

Projecting the Number of Older Singaporeans with Activity of Daily Living Limitations Requiring Human Assistance Through 2030

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Abstract

Introduction: In the context of rapid population ageing and the increase in number of activity of daily living (ADL) limitations with age, the number of older persons requiring human assistance in Singapore is likely to grow. To promote informed planning for the needs of these elderly, we project the number of resident Singaporeans 60 years of age and older with 1 or more ADL limitations requiring human assistance through 2030. **Materials and Methods:** The proportion of community-dwelling older adults with ADL limitations requiring human assistance, stratified by gender and age group, was calculated utilising a recent nationally-representative survey of older Singaporeans. The proportion of older adults in nursing homes with ADL limitations was estimated based on available literature. Together, these prevalence estimates were applied to a simulation of the future population of older adults in Singapore to derive an estimate of the number of individuals with ADL limitations requiring human assistance through 2030. **Results:** By 2030, the number of resident Singaporeans aged 60 years or older with 1 or more ADL limitations requiring human assistance is projected to be 82,968 persons (7% of the total population aged 60 years or older). Of this number, 38,809 (47%) are estimated to have 1 or 2 ADL limitations, and 44,159 (53%) are estimated to have 3 or more. **Conclusion:** The number of elderly Singaporeans with activity limitations is expected to grow rapidly from 31,738 in 2010 to 82,968 in 2030. Estimates of the number of older individuals with ADL limitations requiring human assistance are of value for policymakers as well as acute and long-term care capacity planners as they seek to meet demand for health and social services in Singapore.

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Introduction

Similar to other developed countries in Asia, including Japan, South Korea and Taiwan, the population of Singapore is ageing rapidly.¹ In 2011, 9.3% of the population was 65 years of age or older.² Due in part to decades of sub-replacement level fertility rates and increases in longevity, by 2030 this proportion is expected to increase to 19%.³ Given the tendency of individuals to accumulate health problems and activity of daily living (ADL) limitations as they age,⁴⁻⁶ an important consequence of this demographic shift will likely be a significant increase in demand for acute and long-term care services.⁷

A number of studies provide information on the prevalence of ADL limitations among older Singaporeans, although they vary in the instruments used to measure disability, sample size and representativeness.^{6,8,9} A recent study using data

from the Social Isolation, Health and Lifestyles Survey (SIHLS) 2009, a nationally-representative survey of 5000 community-dwelling elderly Singaporeans aged 60 years and older conducted on behalf of the Ministry of Social and Family Development (erstwhile Ministry of Community Development, Youth and Sports), reported the prevalence of having at least 1 ADL limitation to be 9.7% (12.7% for women and 6.1% for men).⁶ Of those with ADL limitations, approximately 36% had 1 or 2 ADL limitations, 24% had 3 or 4, and 40% had 5 or more. While these studies provide reasonable estimates of the current prevalence of ADL limitations among the elderly in Singapore, published studies projecting the future prevalence of such limitations are unavailable.

To assist researchers, policymakers and care planners in responding to the demands likely to be placed on health

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and social services as a result of population ageing, this paper projects, through 2030, the number of resident Singaporeans aged 60 years or older with 1 or more ADL limitations requiring human assistance. The estimates are based primarily on the age-specific prevalence from the SIHLS 2009.

Materials and Methods

Data Source and ADL Limitations for Community-dwelling Older Adults

Data pertaining to the ADL status of the SIHLS participants were utilised. Details on the design and sampling of the SIHLS are available elsewhere.⁶ In brief: single-stage stratified random sampling was employed to select the survey sample. After informed consent, a total of 5000 community-dwelling older Singaporeans aged at least 60 years or their proxy informants were interviewed face-to-face at their residence to gather information on various aspects of the older persons' physical, mental and social health.

The presence of difficulty in performing the activity (yes/no), and if yes, the type of assistance required (human/device/no assistance), was assessed for 6 ADLs (bathing or showering, dressing, eating, standing or sitting, walking around the house, and toileting) from the SIHLS participants. For each activity, those who reported presence of difficulty and required human assistance were classified as 'limitation requiring human assistance'. The weighted proportion of older adults with 1 or 2 and 3 or more ADL limitations requiring human assistance was calculated for population strata defined by gender and age (in 5-year cohorts from age 60 to 94 years and age 95 years and older). The cut-off between 2 and 3 ADL limitations was chosen because current rules for ElderShield—a government-sponsored insurance scheme that provides basic financial protection to those with long-term care needs—define the 'severely disabled' as individuals who are unable to perform at least 3 of 6 ADLs.¹⁰

Population and ADL Limitations for Institutionalised (in Nursing Home) Older Adults

The proportion of nursing home residents in 5-year age cohorts from age 60 to 95 years, and 95 years and older was estimated using information from a study by Yap et al.⁷ Since Yap et al used different age categories than those needed for the current study, the proportion of individuals in each age category reported by Yap et al was summarised as a linear regression (proportion of individuals in the age category in nursing home = (midpoint age of the age category) (1.0745) – 56.124; $R^2 = 0.87$). This regression model was used to calculate the proportion in 5-year age

cohorts from age 60 to 95 years, and 95 years and older. The estimated proportion in each age cohort was distributed by gender to match the overall gender distribution of nursing home residents (31% male and 69% female) reported by Yap et al. The resulting proportions were multiplied by the estimated total number of nursing home residents aged 60 years or more in 2010 ($n = 9082$) to arrive at the number of nursing home residents in each stratum defined by gender and age cohort. To estimate the total number of nursing home residents aged 60 years or more, the reported number of nursing home residents in 2010 ($n = 9236$)¹¹ was multiplied by the proportion of nursing home residents aged 60 years or more as reported by Yap et al (0.9833).

Assuming the distribution of ADL limitations among residents of nursing homes mirrors that of elderly living in the community, the number of nursing home residents in each gender and age cohort stratum was multiplied by the prevalence estimates corresponding to that stratum for 1 or 2 and 3 or more ADL limitations requiring human assistance from the SIHLS survey. In order to achieve an overall prevalence of at least 1 ADL limitation among nursing home residents equal to that reported by Yap et al (one-third of the unadjusted prevalence), the calculated number of nursing home residents with 1 or 2 and 3 or more ADL limitations in each gender and age cohort stratum was multiplied by 3 to arrive at the estimates.

Population for Simulation

In our previous research,¹² a population model for Singapore was formulated to shift cohort values (ageing in + net migration – deaths) such that individuals in a particular 1-year age cohort advance annually to the next 1-year age cohort at a single instant in time. Because these formulations introduced intra-year distortions, a revised formulation was used in this study in which chronological ages were simulated in continuous time. To do so, the members of each 1-year age cohort were advanced on every computational interval such that the length of transition was the same as the model's computational interval, which has the advantage of producing concordance with standard demographic methods.¹³ In the revised formulation, population cohorts were initialised by age and gender using Singapore Census of Population 2010 data.¹⁴ The same source was used to calculate mortality rates (based on 1-year life tables) and to estimate birth rates. In the absence of a consensus on future trends in birth and mortality rates, these parameters were held constant for all years. In addition to inflow from births, the population was simulated to increase by net migration to 6.5 million residents and expatriate workers and their families by 2050.¹⁵ However, measured migration data are not publicly available, and consequently these were estimated by comparing changes in cohort size indicated

by ageing and mortality rates obtained from published census data.²

Projection of Number of Older Adults with ADL Limitations Requiring Human Assistance

In each gender and age cohort stratum, the estimated number of nursing home residents was subtracted from the 2010 population aged ≥ 60 years, provided by the population simulation model, to arrive at the estimated community-dwelling population of older adults. The prevalence estimates for 1 or 2 and 3 or more ADL limitations from the SIHLS survey were applied to the community-dwelling population to calculate the number of community-dwelling older adults with such limitations in each stratum. In each stratum, the calculated numbers for community-dwelling older adults and older adults in nursing homes with 3 or more ADL limitations were summed. This sum was divided by the 2010 population in that stratum to provide an estimate of the prevalence of older adults with 3 or more ADL limitations requiring human assistance in the total population. A similar calculation provided an estimate of the prevalence of older adults with 1 or 2 ADL limitations requiring human assistance in the total population.

Assuming the prevalence estimates to be constant over time, the prevalence estimates were applied to the simulated population of older resident Singaporeans through 2030 to arrive at the number of resident Singaporeans aged 60 years or older with 1 or 2 and 3 or more ADL limitations requiring human assistance. Because public and private policy changes may result in a change in institutional capacity in the future, we do not provide projected numbers by place of residence of the older adults (i.e. community-dwelling or institutionalised).

Results

Table 1 presents the total population prevalence

estimates—derived by combining those for community-dwelling older adults and older adults in nursing homes—for 1 or 2 and for 3 or more ADL limitations requiring human assistance in cohorts defined by gender and age group. Figure 1 provides the estimated number of older adults in 10-year age cohorts, at five-year intervals through 2030, derived from the population model.

Table 2 applies the prevalence estimates from Table 1 to the population projection without further assumptions regarding changes in birth and mortality rates. The number of resident Singaporeans aged 60 years or older with at least 1 ADL limitation requiring human assistance is projected to increase from 31,738 in 2010 to 82,968 in 2030. Of the 82,968 Singaporeans with ADL limitations requiring human assistance, the majority are estimated to be females (69%) and to be aged 80 years or older (64%). Furthermore, while there is a slight increase in the estimated proportion of individuals with 3 or more ADL limitations requiring human assistance (52.7% in 2010 to 53.2% by 2030), the absolute number is expected to nearly triple between 2010 and 2030.

Figure 2 depicts the proportion of individuals 60 years of age and older with at least 1 ADL limitation requiring human assistance among the total population aged 60 years and older, overall and by gender. By 2030, over 7% of the population aged 60 years and older is projected to have at least 1 ADL limitation requiring human assistance.

Discussion

The results presented herein show that over the relatively short period between 2010 and 2030, the expected number of older Singaporeans with ADL limitations requiring human assistance will increase almost 3-fold. More females than males with such limitations are expected because the prevalence of ADL limitations requiring human assistance

Table 1. Estimated Prevalence of 1 or 2 and 3 or More ADL Limitations Requiring Human Assistance by Age and Gender among Population Aged at least 60 Years (Source: Data from Social Isolation Health and Lifestyles Survey and Yap et al)

Age Group	% with 1 or 2 ADL Limitations		% with 3 or More ADL Limitations	
	Female	Male	Female	Male
60 to 64	0.35	0.86	0.58	0.25
65 to 69	1.03	0.70	1.25	1.08
70 to 74	1.39	1.38	3.04	1.47
75 to 79	3.09	3.04	4.48	2.72
80 to 84	10.44	10.24	8.54	3.49
85 to 89	16.12	15.67	14.48	2.88
90 to 94	29.12	28.71	43.23	28.48
95 and older	18.73	19.39	74.93	32.92

ADL: Activity of daily living

Table 2. Estimated Older Population with ADL Limitations Requiring Human Assistance in 2010, 2020 and 2030, by Age and Gender

Year	2010			2020			2030		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Individuals with 1 or 2 ADL Limitations Requiring Human Assistance									
Age 60 to 69	2158	957	1201	3724	1697	2027	4187	2015	2172
Age 70 to 79	3246	1824	1421	5031	2776	2255	8836	4812	4024
Age 80 to 89	6698	4222	2476	10,961	6951	4009	17,548	10,931	6617
Age 90 to 99	2527	1733	794	4414	2995	1419	7089	4823	2266
Age 100 and older	378	268	110	666	493	172	1151	852	298
Total	15,006	9005	6001	24,795	14,912	9883	38,809	23,432	15,377
Individuals with 3 or More ADL Limitations Requiring Human Assistance									
Age 60 to 69	2142	1306	836	3840	2269	1570	4520	2662	1858
Age 70 to 79	4551	3175	1375	7115	4915	2200	12,161	8283	3878
Age 80 to 89	4291	3589	701	7047	5923	1124	11,177	9278	1899
Age 90 to 99	4489	3577	912	7563	5965	1599	12,385	9813	2572
Age 100 and older	1260	1073	187	2266	1973	292	3915	3408	507
Total	16,732	12,721	4011	27,831	21,046	6785	44,159	33,444	10,714
Total individuals with ADL Limitations Requiring Human Assistance									
Age 60 to 69	4300	2263	2037	7563	3966	3597	8706	4677	4030
Age 70 to 79	7796	5000	2797	12,147	7692	4455	20,997	13,095	7902
Age 80 to 89	10,988	7812	3177	18,008	12,874	5134	28,725	20,209	8516
Age 90 to 99	7016	5311	1705	11,977	8959	3018	19,474	14,636	4838
Age 100 and older	1638	1342	296	2931	2467	465	5066	4260	805
Total	31,738	21,726	10,012	52,626	35,958	16,668	82,968	56,877	26,091

ADL: Activity of daily living

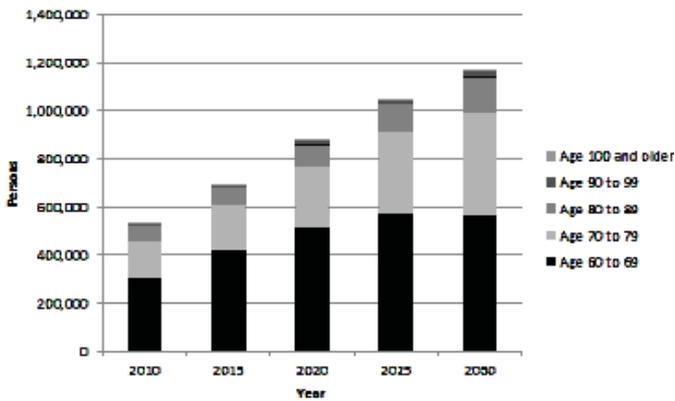


Fig. 1. Graph showing the estimated number of older adults, 2010 to 2030.

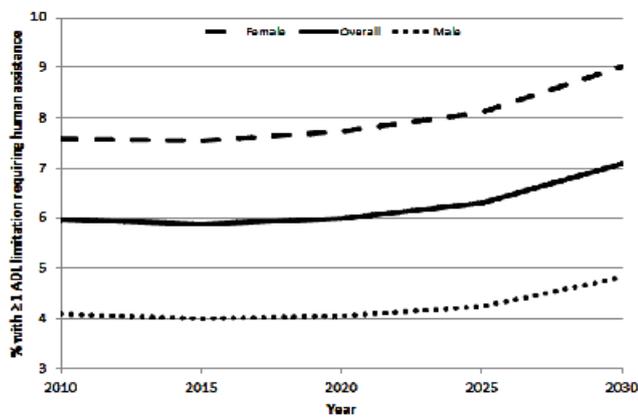


Fig. 2. Graph showing the proportion of older adults (60 years of age and older) with at least one ADL limitation requiring human assistance.

is greater in the older female population than in the male population, especially at advanced ages,¹⁶⁻¹⁸ and more females survive into old age than males.¹⁹ This gender difference in functional limitations has been reported to be due to the greater prevalence of nonfatal disabling health conditions, especially musculoskeletal conditions and depression, among females relative to males, and differences in reporting and health-related behaviours.^{16,20-22} Further, the proportion of individuals with a larger number of ADLs is expected to increase, reflecting the tendency for ADLs to accumulate with age.

As depicted in Figure 2, the simulation suggests that the proportion of individuals 60 years of age and older with at least 1 ADL limitation requiring human assistance decreases from 2010 to 2020 and then increases significantly through 2030. This reflects the fact that ADL limitations are assumed to be primarily age dependent, and that older adults aged 70 years and older are the fastest growing portion of the older population after 2020, as evident in Figure 1.

Limitations

The estimates for prevalence of ADL limitations among nursing home residents are based on a study which utilises

a convenience sample. Further representative study of nursing home residents in Singapore would improve such estimates. However, given the relatively small number of nursing home residents in Singapore (9300 in a population of over 5 million and a population aged over 65 years of approximately 303,000), modest bias in this estimate is not likely to change materially the overall estimates of numbers of individuals with ADL limitations requiring human assistance.^{23,24} The results reported consider neither the causes of ADL limitations requiring human assistance nor transition rates to more severe states. Also, the prevalence of individuals with ADL limitations requiring human assistance is assumed to remain constant. If future elderly are less impaired than the current elderly cohort, or significant improvements in technology and/or treatments are made to alleviate the need for individuals with disabling health conditions to need the assistance of others, then the projected number of individuals requiring human assistance presented herein may be an overestimate.

Conclusion

If the present ADL prevalence remains constant and population trends continue, the older Singaporean

population of 2030 (and beyond) will require more human and infrastructure resource support than the population today. Estimates of the number of older individuals with ADL limitations requiring human assistance expected over time presented in this study are of value for policymakers as well as acute and long-term care capacity planners as they seek to meet growing demands for health and social services in Singapore.

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