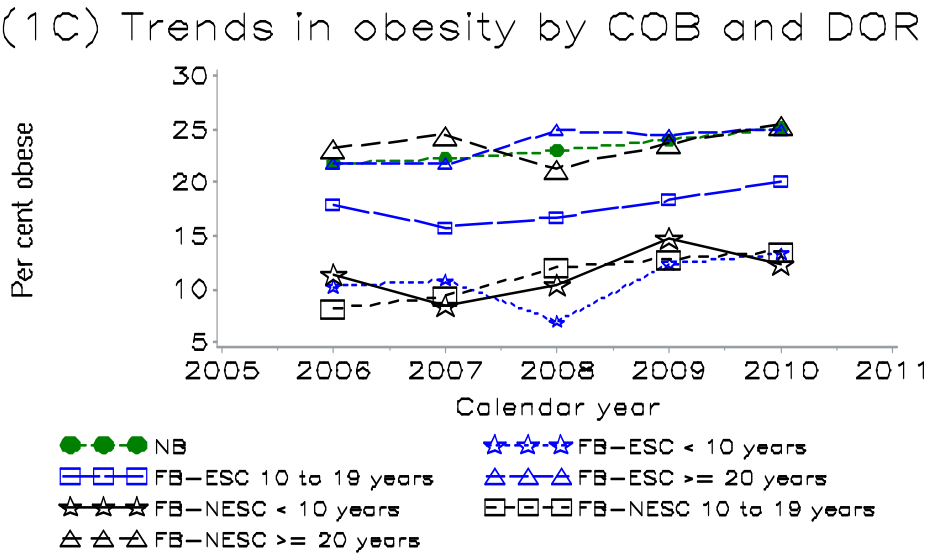
Table 1: Characteristics of the study respondents

Characteristic	NB		FB						All	
			FB-ESC		EB-NESC		All FB			
	N	%	N	%	N	%	N	%	N	%
Sex										
Male	4515	46.9	579	49.5	619	44.7	1198	46.9	5715	46.9
Female	5109	53.1	591	50.5	766	55.3	1357	53.1	6467	53.1
Age group										
15-29	2791	29.0	92	7.9	230	16.6	322	12.6	3114	25.6
30-44	2730	28.4	314	26.8	367	26.5	681	26.7	3411	28.0
45-59	2240	23.3	394	33.7	427	30.8	821	32.1	3062	25.1
60+ years	1863	19.4	370	31.6	361	26.1	731	28.6	2595	21.3
Duration of residence										
<10 years			153	13.1	323	23.3	476	18.7	476	3.9
10-19 years			265	22.7	426	30.8	691	27.1	694	5.7
>= 20 years			750	64.2	635	45.9	1385	54.3	1385	11.4
English proficiency										
Proficient	9378	97.4	1146	98.0	475	34.3	1621	63.4	11000	90.3
Good	246	2.6	24	2.1	778	56.2	802	31.4	1050	8.6
Not good	0	0.0	0	0.0	132	9.5	132	5.2	132	1.1
Level of education										
<12 years of schooling	3551	36.9	335	28.6	369	26.6	704	27.6	4255	34.9
Exactly 12 year school	1395	14.5	150	12.8	254	18.3	404	15.8	1800	14.8
Diploma	2858	29.7	395	33.8	371	26.8	766	30.0	3624	29.8
University education	1816	18.9	290	24.8	391	28.2	681	26.7	2499	20.5
Place of residence										
Major Urban	5456	56.7	765	65.4	1151	83.1	1916	75.0	7375	60.5
Other Urban	2465	25.6	224	19.2	147	10.6	371	14.5	2836	23.3
Bounded Locality	338	3.5	35	3.0	12	0.9	47	1.8	385	3.2
Rural Balance	1365	14.2	146	12.5	75	5.4	221	8.7	1586	13.0
Current marital status										
Married/in de facto	5718	59.4	844	72.1	970	70.0	1814	71.0	7535	61.9
Separated/Widowed	1312	13.6	208	17.8	216	15.6	424	16.6	1736	14.3
Never married/ never in de facto relation	2593	27.0	118	10.1	199	14.4	317	12.4	2910	23.9
Employment status										
Employed	6350	66.0	730	62.4	793	57.3	1523	59.6	7876	64.7
Unemployed	286	3.0	23	2.0	38	2.7	61	2.4	347	2.8
Not in labour force	2988	31.1	417	35.6	554	40.0	971	38.0	3959	32.5
Equivalised income										
<=20,000	2054	21.3	241	20.6	439	31.7	680	26.6	2736	22.5
(20,000-40,000]	4398	45.7	481	41.1	564	40.7	1045	40.9	5443	44.7
(40,000-60,000]	2094	21.8	272	23.3	255	18.4	527	20.6	2621	21.5
>60,000	1078	11.2	176	15.0	127	9.2	303	11.9	1382	11.3
Had obesity	**1834**	**21.8**	**217**	**20.3**	**189**	**17.1**	**406**	**18.7**	**2240**	**21.2**
Sample size	***9624***	***79.0***	***1170***	***9.6***	***1385***	***11.4***	***2555***	***21.0***	***12179***	***100***

Figure 1: Trends in obesity by country of birth, duration of residence, and by country of birth and duration of residence







Note: COB=”Country of Birth”; DOR=”Duration of Residence in Australia”.

Table 2: Effect of country of birth on obesity

Country of birth	Model 1		Model 2		Model 3	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
ESC	0.683	(0.426,1.095)	0.413**	(0.257,0.662)	0.664	(0.405,1.090)
NESC	0.346**	(0.227,0.529)	0.290**	(0.188,0.446)	0.584*	(0.360,0.947)
NB (R)						

Model 1: country of birth is the only explanatory variable.
Model 2: Controls for age, sex, wave number, number of times a person responded between waves 6 and 10.
Model 3: Controls for all variables in Model 2 + additionally controls for level of education, employment status, marital status, and household equivalised income.

Table 2: Effect of duration of residence on obesity, by country of birth

Country of birth and duration of residence	Model 1		Model 2		Model 3	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
ESC < 10	0.131**	(0.040,0.428)	0.182**	(0.044,0.761)	0.333	(0.057,1.940)
ESC 10 to 19	0.295**	(0.106,0.822)	0.293**	(0.099,0.864)	0.570	(0.177,1.835)
ESC > = 20	1.002	(0.595,1.687)	0.475**	(0.275,0.820)	0.796	(0.455,1.393)
NESC < 10	0.106**	(0.044,0.256)	0.120**	(0.042,0.344)	0.210*	(0.045,0.977)
NESC 10 to 19	0.079**	(0.044,0.141)	0.055**	(0.028,0.107)	0.297**	(0.120,0.737)
NESC >= 20	1.516	(0.882,2.607)	0.850	(0.487,1.483)	0.917	(0.494,1.701)
NB (R)						

Model 1: Duration of residence by country of birth is the only explanatory variable.
Model 2: Controls for age, sex, wave number, number of times a person responded between waves 6 and 10.
Model 3: Controls for all variables in Model 2 + additionally controls for level of education, employment status, marital status, and household equivalised income.