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Revisiting Mobility Limitations of Seniors in Singapore, 1995 to 2011

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Abstract

Singapore's life expectancy at birth and at age 65 continues to improve. Although this is a positive development, it is necessary to understand how much of this increased life expectancy is spent with and without mobility limitations. This research uses the latest round of the National Survey of Senior Citizens to examine the situation in 2011 and the possible changes that may have occurred since the last survey in 2005. It seeks to add to earlier research in this area in Singapore and uses the prevalence-based Sullivan method to calculate lifetime free of mobility limitations for this population. Pertinent conclusions drawn from this research include evidence pointing to changing prevalence rates among the older adult population and observations that suggest the possibility of a compression of morbidity for this population in 2011 compared with an expansion of morbidity observed in the previous survey conducted in 2005. The research also shows that women continue to be disadvantaged as they age compared with men.

Keywords

Baby Boomers, compression of morbidity, life expectancy, mobility limitations, Singapore

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Life expectancy at age 65 for Singapore residents has increased from 16 years in 1995 to 20 years in 2011 (Department of Statistics Singapore [DOSS], 2013). However, this figure should not be assumed to be an indicator of improvement to the population's health status as Crimmins, Hayward, and Saito (1994) have shown. For a clearer picture, it is pertinent to understand life expectancy through the concept of health expectancy, which is divided into healthy and unhealthy components (Stiefel, Perla, & Zell, 2010). For example, when health status is defined by disability status, the healthy component is termed *disability-free life expectancy* (Saito, Robine, & Crimmins, 2014).

The debate arising from competing hypotheses on compression of morbidity and expansion of morbidity propelled research on health expectancy (Fries, 1980; Gruenberg, 1977; Kramer, 1980). Compression of morbidity posits that seniors live more years free of ill health or disability, with these symptoms appearing at the tail-end of the life expectancy, while expansion of morbidity suggests the gain in life expectancy among the elderly is accompanied by more years lived in ill health and disability.

Initial research conducted by Yong, Saito, and Chan (2010) observed an "expansion of morbidity" in Singapore. The authors also observed increased mobility limitations for older respondents, and this was observed for both males and females (Yong et al., 2010). With the availability of the National Survey of Senior Citizens (NSSC) conducted in 2011, this article revisits and extends the initial analysis, taking into account increases in the proportion of those aged 65 and older in the population. This survey also captured responses of a small number of respondents from the baby boom generation, those born between 1947 and 1964 (DOSS, 2000). This provides some preliminary insights into this cohort.

Factors Influencing Mobility Limitations

The increasing prevalence of mobility limitations among seniors is a concern, as it affects the quality of life of the elderly population (Yong et al., 2010). It has far-reaching consequences, because older individuals who are less

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mobile are also likely to suffer from poorer health, depression, and social isolation (Satariano et al., 2012). If the increase in the prevalence of mobility limitations observed in 2005 continues, existing resources need to be reallocated, additional resources channeled, or both to assist seniors and their caregivers. This would put pressure not only on the state but also on the individual.

Increases in mobility limitations within the older population are commonly assumed and expected, but reversals do occur. Murabito et al. (2008) observed instances where mobility and disability statuses of community-dwelling older populations improved. Improvements in disability-free life expectancy for the American population 70 years old and older have been observed via longitudinal data (Crimmins, Hayward, Hagedorn, Saito, & Brouard, 2009). Critics of these improvements argue that they came at a cost in terms of health care spending, although recent research in the United States has argued to the contrary (Cai, 2013).

Among the possible factors influencing morbidity is the changing profile of seniors in Singapore, for example, through improved education status and rising incomes especially with the transition of the baby boom cohort into the older age structure (Jatrana & Chan, 2007; Ministry of Community Development, Youth, and Sports [MCYS], 2009). Past rounds of the NSSC have been sensitive in reflecting the differing profiles, for example, in 1995, the survey noted the presence but declining numbers of the original migrant cohort, and this continued to be the case with the 2005 and 2011 surveys. This earlier cohort was very different compared with subsequent birth cohorts born in Singapore (Ministry of Community Development [MCD], 1995). They arrived, when Singapore was still a British colony, from different parts of Asia such as China and India, as well as Southeast Asia such as neighboring Peninsular Malaysia (Saw, 1999). The latest survey instead captures the transition of the first wave of the baby boom generation. It is hypothesized that this may influence the outcome of this study in particular through changing socio-economic profiles.

Changing socio-economic backgrounds are an important determinant as research elsewhere has shown the link between socio-economic status and health status in later life (Enroth, Raitenen, Hervonen, & Jylhä, 2013; Matthews, Jagger, & Hancock, 2006; Melzer, Izmirlian, Leveille, & Guralnik, 2001). In Japan and Finland, this has been observed in studies examining educational attainment, a proxy for socio-economic status, where a positive relationship between educational attainment and the number of years spent in active life emerges (Valkonen, Sihvonen, & Lahelma, 1997; Yong & Saito, 2012). Recent research has even argued that socio-economic factors during an individual's life course have been shown to predict not only mobility limitations but also changes in one's mood in old age (Groffen et al., 2013). Education in particular was shown to be a significant factor in predicting both physical performance and mobility trends in Sweden and Taiwan, respectively (Martin, Zimmer, & Hurng, 2011; Welmer, Kåreholt, Rydwik, Angleman, & Wang, 2013). There have also been observations with regard to the relationship between health inequalities in older age groups and socio-economic status (Jatrana & Chan, 2007).

This article investigates the possible changes behind the shifts in the prevalence of mobility limitations from 2005 to 2011 compared with changes observed between 1995 and 2005 (Yong et al., 2010). This is pertinent given the shifts in educational attainment with the transition of the Singaporean baby boom cohort into the older age structure of the population (MCYS, 2009). In addition, it provides valuable input crucial to the government's strategy of active aging premised on the continued mobility of the elderly population into the older age categories (Webber, Porter, & Menec, 2010). This article will address the following two research questions:

Research Question 1: How will the current age cohorts of seniors compare with earlier cohorts with regard to the "expansion of morbidity" observed between 1995 and 2005 in the study by Yong et al. (2010); and,

Research Question 2: Do men and women, in this population segment, continue to experience differing mobility outcomes?

Data

The analyses here use nationally representative cross-sectional data of the resident population aged 55 and older. The data are from the NSSC conducted in Singapore in 1995, 2005, and 2011 (MCD, 1995; MCYS, 2005, 2011). The 1995 survey had a total of 4,750 respondents with a response rate of 60%, and the 2005 survey had a total of 4,591 respondents with a response rate of 64%. Yong et al. (2010) utilized both surveys in their study. The latest survey in 2011 had a total of 5,000 respondents with a response rate of 65%. To compare the temporal prevalence of mobility limitations, the aforementioned three surveys were used. Target questions are similar and comparable across the surveys.

Prevalence rates by age and gender for 2011 for those individuals with mobility limitations were computed. This, the dependent variable, was based on the following question for self-reported mobility status: "Are you able to move around physically without any help?" The question and response categories remain unchanged since the 1995 survey: (a) ambulant and physically independent, (b) ambulant and physically independent but requires walking aids (e.g., quad stick, walking frame), (c) requires some physical assistance to move around and needs supervision while using assistive devices (e.g., walking aids or wheelchair), (d) not bedridden but requires total physical assistance for transfers and movement (e.g., transfer to and from bed to wheelchair), and

(e) bedridden and requires regular turning in bed. The above five responses were recoded into a dichotomous variable "ambulant and mobile," which included Categories 1 and 2, and "with mobility limitations," which included Categories 3 to 5. This takes into account the need not only to differentiate between a person requiring assistance from another person and one who did not but also to ascertain the severity of the mobility limitation (Yong et al., 2010). This dichotomous variable was recoded in the exact fashion to the previous study to ensure the ability to make comparisons with the previous study.

Statistical Method

All three data sets had specific weights constructed to take into account sampling design. The 2011 data set had to take into account the oversampling at the start of the survey of residential households with elderly aged 65 and older (MCYS, 2011). Oversampling was employed because of the possibility of not being able to obtain a sufficient sample of those in the older age groups, and an obstacle for detailed analysis. The data set utilized for this analysis was weighted back to reflect the resident population distribution by age and gender based on the officially published distribution for 2011 (DOSS, 2012).

Using the Sullivan method, the life expectancy free of mobility limitations was derived based on the computed weighted prevalence rates and published life tables for 2011 (DOSS, 2013; Jagger, Cox, Le Roy, & European Health Expectancy Monitoring Unit, 2007; Registrar-General of Births & Deaths, 2011; Sullivan, 1971). The published abridged age- and gender-specific death rates as well as life tables for the resident population comprise both Singaporeans and Singapore Permanent Residents in 2011. The Sullivan method adjusts life expectancy of a given population by calculating the percentage of time spent with mobility limitations (Sullivan, 1971). The statistical package SAS 9.3 was used to calculate the prevalence rates. These results were compared with results for 1995 and 2005 presented in Yong et al. (2010). The information for 1995 and 2005 from that research has been reproduced in Tables 1 to 5 in this article for purposes of comparison.

Results

The prevalence of mobility limitations from the three surveys is presented in Table 1. A decline in the proportion of those reporting being ambulant and physically independent was observed across gender from 1995 to 2005. Furthermore, in this category, the proportion of female older adults was smaller than that of male older adults. Among the male older adult population, 97.0% of the respondents reported in 1995 that they were ambulant and physically independent compared with 94.3% in 2005. Between 1995 and 2005, the proportion of male older adults who were ambulant and physically independent but required walking aids increased from 1.6% to 3.7%. A similar trend was observed among the female older adult population. In 1995, 94.9% reported that they were ambulant and physically independent, but this declined to 90.3% in 2005. Between 1995 and 2005, the proportion of females who were ambulant and physically independent but required walking aids increased from 2.9% to 6.6%. These changes were significant at the .05 level.

Significant changes to the prevalence of mobility limitations at the .05 level were observed from 2005 to 2011 for both males and females. Among male older adults, the proportion reporting being ambulant and independent increased from 94.3% to 96.7% over this period. The proportion ambulant and physically independent but required walking aids decreased from 3.7% to 1.9%. The proportion of ambulant and physically independent females increased from 90.3% to 94.8% between 2005 and 2011, whereas the proportion of those who were independent but required walking aids decreased from 6.6% to 2.8% from 2005 to 2011.

Across the three survey years, the results show that only a very small proportion of older adult males reported being bedridden and needing assistance. Being physically dependent continued to affect higher proportions of females compared with their male counterparts.

To understand the earlier observed changes, and because the older adult population is not homogeneous, it is pertinent to examine prevalence rates across age groups. Table 2 presents prevalence of mobility based on the dichotomous variable created previously by 5-year age groups and gender. The age groups show little variation with many citing being ambulant and mobile. The proportions for the 55 to 59 age group did not show significant differences in terms of mobility limitations by gender.

In 2011, males in the older age groups demonstrated a significant decrease in the prevalence of mobility limitations at the .05 level. Among older adult males aged 85 and above in 2011, 4.6% experienced mobility limitations compared with 15.5% in the same age group in 2005. Overall, among males in 2011, increases in the prevalence of mobility limitations were delayed until the 75 to 79 age group, whereas such increases occurred earlier for both the 1995 and 2005 samples in the 70 to 74 and 65 to 69 age groups, respectively. Comparing 2005 and 2011, male older adults in the 65 to 69 age group saw a decrease in the prevalence of mobility limitations. The prevalence decreased from 2.2% in 2005 to 0.2% in 2011 and was significant at the .05 level.

Among the female sub-sample in 2011, the younger age groups in the study reported a higher percentage of mobility limitations compared with the 2005 study. The difference between 2005 and 2011 for the age group 60 to 64 was statistically significant at the .05 level.

Table 1. Prevalence of Mobility Limitations by Gender 1995-2011.

	Male					Female				
Mobility limitations	1995† (*n* = 2,058) (%)	2005† (*n* = 2,109) (%)	2011 (*n* = 2,355) (%)	Change 1995-2005	Change 2005-2011	1995† (*n* = 2,692) (%)	2005† (*n* = 2,396) (%)	2011 (*n* = 2,665) (%)	Change 1995-2005	Change 2005-2011
Ambulant and physically independent	97.0	94.3	96.7	−2.7*	2.4*	94.9	90.3	94.8	−4.6*	4.5*
Ambulant and physically independent but requires walking aids	1.6	3.7	1.9	2.1*	−1.8*	2.9	6.6	2.8	3.7*	−3.8*
Requires some physical assistance to move around	0.7	1.3	1.0	0.6*	−0.3	1.5	2.0	1.6	0.5	−0.4
Not bedridden but requires total physical assistance	0.3	0.4	0.3	0.1	−0.1	0.5	0.5	0.4	0.0	−0.1
Bedridden and requires regular turning in bed	0.3	0.4	0.1	0.1	−0.3*	0.3	0.7	0.4	0.4*	−0.3
Total	100.0	100.0	100.0			100.0	100.0	100.0		

†Information reproduced from Yong, Saito, and Chan (2010).
*Statistically significant difference at the .05 level between 1995-2005 and 2005-2011 proportions.

Prevalence of mobility limitations for females increased at later ages, and this is similar to observations from the 1995 and 2005 surveys. Like the older adult males observed earlier, older adult females in 2011 began experiencing increases in the prevalence of mobility limitations beginning with the 75 to 79 age group. A significant difference between 2005 and 2011 for the age group 70 to 74 at the .05 level was observed. There was a decrease in the prevalence of mobility limitations from 4.1% in 2005 to 0.8% in 2011. Like their male counterparts, females also experienced a delay with the onset of mobility limitations. Comparing males and females, it continues to be the case that a larger proportion of women experienced mobility limitations than did men (Yong et al., 2010). This was the case when examining the proportions for the comparable age groups, 75 to 79, 80 to 84, and 85+.

The life expectancy in years by age and gender for the different mobility states for the three surveys is presented in Table 3. The improvement in the category "ambulant and mobile" seems to have occurred faster over the last 5 years compared with the first 10 years. In the first 10 years, between the first and second surveys, there was an increase in "ambulant and mobile" life expectancy from 21.7 years to 24.1 years for males and from 24.8 years to 27.4 years for females, respectively. In the most recent survey, this life expectancy increased to 26.0 years for males and 29.2 years for females. Furthermore, both the male and female older adult populations in 2011 were spending fewer years with mobility limitations compared with their counterparts in 2005. In particular, males at age 85 were likely to enjoy the majority of their remaining life expectancy in the "ambulant and mobile" category.

Older adult females spent more time living with mobility limitations compared with older adult males. Data from the 2011 survey showed that females at selected ages 55, 65, and 75 would spend 1.3 years of their remaining life with mobility limitations. At age 85, they would spend 1.0 year with mobility limitations. Time spent with mobility limitations was less for males at corresponding ages. In fact, the longest period spent with mobility limitations for males was 0.5 years at age 55.

In 2011, the majority of older adults, both males and females, could expect to live 90% or more of their lives free of mobility limitations. The exception being females aged 85. An 85-year-old female could expect to live 87.7% of her remaining life free of mobility limitations, but an elderly male at the same age could expect to live 95.5% of his life free of mobility limitations.

The results presented in Table 4 suggest a deviation from previous research. Overall, across all ages, both males and females reported an increase in the proportion of those in the "ambulant and mobile" category. Furthermore, in 2011, older adult males saw an improvement in the proportion of their lifetime spent being ambulant and mobile as compared with their male counterparts at similar ages in 2005. An older adult male aged 65 years in 2005 could expect to live 95.3% of his life free of mobility limitations, but in 2011, an older adult at this age could expect to live 97.6% of his life free of mobility limitations. This difference is significant at the .01 level. This was the case for males even at age 75. An older adult female aged 75 years in 2005 could expect to live 86.7% of her remaining years free of mobility limitations, but in 2011, a female with the same age could expect to live 90.3% of her life free of mobility limitations. This difference is significant at the .05 level. Notwithstanding this improvement, females experienced a lesser proportion of their remaining lifetime free of mobility limitations compared with their male counterparts at similar ages.

Table 2. Prevalence of Mobility Limitations by 5-Year Age Groups and Gender 1995-2011.

	1995†			2005†			2011		
Age group	*n*	Ambulant and mobile (%)	With mobility limitations (%)	*n*	Ambulant and mobile (%)	With mobility limitations (%)	*n*	Ambulant and mobile (%)	With mobility limitations (%)
Males									
55-59	367	99.2	0.8	515	99.5	0.5	664	98.8	1.2
60-64	375	99.7	0.3	414	99.2	0.8	763	99.1	1.0
65-69	274	99.0	1.0	419	97.8*	2.2*	309	99.8*	0.2*
70-74	201	97.8	2.2	295	98.0	2.0	275	99.1	0.9
75-79	375	96.7	3.3	262	95.5	4.5	194	95.8	4.2
80-84	329	96.3	3.7	126	93.8	6.2	101	96.2	3.9
85+	137	93.3	6.7	78	84.5*	15.5*	29	95.5*	4.6*
Females									
55-59	382	99.0	1.1	532	99.8	0.2	620	99.6	0.4
60-64	432	99.2	0.8	387	99.7*	0.3*	804	98.9*	1.1*
65-69	400	98.3	1.7	463	98.2	1.8	396	99.0	1.0
70-74	321	97.3	2.7	322	95.9*	4.1*	361	99.2*	0.8*
75-79	501	96.0	4.0	330	94.5	5.5	281	91.8	8.2
80-84	412	94.0	6.0	197	87.3	12.8	148	92.0	8.1
85+	244	88.5	11.6	165	77.5*	22.5*	55	87.7*	12.3*

†Information reproduced from Yong, Saito, and Chan (2010).
*Statistically significant difference at the .05 level between the 2005 and 2011 proportions.

Table 3. Life Expectancy (in Years) in Different Mobility States by Age and Gender 1995-2011.

	Males					Females				
				Change over time					Change over time	
	1995†	2005†	2011	1995-2005†	2005-2011	1995†	2005†	2011	1995-2005†	2005-2011
At age 55										
Total	22.1	24.9	26.5	2.8	1.6	25.6	29.0	30.5	3.4	1.5
Ambulant and mobile	21.7	24.1	26.0	2.4**	1.9**	24.8	27.4	29.2	2.5**	1.8**
With mobility limitations	0.4	0.8	0.5	0.4**	−0.3	0.8	1.7	1.3	0.9**	−0.4
At age 65										
Total	14.6	16.9	18.1	2.3	1.2	17.2	20.4	21.6	3.2	1.2
Ambulant and mobile	14.2	16.1	17.7	1.9**	1.6**	16.5	18.6	20.3	2.1**	1.7**
With mobility limitations	0.4	0.8	0.4	0.4*	−0.4	0.7	1.8	1.3	1.1**	−0.5
At age 75										
Total	8.8	10.4	11.2	1.6	0.8	10.4	12.8	13.7	2.4	0.9
Ambulant and mobile	8.4	9.6	10.8	1.2**	1.2**	9.7	11.1	12.4	1.4**	1.3*
With mobility limitations	0.4	0.8	0.4	0.4	−0.4	0.7	1.7	1.3	1.0**	−0.4
At age 85										
Total	4.4	5.9	6.1	1.5	0.2	4.6	7.2	7.7	2.6	0.5
Ambulant and mobile	4.1	5.0	5.9	0.9*	0.9*	4.1	5.6	6.7	1.5**	1.1
With mobility limitations	0.3	0.9	0.2	0.6	−0.7	0.5	1.6	1.0	1.1**	−0.6

†Information reproduced from Yong, Saito, and Chan (2010).
*Statistically significant difference at the .05 level. **Significant at .01 level.

Discussion

Life expectancy both at birth and at age 65 in Singapore has seen gains in recent decades. These observed improvements are good, if the elderly population spend these gains in a healthy state free of mobility limitations, or illnesses, or both. However, as research has shown, this may not always be the case (Crimmins & Saito, 2001; Yong et al., 2010). From the Singapore government's perspective, senior mobility is a pertinent area of concern because this has implications on their continued ability to age within the community and with family rather than being institutionalized (MCYS, 2006). In short, their quality of life can be greatly affected if left unchecked. This issue also highlights areas such as resource planning and allocation by the government to

Table 4. Proportion of Lifetime in Different Mobility States by Age and Gender 1995-2011.

	Males (%)			Females (%)		
	1995†	2005†	2011	1995†	2005†	2011
At age 55						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Ambulant and mobile	98.2	96.8	98.1	96.9	94.2	95.8
With mobility limitations	1.8	3.2	1.9	3.1	5.8	4.2
At age 65						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Ambulant and mobile	97.3	95.3	97.6	95.9	91.2	94.2
With mobility limitations	2.7	4.7	2.4	4.1	8.8	5.8
At age 75						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Ambulant and mobile	95.5	92.3	95.8	93.3	86.7	90.3
With mobility limitations	4.5	7.7	4.2	6.7	13.3	9.7
At age 85						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Ambulant and mobile	93.2	84.7	95.5	89.1	77.8	87.7
With mobility limitations	6.8	15.3	4.5	10.9	22.2	12.3

†Information reproduced from Yong, Saito, and Chan (2010).

support families with older adults with care giving needs. The setting up of the Agency for Integrative Care (AIC, 2015) to look into the needs of the long-term care sector and to administer the "Seniors' Mobility and Enabling Fund" that seeks to support seniors to "remain mobile and live independently in the community" is a further indication of the government's continued focus in this area.

This study showed that the older adult population in Singapore may experience periods of both an expansion and a compression of morbidity. In the earlier study, there was evidence of an expansion of morbidity. However, the change observed from 2005 to 2011 suggests a compression of morbidity, as the proportion of those in the "ambulant and mobile" category in the 2011 sample was greater than that in the 2005 sample. This was evident at the later ages of 75 and 85. Mobility decline seems to begin for females at age 85 where 87.7% were in the mobile category compared with 90.3% at age 75. Compared with percentages from 2005, these percentages were higher, thus suggesting the possibility of a compression of morbidity rather than an expansion of morbidity. This aside, the older adult population surveyed is largely ambulant and mobile, and this continues to be consistent with observations from both the 1995 and 2005 surveys. Gender differences with regard to mobility limitations remained, with a larger proportion of older adult females experiencing mobility limitations compared with males in similar age groups. This can be attributed to the "feminisation of ageing" thesis that has been well documented elsewhere showing that in most societies, aging and the issues accompanying it tend to affect the female rather than the male population (World Health Organization, 2002).

The current results based on the 2011 survey suggest improvements in the prevalence of mobility limitations compared with the 2005 survey findings. Taken in totality, the results from the 3 survey years suggest that the prevalence of mobility limitations remains in constant flux. More specifically, the latest data suggest that a shift in the prevalence of mobility limitations may have occurred.

In light of these observations, it should also not be overlooked that the profile of the resident older adult population in Singapore has been changing, and this could be another piece of the puzzle that would help one to make sense of the changes observed in this study. An important feature of those surveyed in the 2011 survey was the vast improvement in the highest educational attainment reported. Table 5 reveals improvements in educational attainment and shows that in 1995, more than half of those surveyed had little or no qualifications. In 2011, it can be observed that the seniors who had no qualifications comprised 28.3% of those surveyed. In fact, a higher percentage reported completing primary education at the very minimum. This is attributed, to a certain extent, to the 2011 survey capturing information on the early baby boom cohort as they transitioned into the older age structure of the population.

An older adult population that is better educated and has greater awareness of available resources may report and seek assistance for their health issues earlier on in their life and, thus, may influence prevalence rates with regard to mobile life expectancy (Yong et al., 2010). In fact, in societies with populations attaining high levels of educational attainment, it is not uncommon to see evidence of education being a positive influence on the number of years spent in active life (Valkonen et al.,

Table 5. Highest Educational Attainment 1995-2011 (Weighted Percentages).

Highest educational attainment	1995† (%) (*n* = 4,798)	2005† (%) (*n* = 4,498)	2011 (%) (*n* = 4,976)
No qualification	61.5	56.9	28.3
Primary	25.7	23.7	38.5
Secondary and above	12.8	19.4	33.2
Total	100.0	100.0	100.0

†Information reproduced from Yong, Saito, and Chan (2010).

1997; Yong & Saito, 2012). In the United States, compression of morbidity has tended to occur more with the better educated than the less educated (House, Lantz, & Herd, 2005).

In recent years, the government of Singapore has dedicated resources to deal with the challenges of population aging. The measures taken include strengthening the health care infrastructure as well as allocating resources at the community level to ensure that families are able to utilize these facilities as they care for senior family members. A number of these changes do not only benefit the senior segment of the population but also benefit the rest of the population. These include ensuring universal access to most common spaces as well as making living spaces within public housing senior friendly. This is pertinent because in Singapore, the majority (82.0%) of the population lives in public housing (Housing & Development Board, 2015). These strategies and initiatives can also contribute to improved prevalence rates for the older adult population.

Although not conclusive, the results from this research point to the changes occurring to prevalence rates for mobility limitations of the older adult population. Our research results may also indicate a possible compression of morbidity among the older adult population. One reason for this observation is that earlier interventions in a person's life course can have positive health effects on their later life (Mayer, 2009). For example, abstaining from risky activities such as smoking can result in individuals living longer as well as healthier and more active lives (Wilkins, Shields, & Garner, 2013). Government public health interventions, for example, the availability of community screening programs for functional decline such as those in Singapore may also influence prevalence rates (Health Promotion Board, 2015).

This study revisited the initial study by Yong et al. (2010) with cross-sectional data from 2011 to investigate the possibility of new developments. To allow for comparisons across the survey years, the self-reported mobility status of the respondents was utilized. This may not be the best indicator to study, as it does not provide further information with regard to why the respondent may be immobile. For example, from this indicator, we are unable to ascertain whether the reported mobility issues were due to osteoporosis, rheumatoid arteritis, or a combination of multiple conditions. This is an acknowledged limitation of the current study. The omission of institutionalized seniors from the 2011 survey continues to be a glaring limitation (Yong et al., 2010). In 2011, the number of resident older adults aged 60 and above who were institutionalized was 9,904 (DOSS, 2015). This suggests that the numbers residing in institutions may influence the prevalence rates reported in the surveys. It is also likely that ethnic variations exist and that may also influence prevalence rates (Lim et al., 2013). Relevant data on ethnic groups remain unavailable for this research. These continue to be areas that future research must attempt to address.

Despite the limitations, this study has both elaborated on the earlier study by Yong et al. (2010) and provided more insights with regard to improvements in life expectancy for the older population in Singapore. Female older adults in Singapore continue to show higher instances of mobility limitations compared with their male counterparts. The results of this study also suggest the possibility of this population segment experiencing a compression of morbidity from 2005 to 2011. This is an area that needs to be explored in greater detail in view of the complexity of such occurrences and their policy implications (Howse, 2006). This study has also provided some preliminary insight into the early baby boom cohort that is transitioning into the older age structure of the resident population. In the years ahead, as more in the baby boom cohort age, changes to the education level of the older adult population will likely further influence the prevalence rates of mobility limitation.

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Declaration of Conflicting Interests

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