Original Article

The Prevalence and Correlates of Activity Limitations Among the Elderly in Informal Caregiving Settings in Colombo District, Sri Lanka: A Community Based Cross-Sectional Study

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Abstract

Background: Limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL) reduce the independence of the elderly and compromise the quality of life.
Objective: This study examined the prevalence and factors affecting the ADL and IADL limitations of elderly.
Methods: In this community based cross-sectional study, a representative sample (n=723) of elderly aged >65 years was obtained by multi-stage cluster sampling. ADL and IADL were assessed using validated Sinhala versions of 10-item Barthel Index and Lawton IADL scales respectively. Simple and multiple logistic regression analyses were conducted to find the factors associated with ADL/IADL limitations.
Results: Mean±SD age was 72.23±6.3 years. Mean±SD ADL and IADL scores were 94.42±17.08 (out of 100) and 6.58±2.3 (out of 8) respectively. Of the elderly, 16.9% and 39.4% had more than one ADL and IADL limitations respectively. Out of the ADL limited elderly, 91.8% had IADL limitations. Most of the ADL (80.3%) and IADL (76.5%) limited elderly had more than one chronic disease. Age (75-84 years odds ratio [OR]=3.03, p<0.001; >85 years OR=3.80, p<0.001), male gender (OR=1.79, p<0.05), history of a stroke (OR=6.12, p<0.001) and arthritis (OR=1.96, p>0.05) showed significant positive associations with ADL limitations in adjusted model. IADL limitations positively associated with age (75-84 years OR=2.91, p<0.001; >85 years OR=3.93, p<0.001), having more than one disease condition (OR=1.67, p<0.05) and history of a stroke (OR=5.53, p<0.001) in the adjusted model.
Conclusion: The mean scores for ADL and IADL are high in this sample indicating a low disability level. Almost all elderly with ADL limitations also had IADL limitations. The odds of having ADL and IADL were greatest for the elderly who are over 75 years and has had a stroke. It is recommended that comorbidities are managed optimally in order to minimize activity limitations among elderly in informal caregiving settings.

Key words: ADL, IADL, activity limitations, prevalence, elderly, informal care giving settings

Introduction

Ageing is an inevitable biological phenomenon which occurs due to certain structural and functional changes taking place in the body (Sowmiya, Kumar & Nagarani, 2015).

Population around the world is rapidly ageing (Bloom, Canning & Lubet, 2015) which is an enormous challenge, especially for middle-income countries (United Nations, 2013). Sri Lanka has one of the fastest ageing populations

in the developing world due to its accelerated demographic transition (Dissanayake & Kaluthantiri, 2004; Siddhisena, 2005; World Bank, 2008; De Silva, 2015). With ageing, older adults tend to develop activity limitations and inability to perform self-care activities in turn leads to increased prevalence of disability (Gureje, Kola & Afolabi, 2006; Abdulraheem, Oladipo & Amodu, 2011; Araujo et al, 2016; Ran et al, 2016). Previous investigators have described activity limitations in terms of two sets of activities, 'ADL' and 'IADL' (Katz et al, 1993). ADL is measured in relation to functional performance in basic self-care activities (Shen et al, 2015) while IADLs reflect the ability to perform household and social tasks (Lawton and Brody, 1969). It is reported that 15%-30% of non-institutionalized older individuals have limitations in ADLs (Desai, Lentzner & Weeks, 2001). Inability to perform activities of daily living is associated with longevity which is linked with comorbidity and multimorbidity (Griffith et al, 2010; Wister et al, 2015), negative health outcomes, poor quality of life (QoL) and mortality (Fortin et al, 2004; Kadam & Kroft, 2007). Also, the presence of chronic diseases such as hypertension (Uddin et al, 2014), diabetes mellitus and cerebrovascular disease (Dunlop et al, 2002) are shown to be closely associated with ADL and/or IADL disability (Ralph et al, 2009; Su et al, 2016; Araujo et al, 2019). Therefore, with the rapid increase in the elderly population, a multitude of serious consequences are expected unless timely and appropriate actions are taken (Seneviratne, 2004).

A decreasing trend in employing paid care with increasing reliance on family caregivers is noted among old people with disabilities (Spillman & Black, 2005). However, the interest for informal care is reported to disappear as the level of disability of the elderly persons increases (Bonsang, 2009). As understanding ADL and IADL is considered as an essential part of homecare, this study was designed to explore the prevalence and factors affecting activity limitations of elderly in informal caregiving settings in Sri Lanka.

Aim: This study examined the prevalence and correlates of activity limitations among a cohort of elderly living in informal caregiving settings in Colombo district.

Methods

Study design, sampling and study population: This community based cross-sectional study was conducted in the Colombo district among a total of 723 elders over the age of 65 years living in informal caregiving settings for more than 6 months. Those who had communication difficulties, cognitive impairments or severe psychiatric disorders (i.e. depression, dementia) were excluded from the study. Multi-stage cluster sampling technique was used for sample collection where a Grama Niladhari (GN) division which is the lowest administrative unit in Sri Lanka was considered as a cluster. The sample size was calculated using the standard formula for prevalence studies (Lemeshow, et al, 1990) and it came up to 787 when the proportion was taken as 64% (Fernando and Senevirathna, 1993), Z level as 1.96, precision as 5%, design effect as 2 and non-response rate as 10%. The cluster size was kept at 20 (Lemeshow, et al, 1990) and 40 clusters were selected using the proportion to the population size (PPS) to gather the total sample. From each cluster, 20 households were randomly selected and within a household, one elderly person was randomly selected. The response rate of this study was 91.8%.

Ethical considerations: Ethical approval was obtained from the Ethics Review Committee, Faculty of Graduate Studies of the University of Colombo, Sri Lanka prior to data collection. As this study was conducted on elderly living in their private homes, permission was obtained from the Divisional Secretariats of the Colombo district. Informed written consent was obtained from the participants. No identification details were obtained to maintain confidentiality of information.

Instruments for data collection - Outcome variables: ADL was measured using the validated Sinhala version of 10 item Barthel Index of ADL with a global Cronbach's alpha of 0.92 (Lekamwasam et al, 2011). The Barthel Index (Mahoney and Barthel, 1965) which consists of 10 items is used to detect problems in performing basic activities of daily living which includes feeding, bathing, grooming, dressing, bowel and bladder functions, toilet use, transfer (moving between bed and chair), walking on flat surface and using steps. IADL was measured using the IADL scale developed by Lawton and

Brody (1969), and was validated for Sri Lanka by Siriwardhana et al in 2018 with a high internal consistency (Cronbach's alpha = 0.91). IADL scale assesses more complex activities such as shopping, preparing or cooking food, using the telephone, washing clothes, housekeeping, transportation, taking medication and managing finances. ADL and IADL scores were calculated (minimum of 0 in both ADL and IADL and maximum of 100 in ADL and 8 in IADL scale). In the present study, the participants who responded as needing partial or full assistance to perform one or more activities listed in the Barthel Index or Lawton IADL scale were considered as having ADL and/or IADL limitations (Su et al, 2016).

Other variables: Other variables assessed were age, gender, civil status, ethnicity, religion, level of education, living arrangements and self-perceived health as they are known to be associated with ADL and IADL limitations. Elderly were divided into three age categories; 65-74 as young elderly, 75-84 as old elderly and ≥ 85 as oldest elderly.

Morbidity patterns: The presence of ten most common diseases in elderly, hypertension, heart disease, diabetes mellitus, respiratory diseases (COPD, bronchitis, etc), arthritis, chronic kidney disease, thyroid disease, stroke, osteoporosis and carcinomas was assessed and recorded.

Statistical analysis: The data collected were analyzed by the Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics were used to present socio-demographic characteristics and morbidity patterns. Binary logistic regression (unadjusted) and multiple logistic regression (adjusted) tests with Odds ratios were used to identify the impact of a unit change in the sociodemographic and health variables on the ADL/IADL limitations among elderly. The variable entry criterion was set to p<0.05 based on the results of the bivariate analysis and were included in the logistic regression model.

Results

Socio-demographic characteristics: Table 1 shows the sociodemographic characteristics of the participants. The mean age of the sample was 72.2 years (SD=6.3 years). More than half of the sample (59.1%) were living with spouse and children while only 4% lived alone.

Prevalence of ADL, IADL and morbidity status: Mean ADL and IADL scores of the elderly were 94.42 (SD=17.08) out of 100 and 6.58 (SD=2.3) out of 8 (Table 2). Out of the ADL limited elderly, 91.8% (n=112) had at least one IADL limitation. Of the total 723 elderly, 15.5% had both ADL and IADL limitations. Among the total sample, 59.3% (n=429) did not have either ADL or IADL limitations.

Table 3 shows the prevalence of disease conditions and the comorbidity status of the elderly. A total of 520 (71.9%) elderly reported to have at least one chronic disease. Among the activity limited elderly, 80.3% of the ADL limited elderly and 76.5% of the IADL limited elderly had at least one chronic disease. Of the total population, 25% reported neither activity limitations nor comorbidities. Among the elderly who were having both ADL and IADL limitations (15.5%, n=112), 80% (n= 90) had some chronic disease condition.

When considering self-perceived health of elderly, nearly 1/4th of participants perceived their health as good (21.2%) and very good (4.7%). Out of the 723, majority perceived their health as poor (43.4%) and 30.7% as satisfactory. Among the activity limited elderly, 68% with ADL limitations and 50% with IADL limitations perceived their health as poor. Out of the elderly with comorbidities, 27.8% (N=145) reported to have 3 or more chronic disease conditions.

Factors associated with ADL/IADL limitations - *Socio-demographic factors and morbidity status:* Results of the Pearson's chi square test uncovered that ADL limitation was significantly associated (p<0.05) with age, gender, having one or more chronic disease and specifically, arthritis and stroke. When considering IADL limitations, significant associations (p<0.05) were found with age, one or more chronic disease and having a history of stroke. Only variables with statistical significance in the Pearson's chi square test and the binary logistic regression analysis were included in the multiple logistic regression model. The odds ratios (OR), confidence intervals (CI) and P values of bivariate logistic regression (unadjusted) and multiple logistic regression (adjusted) of having at least one ADL limitation and IADL limitation are given in table 4 and table 5 respectively.

Table 4 shows that being male, being more than 75 years, diagnosed with one or more chronic disease and specifically arthritis and stroke are positively associated with ADL limitations in unadjusted models. However, only advanced age, male gender, having arthritis or stroke were significant after adjusting for confounders in the multiple logistic regression analysis.

Table 5 shows that being more than 75 years, having one or more chronic disease and specifically stroke are positively associated with IADL limitations in unadjusted models. Also, all those variables remained significant after adjusting for confounders.

Further, the results indicate that the odds of having ADL and IADL are greatest for the elderly who are over 75 years and having a diagnosis of stroke. History of stroke had the greatest effect towards both ADL and IADL limitations and having arthritis was only associated with ADL limitations. When considering the significance of odds ratios between adjusted and unadjusted models, all variables which were significant in the bivariate regression remained significant even after adjusting for confounders except the odds of having one or more chronic disease with ADL limitations in the adjusted model.

Table 1. Sociodemographic characteristics of the elderly living in informal caregiving settings in Colombo district, Sri Lanka (N=723)

Characteristics		Number (percent %)
Gender		
	Male	432(59.8)
	Female	291(40.2)
Age		
	65-74 years	506(70.0)
	75-84 years	173(23.9)
	>85 years	44(6.1)
Ethnicity		
	Sinhala	664(91.8)
	Tamil	38(5.2)
	Muslim	17(2.4)
	Burgher	4(0.6)
Religion		
	Buddhist	621(85.9)
	Hindu	33(4.6)
	Muslim	19(2.6)
	Christian	50(6.9)
Educational level		
	Illiterate	92(12.7)
	Primary	342(47.3)
	Secondary	242(33.5)
	Tertiary	41(5.7)
Civil status		
	Unmarried	26(3.6)
	Married	520(71.9)
	Divorced	6(0.8)
	Widowed	171(23.7)
Living arrangement		
	Living alone	29(4.0)
	Living with spouse only	92(12.7)
	Living with spouse and children	427(59.0)
	Living with children only	158(21.9)
	Living with other relatives/ non-relatives	17(2.4)

Table 2. Prevalence of activity limitations among the elderly living in informal caregiving settings in Colombo district, Sri Lanka (N=723)

Characteristics	n (%)
ADL limitations	
Having one or more ADL limitations	122(16.9)
Not having ADL limitations	601(83.1)
Feeding	32(4.5)
Bathing	67(9.3)
Grooming	49(6.8)
Dressing	56(7.7)
Bowels	27(3.7)
Bladder	36(5)
Toilet use	55 (7.6)
Transfers	71(9.8)
Mobility on surfaces	67(9.2)
Stairs	106(14.7)
IADL limitations	
Having one or more IADL limitations	285(39.4)
Not having IADL limitations	438(60.6)
Telephone use	85 (11.8)
Shopping	183(25.3)
Food preparation	200(27.7)
House keeping	101(14)
Laundry	112(15.5)
Transportation	133(18.4)
Medication administration	112(15.5)
Handling finances	103(14.2)

Table 3. Morbidity status among the elderly living in informal caregiving settings in Colombo district, Sri Lanka (N=723).

Characteristics	n (%)
Presence of chronic diseases	
No diseases	203(28.1)
Having 1 disease	221(30.5)
Having 2 diseases	154(21.3)
Having 3 diseases	88(12.2)
Having 4 or more diseases	57(7.9)
Disease conditions	
Hypertension	315(43.6)
Diabetes Mellitus	232(32.1)
Heart diseases	159(22)
Arthritis	158(21.9)
Respiratory diseases	69(9.5)
Stroke	27(3.7)
Kidney disease	15(2.1)
Thyroid disease	10(1.4)
Osteoporosis	6(0.8)
Cancer	4(0.6)

Table 4. bivariate and logistic regression analysis of activities of daily living limitations and associated factors among the elderly living in informal caregiving settings in Colombo district, Sri Lanka (N=723)

Variables	N	Unadjusted regression model			Adjusted regression model		
		OR	CI	p-value	OR	CI	p-value
Gender							
Female	291	1	Reference				
Male	432	1.84	1.20-2.81	**<0.01**	1.79	1.14-2.82	**<0.05**
Age							
65-74 years	506	1	Reference				
75-84 years	173	3.05	1.98-4.68	**<0.001**	3.03	1.94-4.75	**<0.001**
>85 years	44	3.99	2.02-7.89	**<0.001**	3.80	1.86-7.78	**<0.001**
Having one or more disease conditions							
At least one chronic disease	520	1.73	1.07-2.79	**<0.05**	1.27	0.74-2.17	>0.05
No disease condition	203	1	Reference				
Arthritis							
Yes	158	2.09	1.36-3.20	**<0.01**	1.96	1.21-3.19	**<0.01**
No	565	1	Reference				
Stroke							
Yes	27	6.88	3.13-15.10	**<0.001**	6.12	2.64-14.15	**<0.001**
No	696	1	Reference				

The variables entered in the model for ADL limitations: Age, Gender, One or more disease conditions, Stroke, Arthritis

Table 5. bivariate and logistic regression analysis of instrumental activities of daily living limitations and associated factors among the elderly living in informal caregiving settings in Colombo district, Sri Lanka (N=723)

Variables	N	Bivariate regression (Unadjusted)			Multiple Logistic Regression (Adjusted)		
		OR	CI	p-value	OR	CI	p-value
Age							
65-74 years	506	1	Reference				
75-84 years	173	3.00	2.10-4.28	**<0.001**	2.91	1.87-4.52	**<0.001**
>85 years	44	4.80	2.48-9.31	**<0.001**	3.93	1.94-7.93	**<0.001**
Having one or more disease conditions							
At least one chronic disease	520	1.46	1.04-2.06	**<0.05**	1.67	1.01-2.74	**<0.05**
No disease condition	203	1	Reference				
Stroke							
Yes	27	7.24	2.71-19.36	**<0.001**	5.53	2.43-12.57	**<0.001**
No	696	1	Reference				

The variables entered in the model for IADL limitations: Age, One or more disease conditions, Stroke.

Discussion

This study examined the prevalence and correlates of activity limitations among the elderly in informal caregiving settings in Colombo district, Sri Lanka. We adopted a multi-stage cluster sampling with questionnaire-based interviews carried out at household level. Authors believe that this method facilitated selecting a sample as representative as possible with easy accessibility to the population. Similar sampling methods have been adopted by Su et al (2016) among elderly in China, in cross sectional studies carried out by Araujo et al (2019) in Brazil and by Curcio, Henao & Gomez (2014) in Colombia. Most of the studies have used 10 item Barthel Index and Lowton IADL scales for the assessment of activity limitations. Disease conditions were determined based on the diagnosis of the medical professional whose in charge of the elderly.

Although according to literature, the overall prevalence of disability and functional limitations increase with advancing age (Gureje, Kola & Afolabi, 2006; Abdulraheem, Oladipo & Amodu, 2011; Ran et al, 2017; Araujo et al, 2019) the scores for ADL and IADL are high in this sample indicating a low disability level which can be attributed to the fact that a large majority of the sample belonged to the 65 – 74 age group. However, since we used a stringent protocol for sample selection, it is likely that that our sample is a true representation of the elderly population in Sri Lanka. The prevalence of ADL and IADL limitations of our study are similar to the results of a cross-sectional study conducted in Poland (Cwirlej-Sozanska et al, 2019) where the percentages of elderly with at least one ADL limitation and one IADL limitation were 17.13%, and 35.75% respectively. Both ADL and IADL limitations show an increasing prevalence with advancing age (Su et al, 2016; Cwirlej-Sozanska et al, 2019). When compared with most of the studies including ours, Su et al (2016) demonstrated the highest prevalence in ADL limitations probably because the sample consisted of elderly of more than 80 years. Also it is noted that in this oldest old population, although ADL limitations showed a higher prevalence compared to our study, the prevalence of IADL limitations are comparable. ADLs are self-maintenance abilities such as dressing or bathing (Gold, 2012) and IADLs are more complex everyday tasks such as preparing a meal

or managing finances (Lawton & Brody, 1969) which needs higher cognitive functioning. This is probably the most likely reason for the higher prevalence of IADL in most studies including ours. Therefore, evaluating the impact of cognitive impairment on routine activities plays an important role when assessing the functional abilities of older adults (Gold, 2012). This was further proven with the results of another study conducted among Chinese residents, aged 80 or older where 23.23% and 37.90% reported ADL and IADL disability respectively (Su et al, 2016) suggesting that although ADL limitations increase drastically with advancing age, IADL limitations remain somewhat constant across young to older elderly. In agreement with our results, some previous studies (Sowmiya, Kumar & Nagarani, 2015; Araujo et al, 2019) have also mentioned that activity limitations show significant positive associations with increasing age implying the necessity of advanced planning of caregiving facilities to minimize unexpected complications.

On exploration of our findings, it was evident that among the activities assessed, limitations were mostly seen with mobility related activities. In line with our findings, Curcio, Henao & Gomez (2014) also demonstrated limitations in activities like climbing stairs and transferring between bed to chair. The limitations in mobility related activities may be attributed to the age-related progressive loss of muscle mass, muscle wasting and weakness which in turn have a considerable impact on the quality of life of the elderly (Degens and Korhonen, 2012). This highlights the importance of introducing strategies to maintain locomotor system health in the elderly and training caregivers on proper lifting and moving methods in order to provide assistance when needed to minimize unmet needs.

Majority of the elderly (71.9%) in the present study reported to have at least one diagnosed chronic disease. A higher value (78%) is reported in a similar study conducted in China probably because the elderly population studied was over 80 years (Su et al, 2016). Majority of the activity limited elderly had at least one chronic disease highlighting the association between activity limitations and morbidity status. Out of the elderly with comorbidities, 27.8% (N=145) had 3 or more chronic diseases emphasizing the role of caregivers in ensuring the safe use of

medications among the older people. Further, among the 43% of the elderly who perceived their health as poor, 26.4% and 45.5% had ADL and IADL limitations respectively. This shows the impact of activity limitations on the self-perceived health in our cohort. However, in a study conducted among a functionally independent elderly population, only 18% perceived their health as poor (Machon et al, 2016). This finding along with ours where 68% of elderly with ADL limitations and 50% of elderly with IADL limitations perceiving their health as poor, suggest that although activity limitations is not the only reason for low self-perception of health, elderly with activity limitations have a higher tendency to rate their health as poor. In addition, Ran et al, (2017) stated that negative self-perception of health is found to be a potential risk factor for functional limitations among the elderly and these factors appear to operate in a vicious cycle where elderly needs assistance in one or more ADL/IADL limitations (Storeng, Sund & Krokstad, 2018). Steps should be taken to minimize activity limitations and/or provide assistance to deal with these limitations in order to break this cycle and to improve the self-perceived health and the overall quality of life of the elderly living in informal caregiving settings.

Functional disability is closely associated with the presence of chronic co-morbid conditions (Hairi et al, 2010; Abdulraheem, Oladipo, & Amodu, 2011; Sowmiya, Kumar & Nagarani, 2015; Ran et al, 2017; Araujo et al, 2019). Out of the 10 chronic diseases evaluated in this study, the two diseases that had significant associations with ADL limitations were stroke and arthritis although the odds of having ADL limitations were higher with stroke than arthritis. In addition to stroke, Pinto et al (2016) reported that heart diseases were also associated with ADL limitations. Although stroke was the only disease which showed an effect towards IADL limitations in this study, other studies have shown that osteoporosis directly contributes towards the development of activity limitations (Pinto et al, 2016; Araujo et al, 2019). The lower prevalence of osteoporosis seen in our study may be attributed to less apparent diagnosis when compared to conditions such as stroke. Although hypertension and diabetes mellitus are rated as most prevalent disease conditions in our study, an association was not observed with activity

limitations of elderly. Even if the mere presence of these conditions is not associated with activity limitations, their complications ie. stroke is shown to increase the tendency of both ADL and IADL limitations. Hence this study highlights the importance of the optimum management of common comorbidities of elderly in order to prevent complications which leads to activity limitations. Arthritis which is the other morbid condition to show a significant association with ADLs was reported in about one fifth of the cohort. Although arthritis is not listed under leading causes of mortality (Desai, Lentzner & Weeks, 2001; Ferrucci, Giallauria & Guralnik, 2008), it is reported to be the reason for nearly one-fourth of new cases of ADL disability in non-institutionalized older adults in America (Song, Chang & Dunlop, 2006) proving the strong association it has with ADL disability. The association demonstrated between arthritis and ADL limitations in the current study further proves the impact it has on overall health and quality of life.

Limitations : Although we have uncovered important factors associated with activity limitations, it is not possible to determine the exact direction of causality as this study used a cross sectional design. Although significant associations have been reported previously between factors related to mental health and activity limitations, we excluded elderly with cognitive impairment and psychiatric disorders as the elders needed to have abilities of comprehension for the subsequent components of the study.

Conclusion: In this representative sample of elderly, the mean scores of ADL and IADL are high, indicating a low disability level. The prevalence of IADL limitations were higher than the ADL limitations and the activity limitations reported are mainly mobility related. Majority of the activity limited elderly suffered from at least one chronic morbidity and perceived their health as poor. Hypertension, diabetes mellitus, heart disease and arthritis were the most prevalent morbid conditions among the elderly in our cohort. Significant positive associations were seen between ADL limitations and age more than 75 years, male gender and having arthritis or stroke and, between IADL limitations and age more than 75 years, presence of morbidity and having stroke when the factors were adjusted for confounders. However, the odds of having ADL

and IADL were greatest for the elderly who are over 75 years and having stroke. The care system in informal caregiver settings should be improved in order to minimize the risk of non-communicable diseases and their complications like strokes. This will ultimately be beneficial to minimize activity limitations, improve self-perceived health and enhance the overall quality of life of the elderly living in informal caregiving settings.

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