

A Comparative Study of Physical Activity and Cognitive Function of a Sample of Elderly Nigerians Living In a Rural and an Urban Area

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Abstract

The study was undertaken to ascertain the difference in physical activity and cognitive function between elderly (65-75 years) rural and urban-dwelling people using structured questionnaire and discussions. The activity domains measured were work, housework, sports and volunteer work. Cognitive function was assessed by the six-item screener method and self-rated memory. Rural-based elders had significantly higher physical activity score (median=41.6 vs. 35.5, $P=0.04$, Mann-Whitney U test) than the urban-dwelling elders socio-demographic variables (gender, age, education and income) notwithstanding. There was no significant difference in cognitive function by overall assessment, but rural elders aged 71-75 or lowly educated (\leq secondary), had significantly higher cognitive function ($P=0.000/0.02$). Rural elders reported significantly lesser physical pains (median=4.0 vs. 6.5, $P=0.02$). Significant physical activity/cognitive function (rural/urban: $r_s=0.48/0.42$; $P=0.005/0.01$) and physical activity/physical pain (rural/urban: $r_s=-0.49/-0.47$; $P=0.005/0.015$) relationships occurred, but was stronger with rural elders as indicated by the r_s and P values. It can be concluded that the higher performance of the rural elders is attributable to regular intense working exercises such as farming, fishing and hunting. The need for some form of intense physical activity for the aged is therefore, indicated.

Keywords: Ageing, Physical activity, Cognitive function, Rural, Urban, Elderly Nigerians

Introduction

The relationship between activity and the risk of morbidity and mortality has in recent decades become subject of intense research especially in gerontology (e. g. Patterson & Carpenter, 1994; Misra, Alexy & Panigrahi, 1996; Menec, 2003). The Activity theory is one of the social theories of gerontology that addressed the relationship between activity and the wellbeing of the aged. The theory was put forward by Havinghurst (1963) but formally developed by Lemon, Begtson & Peterson, (1972) and elucidated by Rowe and Kahn (1997). The theory suggests a positive relationship between activity and wellbeing where the frequency of activity promotes greater life satisfaction and good health. Despite its popularity in gerontological literature, there is no universally agreed definition of activity. Physical activity is one of the dimensions of activity that has been shown to be useful for successful ageing.

The health benefits of physical activity defined by the Health Education Authority (1995) as the movement produced by skeletal muscles that involves expenditure of energy has received considerable attention in the last two decades. Reports have shown that regular physical activity has health benefits to all age groups. However for older people the benefits include reduced risk of coronary heart disease and cancer of the colon (Morris *et al.*, 1990; Shaper *et al.*, 1991; Giovannucci *et al.*, 1995). Other benefits for the elderly are, prevention of memory loss (Fabre *et al.*, 1999) promotion of psychological well-being (Philips, Arber & Ginn, 2001) and improved cardiovascular status, strength and functional capacity (Ntz, Wu, Becker & Tenebaum, 2005). Furthermore, Lautenschlager *et al* (2008) reported that a six-month program of physical activity provided a modest improvement in cognition over an 18-month follow-up period for older adults with subjective memory impairment. The review by Rolland, van Kan & Vellas (2010) showed that regular physical activity has protective effect on brain functioning in elderly population. It is therefore important that elderly people be encouraged to undertake regular physical activities.

It is well known that neuromuscular coordination, muscle strength and physiological capacity for exercise consequently decline with age. Some of these factors may be due to illness or as the literature shows, result from lack of physical exercise. Literature sources have shown that physical activities by older adults relate more to house work and limited outdoor activities such as gardening and leisure (Dallosso *et al.* 1988; Morgan *et al.* 1991; ELSA, 2002) while rigorous physical activity is reduced. However, the report by Byberg *et al.* (2009) showed that older men who indulged in high or vigorous physical activity had lower mortality rate than those with lower or medium physical activity. Going by these reports it would be expected that mortality rates will be low among Nigerians that work almost all through life or till serious physical disabilities set in. It would also be expected that decline in cognitive function among such Nigerians would be low.

Work particularly when it entails farming, fishing and hunting is a vigorous exercise. Many Nigerians living in the rural areas are farmers, fishermen, hunters or nomadic herdsmen who do not retire until physical disabilities set in. Indeed the concept of work and retirement is a colonial heritage in Africa. It is common to see elderly people along roads riding loaded bicycles or trekking long distances carrying farm products on their heads. Indeed it is the belief of some Nigerians that the rural farmers and pastoralists live longer than their urban-dwelling counterparts. This view tends to be supported by the incidents of early deaths of many retirees who returned to the village to live sedentary lives. The returnee retirees miss the social activities of the urban areas that promoted their wellbeing hence some of them return to the urban areas. However, the view that the old people in the rural areas live longer and healthier lives with attendant limited cognitive decline than urban dwelling elders is a hypothesis that needs empirical substantiation in the Nigerian setting. A preliminary comparative study of the physical activities and cognitive function of a sample of old people living in a rural and an urban centre was therefore, undertaken to test the hypothesis. The outcome may be useful in the campaign to promote physical activity for healthy old age and its attendant reduction of medical care costs burden of these senior citizens.

Method

Data Source

The data for the study was obtained from respondents aged between 70 and 75 years living in a rural farming and fishing community and an urban centre. The farming/fishing community (Utchi) is located on the bank of River Niger while the town Kwale) is the administrative headquarter of a Local Government Area. Unlike the rural community, facilities for recreation (outdoor and indoor sports, swimming pools e.t.c.) and social life are available in the urban centre used for this study. In addition the town has a well equipped Government hospital manned by qualified doctors, nurses and laboratory technicians. The rural community has only a Health Centre manned only by nurses and Para-medical personnel. The lives of the rural dwellers merely centre on their fishing, farming and the seasonal festivals. Social life is limited to friendly exchange of visits on market days when they are not expected to be at work. Both the rural and urban communities are located in the Delta State of Nigeria. Respondents numbering 100 were randomly selected at 50 per community for the study. The socio-demographic variables considered for the study included gender, age, education and income.

Measures

A compendium of physical activities based on observation and discussions with some elderly men and women aged 65-75 years in the localities of the study was drawn up (Table 1). The central theme of the discussions was on their activities within and outside their homes. A one-on-one interview with the respondents was conducted using a structured questionnaire containing scales for measuring physical activities, cognitive impairment, and physical pains. For the measurement of the frequency of the activity types listed in Table 1, a 1-5 single item scale was developed and tested in pilot studies for reliability. The Cronbach's alpha stood at 0.75. The respondents were asked to indicate the extent of their involvement in each of the activity type (1, none; 2, on rare occasions; 3, some of the time; 4, most of the time; and 5, all the time). The scores were calculated for each activity type and domains and combined to obtain the overall activity score.

Two standardised scales, a six-item screener to identify cognitive impairment (Callahan *et al.*, 2002) and a single item self-rated memory scale routinely used in gerontological studies were used to assess the cognitive function of the respondents. With respect to the six-item scale, the words apple and penny were substituted with orange and "kobo", respectively. The word kobo is more familiar than penny and it is the lowest Nigerian money denomination.

Correct answer to each of the six items scores 1 while it is 0 for an incorrect one (maximum point=6). For the self-rated memory test, the respondents were requested to rate their present ability to recall or remember events on a scale of: poor, 1; fair, 2; good, 3; very good, 4; and excellent, 5. High scores indicate good cognitive function.

Two questions designed to elicit information on physical pains were adopted from SF-36 Health Survey questionnaire. The respondents were requested to indicate the severity of any pains they had in the last four weeks (1, none; 2, very mild; 3, mild; 4, moderate; 6, severe or 7, very severe) and if the pains interfered with their normal activity (1, not at all; 2, a little bit; 3, moderately; 4, quite a bit or 5, extremely). The scores for both scales were combined (maximum point=12) and used for the analyses of the physical pains data.

Data Analyses

The ordinal data was not normally distributed hence median and range scores were used for descriptive analyses. The differences in the physical activity domain scores between the rural and urban-dwelling old people were analysed with *Mann-Whitney U* test while graphs were used to illustrate the variation and differences in activity types. *Mann-Whitney U* test was also used to analyse the rural/urban differences based on the overall physical activity score and socio-demographic variables. Median values were also presented for the cognitive function index and physical pains' scores while the rural/urban differences were similarly tested with *Mann-Whitney U* statistics. Spearman's correlation statistics was used to test the association between physical activity or physical pain and cognitive function scores. The relationship between physical activity and physical pains was also similarly analysed. The SPSS version 16 was used for the statistical analyses.

Results

The socio-demographic information of the samples of the elderly people is presented in Table 2. The median value for the overall physical activities' scores for both the rural and urban elders was generally less than 50% of the maximum score (Table 3). However, as shown in Table 3, the overall physical activities' scores showed that rural elders tended to be significantly more active. Going by domain analyses, significant differences between the rural and urban dwelling elders occurred only with working activity with the rural elders being more active and volunteer work with the urban elders being more active (Table 3). The analyses of the overall activity score by socio-demographic variables and *Mann-Whitney U* test showed that the rural elders remained significantly more active in all variables particularly in the age group 71-75 (Table 4).

Further analyses by activity types showed that the superior score of the rural elders in the domain of working activity, emanated from their markedly higher scores in hunting, river fishing and crop farming (Figure 1a). With respect to activity types under the housework domain, there were no marked differences except in "gardening and cleaning floor" where the urban elders scored higher (Figure 1a). Under the sports domain, urban elders were more active in tennis and jogging while the rural old people scored higher in "cycling" and "rowing boat/canoe" activity types (Figure 1b). Walking was the dominant sporting activity type for both groups as shown by the higher and equal scores (Figure 1b). The urban elders had markedly higher scores in the three activity types of the volunteer work domain (Figure 1b).

Compared to the maximum points, the median scores indicated average cognitive function irrespective of the socio-demographic variables or the cognitive index (Table 5). The table further shows that when all respondents were considered no significant difference in cognitive function occurred between the rural and urban elders. However, the older respondents (71-75 years) and those with secondary or lower education among the rural elders had significantly higher cognitive function than their urban counterparts (Table 5). Physical pains were generally significantly lower with the rural elderly respondents (Table 6). Physical activity was related to cognitive function whereas physical pains were not (Table 7). Furthermore, the relationship between physical activity and cognitive function was stronger with the rural elders the cognitive index type notwithstanding (Table 7). However, physical pain was significantly negatively related to physical activities with Spearman correlation coefficient of -0.47 for urban elders ($P=0.015$) and -0.49 for rural respondents ($P=0.005$).

Discussion

The findings of this study generally suggest that the overall physical activities of the old people tended to be low (33-39% of max. points) as indicated by the median and values.

However given the knowledge that the capacity for physical activities diminish with age for biological reasons, such a performance can be considered acceptable and not really low, because it is far from being sedentary. Although research reports suggest that the higher physical activity leads to greater health benefits (Byberg *et al.*, 2009), studies have also shown that modest physical activity in old age significantly enhanced physical capacity (Paffenbarger *et al.*, 1993; Stewart, 2005; Charansonney, 2011). Nevertheless, low physical activities have been generally acknowledged as common with elderly people (Dallosso *et al.*, 1988; Morgan *et al.*, 1991; Crombie *et al.*, 2004)). However, another observation is that the average low scores may not necessarily indicate poor physical activity because participation may be selective. Indeed the results here revealed that the elders' level of participation varied with activity domain and type. This was buttressed by the finding that work and housework domains contributed more to the overall activity performance of the rural elders. Even within the activity domains, "crop farming" and "walking" activity types had the highest scores.

Generally the rural elders were significantly more active than their urban counterparts irrespective of the socio-demographic variables. The working activity domain tilted the scale in their favour with the major score contributions coming from crop farming, river fishing, and hunting including rowing boats. Although rowing boat or canoe was classified as sports, in reality it accompanied river fishing hence the urban dwellers never participated. Indeed crop farming and river fishing entail intense physical actions, which the rural elders are expected to be beneficiaries in terms of preserved physical capacity and cognitive function better than the urban elders. The significantly lesser physical pains experienced by the rural elders as the findings show, suggest that their physical capacity was indeed maintained.

However, this higher physical activity was not translated into higher cognitive function when the overall cognitive index scores were considered, because there was no significant difference between the two groups. The urban dwellers had opportunities for social interaction, recreation, leisure and sports that are not available to the rural dwellers. For example the results showed that they scored higher in sporting activities which tended to make up for the low scores in working activity. Socialization, recreation and leisure have been associated with cognitive preservation and wellbeing in old people (Giles, Anstey, Walker & Luszcz, 2012; Iwasa, Yoshida, Kai, Suzuki, Kim & Yoshida, 2012). Despite the absence of recreational facilities the rural elders were able to maintain identical levels of cognitive function with the urban elders because of regular exercises involving trekking long distances or riding bicycles to the farm, the manual system of farm work, hunting and fishing.

Although eclipsed by the overall score the finding that the older respondents (71-75) in the rural community had significantly higher cognitive index scores than their urban counterparts substantiates the above research reports. The inference is that the older respondents (71-75) in the urban area tend to become more sedentary unlike their rural counterparts that continue to work till very old age. Working till very old age is consistent with the traditional system where there is no formal retirement from work. In the course of the investigation some elders above 80 years were seen going to their farms to supervise or even engage in weeding while those at home were mainly the few retirees who "returned home" from the cities. Indeed in the course of discussions, some of the elders expressed the belief that their farm work made them strong and would want to continue working. Indeed one of them said: "My children complain when I go to the farm. They refuse to understand that staying at home makes me sick".

For the same working activity reasons, rural elders with low education (\leq secondary) had significantly higher cognitive index score than their urban counterparts. It is already known as the results here show that recreational facilities like sports and volunteer work contributed the activity scores which compensated for the low score from working activity. This compensation was not forth coming for the lowly educated urban elders probably due to cost and class difference that made them engage less in recreation activities. One such urban elder had this to say:

How can I play Lawn or Table Tennis or swim when the facilities are in the premises of clubs that I cannot be a member or afford to go to hotels that have the facilities. The secondary schools where one may find such facilities are not open to everybody. All I do is walk to visit friends when I am tired of staying at home.

Further differences between the rural and urban elders occurred in the strength of the significant positive relationship between physical activity and cognitive function. The relationship was stronger and more significant with the rural elders, thereby buttressing the finding, which indicated their higher physical activity.

Although physical pains were not associated with cognitive function, its significant negative relationship with physical activity was stronger with rural elders. This again reinforced the better physical activity of the rural elders.

Although this report indicates that differences in physical and cognitive function between the rural and urban-dwelling elderly people exist, literature sources have shown that recreation, leisure, and social engagement also have profound positive effect on the wellbeing and cognitive function of old people. This study did not measure the level of participation in the social and leisure engagement of the rural and urban elders, which may have contributed to their cognitive processes. In addition the preponderance of physical disabilities and dietary habits need to be investigated for further assessment of the benefits of physical activities in a Nigerian setting. These limitations are being addressed in an on-going study.

Conclusion

The hypothesis that the rural elders are likely to be more physically active than their urban counterparts has been sustained by the evidence from this study. However, only those above 70 years in the sample of the rural elders had better cognitive function than those of similar age group among the urban elderly respondents thereby indicating partial sustenance of the hypothesis with respect to cognitive function. Thus this report substantiates the findings of other studies on the relationship between physical activity and cognitive decline. It further indicated that the extent of cognitive preservation and enhancement of physical capacity may depend on undertaking some intense physical activity as was observed with the rural elders that do regular fishing and farm work.

The urban elders appear to become sedentary as they grow older, which is not healthy. An awareness campaign in this regard becomes necessary in order to reduce ill-health and save cost of medical care. The urban elders also need to be encouraged to undertake some intense physical activities like the rural elders that engage in regular farm work. Access to gymnasium is limited and is not yet popular in Nigeria. Small scale farming is therefore, a better option under this circumstance. What the rural elders lost by not having recreational facilities they made up with farm work. This notwithstanding, their lives would be better if recreational facilities are made available especially for “returnee” retirees that are yet to come to terms with farm work or fishing as a worthy physical exercise in the rural setting.

Acknowledgement

The author is grateful to Professor B. O. Ejechi of the Faculty of Science, Delta State University, Abraka Nigeria for assisting with statistical analyses.

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Table 1: Physical activities associated with the elderly in the rural and urban centres

Activity Domain	Activity type	Available points/Domain
Work	Crop farming	30
	Fish farming (artificial ponds)	
	River/streams fishing	
	Livestock (poultry)	
	Hunting	
	Running a store/shop	
Housework	Sweeping	30
	Cleaning tile/rug carpet/floor	
	Cooking	
	Washing dishes	
	Laundry	
	Gardening	
Sports	Table tennis	30
	Lawn tennis	
	Cycling	
	Jogging	
	Walking	
	Rowing boat/canoe	
Volunteer work	Red Cross	15
	Road Safety Corps	
	Supervising community sanitation	
Overall total score		105

Table 2: Socio-demographic characteristics of the rural and urban-dwelling elders

Variables	Respondents			
	Rural elders		Urban elders	
	N=50	%	N=50	%
Gender				
Male	30	60	25	50
Female	20	40	25	50
Age				
66-70	32	64	27	54
71-75	18	36	23	46
Education				
≤Secondary	34	68	20	40
Post-secondary	16	32	30	60
Annual income				
<N240,000.00	26	52	19	38
>N240,000.00	24	48	31	62

Table 3: Frequency of physical activities of the elders

Activity domain	Activity Score (median)		
	Rural elders	Urban elders	*P
Work	13.0 (3)	8.5 (4)	0.03
Housework	15.5 (4)	13.5 (5)	0.06
Sports	9.5 (3)	10.0 (4)	0.20
Volunteer work	0.5 (1)	2.0 (2)	0.04
All activities	41.6 (5)	35.5 (5)	0.04

*Significant difference (*Mann-Whitney U* test). Range values are in parentheses.

Table 4: Frequency of Physical activities by socio-demographic variables

Variables	Overall activity score (median)		
	Rural elders	Urban elders	*P
Gender			
Male	38.5	31.0	0.03
Female	44.0	36.8	0.03
Age			
61-70	44.0	36.4	0.03
71-75	40.5	29.8	0.00
Education			
≤Secondary	45.6	36.4	0.02
Post-secondary	34.5	28.6	0.03
Annual income			
<N240, 000.00	43.5	35.0	0.04
>N240, 000.00	36.0	25.0	0.02

*Significant difference (*Mann-Whitney U* test)

Table 5: Cognitive function of the rural and urban-dwelling elders

Variables	Cognitive index score (median)					
	*By six item screener			**By self-rated memory		
	Rural	Urban	***P	Rural	Urban	***P
All respondents	3.5	3.5	0.560	3.0	3.0	0.622
Gender						
Male	3.0	3.5	0.062	2.5	3.0	0.465
Female	3.0	3.5	0.532	3.0	3.0	0.558
Age						
61-70	4.0	4.0	0.764	3.5	4.0	0.321
71-75	4.0	2.5	0.005	3.5	2.0	0.034
Education						
≤Secondary	4.0	2.5	0.004	3.5	2.5	0.025
Post-secondary	4.5	4.5	0.852	4.0	3.5	0.070
Annual income						
<N240, 000.00	3.0	2.0	0.060	3.0	2.5	0.16
>N240, 000.00	4.0	4.5	0.084	3.5	4.0	0.153

Maximum points=*6; **5. ***Significant difference (*Mann-Whitney U* test)

Table 6: Extent of physical pains experienced by the elders

Variables	*Physical pains score (median)		
	Rural elders	Urban elders	**P
All respondents	4.0	6.5	0.02
Gender			
Male	3.5	5.0	0.04
Female	5.5	7.0	0.04
Age			
61-70	3.5	5.5	0.03
71-75	5.5	7.0	0.04
Education			
≤Secondary	3.5	5.5	0.03
Post-secondary	4.5	6.5	0.03
Annual income			
<N240, 000.00	3.5	6.0	0.02
>N240, 000.00	4.5	6.5	0.03

*Maximum point=12; **Significant difference (*Mann-Whitney U* test)

Table 7: The relationship between physical pain/activities and cognitive function of rural and urban-dwelling elders

Domain	Respondents' Location	Spearman's Correlation coefficient (r_s)	
		Cognitive index: Six-item screener	Self-rated memory
Physical activities	Urban	0.42 (0.010)	0.37 (0.036)
	Rural	0.48 (0.005)	0.39 (0.025)
Physical pains	Urban	-0.12 (0.43)	-0.13 (0.54)
	Rural	-0.09 (0.65)	-0.10 (0.55)

The values in parentheses are the *P* values computed from SPSS version 16.

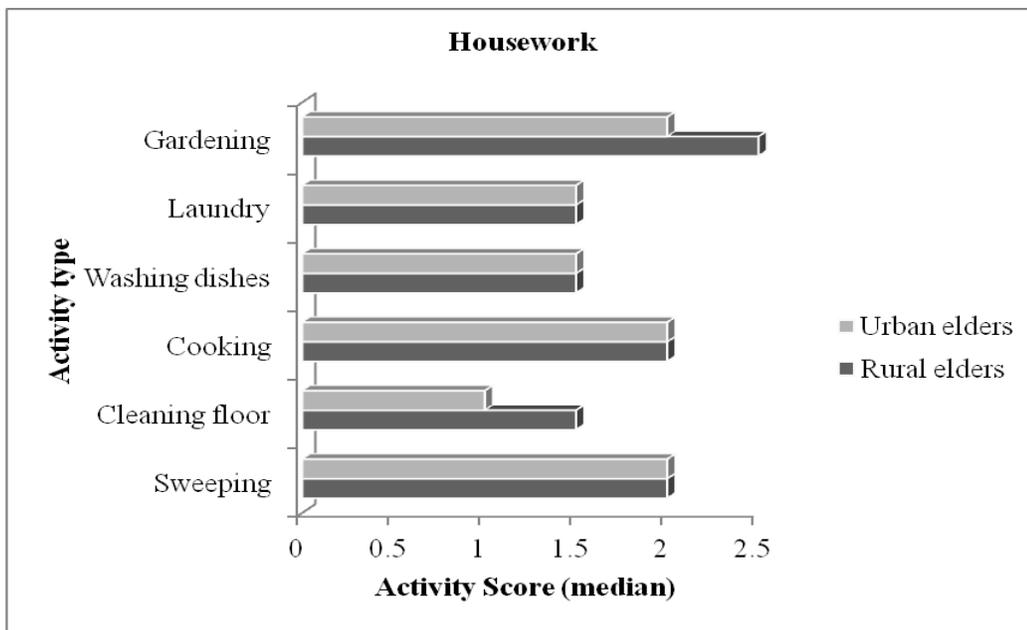
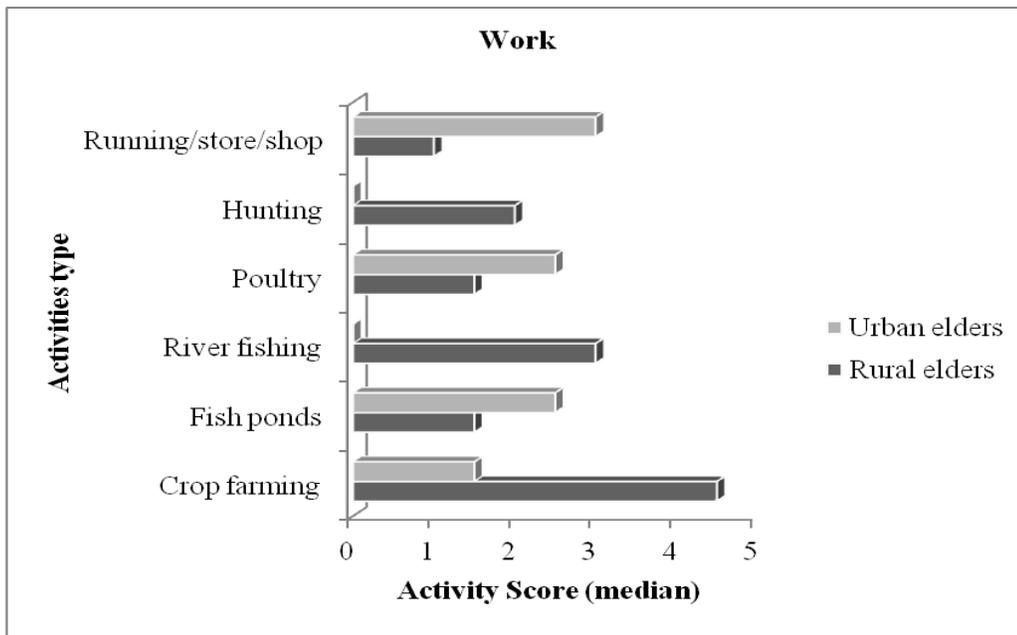


Figure 1a: Physical activities of the rural and urban-dwelling elders: work and housework domains (max. points per activity type=5)

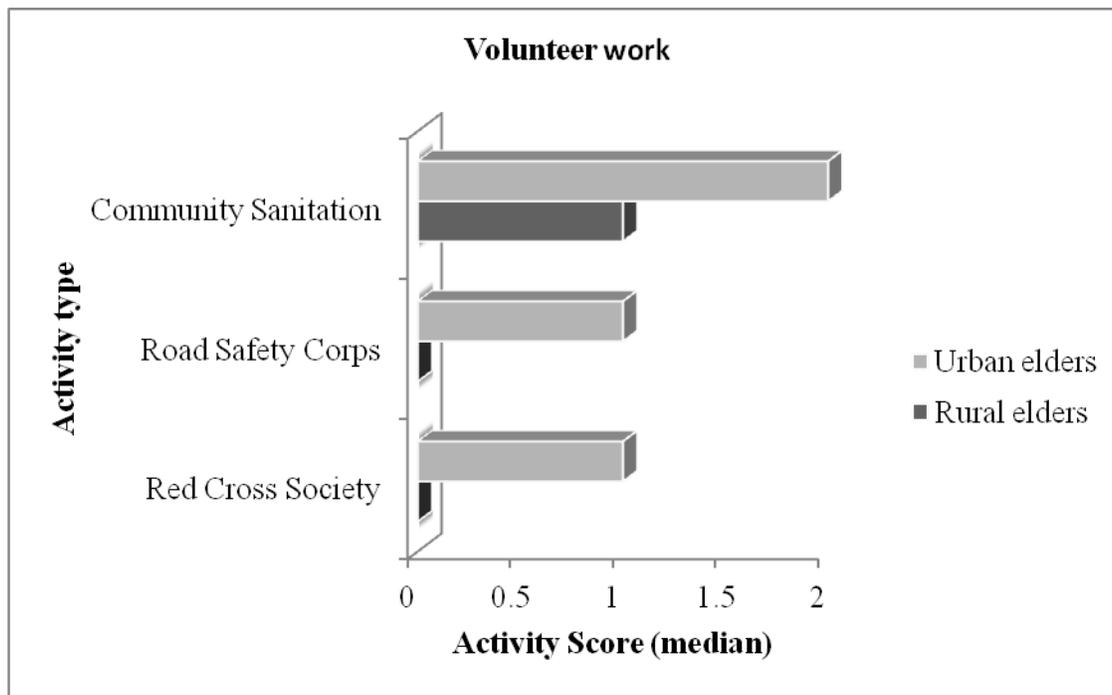
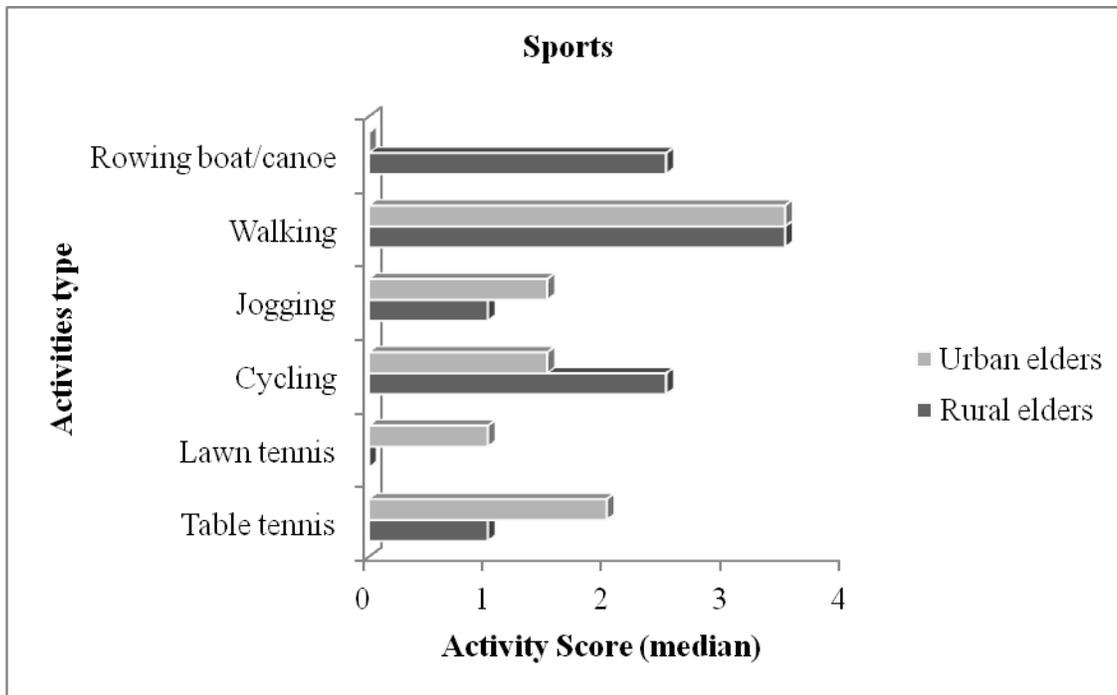


Figure 1b: Physical activities of the rural and urban-dwelling elders: sports and volunteer work domains (max. points per activity type=5)