

## Functional capacity of older adults living in rural areas: a pilot study

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A – Development of the concept and methodology of the study; B – Query – a review and analysis of the literature; C – Submission of the application to the appropriate Bioethics Committee; D – Collection of research material; E – Analysis of the research material; F – Preparation of draft version of manuscript; G – Critical analysis of manuscript draft version; H – Statistical analysis of the research material; I – Interpretation of the performed statistical analysis; K – Technical preparation of manuscript in accordance with the journal regulations; L – Supervision of the research and preparation of the manuscript

### Abstract

**Introduction and objective.** Ageing is associated with a gradual decline in functional reserves and an increased risk of losing independence in activities of daily living. The present study assessed functional capacity in adults aged  $\geq 60$  years living in rural areas and examined its association with selected sociodemographic characteristics.

**Materials and methods.** A pilot study was conducted from April to September 2025 among 100 rural residents of Dąbrówka municipality, Mazowieckie Voivodeship, Poland. An original questionnaire and the Barthel Index were used. Associations were analysed with Pearson's chi-square test and, for sparse contingency tables, the Fisher–Freeman–Halton exact test with Monte Carlo estimation;  $p < 0.05$  was considered significant.

**Results.** High functional capacity was found in 71.0% of participants, moderate capacity in 23.0%, and low capacity in 6.0%. The overall level of capacity did not differ significantly by sex ( $p = 0.063$ ), but was associated with age ( $p = 0.001$ ) and marital status ( $p = 0.032$ ). With increasing age, independence decreased in regard to personal hygiene ( $p = 0.006$ ), washing and bathing ( $p < 0.001$ ), mobility on level surfaces ( $p = 0.001$ ), stair use ( $p < 0.001$ ) and dressing and undressing ( $p = 0.007$ ).

**Conclusions.** Most participants maintained high functional capacity, but independence decreased with age and lower capacity was more common among widowed respondents. The greatest limitations concerned stair use and washing and bathing.

**Keywords:** rural environment, seniors, functional capacity, older adults, self-care, Barthel Index.

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### INTRODUCTION

Increases in life expectancy and in the proportion of older people in the population have intensified the importance of maintaining functional capacity and independence in later life. Older adults are a heterogeneous population in terms of age, family circumstances, social conditions and health status. With advancing age, chronic diseases and functional limitations become more common and may gradually lead to loss of independence [1-5].

The process of ageing itself is not synonymous with disease, but it is accompanied by a reduction in physiological reserves. Multimorbidity is particularly important because the coexistence of several chronic conditions, together with age-related changes, may restrict everyday functioning [4-7].

Functional capacity refers to the ability to perform basic activities of daily living independently. Its assessment is important in geriatrics, nursing and public health because it helps identify both preserved abilities and areas in which limitations occur [6-8]. Particular attention should be paid to older adults living in rural areas, where demographic, family and health-related conditions may affect independent functioning in the place of residence [5,6,8,10].

### OBJECTIVE

The objective of the study was to assess functional capacity in adults aged  $\geq 60$  years living in rural areas and to determine associations between functional capacity and participants' sex, age, and marital status.

METHODS AND MATERIALS

The pilot study was conducted from April to September 2025 among 100 residents of rural areas in Dąbrówka municipality, Wolomin County, Mazowieckie Voivodeship, Poland. The study participants were adults aged ≥60 years receiving medical care from the Medical Center of the Battle of Warsaw 1920 in Radzymin, an Independent Public Health Care Complex, who had submitted a declaration selecting a family physician at this facility. The study formed part of a pilot project intended to prepare a primary health care clinic to provide long-term care for older residents of the municipality.

Individuals qualifying for a visit to a primary care family physician were eligible for recruitment. Inclusion criteria were residence in a rural area within Dąbrówka municipality, age ≥60 years, and voluntary consent to participate. No additional exclusion criteria were applied other than failure to meet the inclusion criteria or lack of consent to participate.

Data were collected using an original interview questionnaire covering sociodemographic characteristics and information on existing diseases, together with the Barthel Index. The Barthel Index comprises 10 items assessing the ability to perform basic activities of daily living, including feeding, mobility, dressing and undressing, personal hygiene, toilet use and control of physiological functions. Depending on the assessed activity, the degree of independence or dependence on another person is scored on a two-, three-, or four-level scale: 0-5 points, 0-5-10 points, or 0-5-10-15 points. The total score ranges from 0 to 100 points, with higher scores indicating greater independence. Three levels of functional capacity were used: 0-20 points – low functional capacity (unable to perform self-care; severe condition); 25-85 points – moderate functional capacity (requires partial assistance; moderately severe condition); and 90-100 points – high functional capacity (independent; mild condition) [22].

Associations between categorical variables were assessed using Pearson’s chi-square test when assumptions regarding expected cell frequencies were satisfied. In case of contingency tables with sparse expected cell counts, the Fisher–Freeman–Halton exact test with Monte Carlo estimation was used. Statistical significance was set at  $p<0.05$ . P-values were reported to three decimal places and chi-square statistics, where applicable, to two decimal places. Statistical analyses were performed using Statistica 13.1 PL.

According to the regulations applicable in Poland, formal approval by a bioethics committee was not required for this type of observational, non-interventional study. Ethical principles concerning voluntary participation, informed consent, privacy and confidentiality, were consistent with the Declaration of Helsinki [11], were observed. Before participation, individuals were informed about the purpose of the study, the voluntary nature of participation, their right to withdraw at any stage, and the complete anonymity of the collected data. No information enabling identification of participants was collected for the purposes of the study.

RESULTS

According to the study group, women accounted for 65.0% of the study group and men for 35.0%. The largest age category was 70-79 years (54.0%), 27.0% were aged 60-69 years and 19.0% were aged ≥80 years. Vocational education was

TABLE 1. Sociodemographic characteristics of participants (%).

| Characteristic | Category    | Women | Men   | Total |
|----------------|-------------|-------|-------|-------|
| Age            | 60-69 years | 13.0% | 14.0% | 27.0% |
|                | 70-79 years | 38.0% | 16.0% | 54.0% |
|                | ≥80 years   | 14.0% | 5.0%  | 19.0% |
| Marital status | single      | 3.0%  | 2.0%  | 5.0%  |
|                | married     | 23.0% | 24.0% | 47.0% |
|                | widowed     | 39.0% | 9.0%  | 48.0% |
| Education      | primary     | 26.0% | 8.0%  | 34.0% |
|                | vocational  | 30.0% | 17.0% | 47.0% |
|                | secondary   | 9.0%  | 9.0%  | 18.0% |
|                | higher      | 0.0%  | 1.0%  | 1.0%  |

TABLE 2. Household composition according to sex (%).

| Living arrangement       | Men   | Women | Total  |
|--------------------------|-------|-------|--------|
| with spouse              | 14.0% | 13.0% | 27.0%  |
| with spouse and children | 10.0% | 11.0% | 21.0%  |
| with children            | 3.0%  | 20.0% | 23.0%  |
| alone                    | 8.0%  | 21.0% | 29.0%  |
| Total                    | 35.0% | 65.0% | 100.0% |

TABLE 3. Diseases reported by participants (%)\*.

| Disease group      | Men   | Women | Total |
|--------------------|-------|-------|-------|
| Cardiovascular     | 22.0% | 51.0% | 73.0% |
| Urinary system     | 11.0% | 33.0% | 44.0% |
| Musculoskeletal    | 15.0% | 31.0% | 46.0% |
| Nervous system     | 3.0%  | 12.0% | 15.0% |
| Respiratory system | 7.0%  | 6.0%  | 13.0% |
| Digestive system   | 12.0% | 10.0% | 22.0% |

\* More than one disease could be reported.

TABLE 4. Functional capacity according to sex, classified by the Barthel Index, n (column %).

| Functional capacity | Men (n=35) | Women (n=65) | p (exact) |
|---------------------|------------|--------------|-----------|
| High                | 30 (85.7%) | 41 (63.1%)   | 0.063     |
| Moderate            | 4 (11.4%)  | 19 (29.2%)   |           |
| Low                 | 1 (2.9%)   | 5 (7.7%)     |           |

Percentages are calculated within the sex groups. p: Fisher-Freeman-Halton exact test with Monte Carlo estimation.

TABLE 5. Functional capacity according to age, by the Barthel Index, n (column %).

| Functional capacity | 60-69 years (n=27) | 70-79 years (n=54) | ≥80 years (n=19) | p (exact) |
|---------------------|--------------------|--------------------|------------------|-----------|
| High                | 26 (96.3%)         | 36 (66.7%)         | 9 (47.4%)        | 0.001     |
| Moderate            | 0 (0.0%)           | 15 (27.8%)         | 8 (42.1%)        |           |
| Low                 | 1 (3.7%)           | 3 (5.6%)           | 2 (10.5%)        |           |

Percentages are calculated within age groups. p: Fisher-Freeman-Halton exact test with Monte Carlo estimation.

TABLE 6. Functional capacity according to marital status, measured by the Barthel Index, n (column %).

| Functional capacity | Single (n=5) | Married (n=47) | Widowed (n=48) | p (exact) |
|---------------------|--------------|----------------|----------------|-----------|
| High                | 5 (100.0%)   | 39 (83.0%)     | 27 (56.3%)     | 0.032     |
| Moderate            | 0 (0.0%)     | 6 (12.8%)      | 17 (35.4%)     |           |
| Low                 | 0 (0.0%)     | 2 (4.3%)       | 4 (8.3%)       |           |

Percentages are calculated within marital-status groups. p: Fisher-Freeman-Halton exact test with Monte Carlo estimation.

TABLE 7. Functional independence in selected activities of daily living in the total study group (N=100), n (%).

| Domain                             | Level of independence                                 | 60-69 years (n=27) | 70-79 years (n=54) | ≥80 years (n=19) | p (exact) |
|------------------------------------|-------------------------------------------------------|--------------------|--------------------|------------------|-----------|
| Personal hygiene                   | Unable                                                | 1 (3.7%)           | 3 (5.6%)           | 1 (5.3%)         | 0.006     |
|                                    | Needs assistance                                      | 0 (0.0%)           | 11 (20.4%)         | 7 (36.8%)        |           |
|                                    | Independent                                           | 26 (96.3%)         | 40 (74.1%)         | 11 (57.9%)       |           |
| Washing and bathing the whole body | Bathing in a bathtub with assistance                  | 1 (3.7%)           | 3 (5.6%)           | 1 (5.3%)         | <0.001    |
|                                    | Requires assistance                                   | 0 (0.0%)           | 18 (33.3%)         | 11 (57.9%)       |           |
|                                    | Independent                                           | 26 (96.3%)         | 33 (61.1%)         | 7 (36.8%)        |           |
| Mobility on level surfaces         | Does not move at all                                  | 1 (3.7%)           | 3 (5.6%)           | 2 (10.5%)        | 0.001     |
|                                    | Up to 50 m with equipment and assistance of ≥1 person | 0 (0.0%)           | 12 (22.2%)         | 8 (42.1%)        |           |
|                                    | Independent >50 m, including with assistive equipment | 26 (96.3%)         | 39 (72.2%)         | 9 (47.4%)        |           |
|                                    | Unable even with assistance                           | 1 (3.7%)           | 5 (9.3%)           | 2 (10.5%)        |           |
| Ascending and descending stairs    | Needs physical assistance or supervision              | 2 (7.4%)           | 27 (50.0%)         | 12 (63.2%)       | <0.001    |
|                                    | Independent                                           | 24 (88.9%)         | 22 (40.7%)         | 5 (26.3%)        |           |
|                                    | Needs complete assistance                             | 1 (3.7%)           | 3 (5.6%)           | 2 (10.5%)        |           |
| Dressing and undressing            | Needs partial assistance                              | 0 (0.0%)           | 12 (22.2%)         | 6 (31.6%)        | 0.007     |
|                                    | Independent                                           | 26 (96.3%)         | 39 (72.2%)         | 11 (57.9%)       |           |

Percentages are calculated within age groups. p: Fisher-Freeman-Halton exact test with Monte Carlo estimation.

TABLE 8. Independence in selected activities of daily living by age, n (column %).

| Domain                             | Level of independence                                 | 60-69 years (n=27) | 70-79 years (n=54) | ≥80 years (n=19) | p (exact) |
|------------------------------------|-------------------------------------------------------|--------------------|--------------------|------------------|-----------|
| Personal hygiene                   | Unable                                                | 1 (3.7%)           | 3 (5.6%)           | 1 (5.3%)         | 0.006     |
|                                    | Needs assistance                                      | 0 (0.0%)           | 11 (20.4%)         | 7 (36.8%)        |           |
|                                    | Independent                                           | 26 (96.3%)         | 40 (74.1%)         | 11 (57.9%)       |           |
| Washing and bathing the whole body | Bathing in a bathtub with assistance                  | 1 (3.7%)           | 3 (5.6%)           | 1 (5.3%)         | <0.001    |
|                                    | Requires assistance                                   | 0 (0.0%)           | 18 (33.3%)         | 11 (57.9%)       |           |
|                                    | Independent                                           | 26 (96.3%)         | 33 (61.1%)         | 7 (36.8%)        |           |
| Mobility on level surfaces         | Does not move at all                                  | 1 (3.7%)           | 3 (5.6%)           | 2 (10.5%)        | 0.001     |
|                                    | Up to 50 m with equipment and assistance of ≥1 person | 0 (0.0%)           | 12 (22.2%)         | 8 (42.1%)        |           |
|                                    | Independent >50 m, including with assistive equipment | 26 (96.3%)         | 39 (72.2%)         | 9 (47.4%)        |           |
|                                    | Unable even with assistance                           | 1 (3.7%)           | 5 (9.3%)           | 2 (10.5%)        |           |
| Ascending and descending stairs    | Needs physical assistance or supervision              | 2 (7.4%)           | 27 (50.0%)         | 12 (63.2%)       | <0.001    |
|                                    | Independent                                           | 24 (88.9%)         | 22 (40.7%)         | 5 (26.3%)        |           |
|                                    | Needs complete assistance                             | 1 (3.7%)           | 3 (5.6%)           | 2 (10.5%)        |           |
| Dressing and undressing            | Needs partial assistance                              | 0 (0.0%)           | 12 (22.2%)         | 6 (31.6%)        | 0.007     |
|                                    | Independent                                           | 26 (96.3%)         | 39 (72.2%)         | 11 (57.9%)       |           |

Percentages are calculated within age groups. p: Fisher–Freeman–Halton exact test with Monte Carlo estimation.

the most common educational level (47.0%) (Table 1). The largest group consisted of participants living alone (29.0%). A statistically significant association was found between sex and household composition ( $\chi^2=10.41$ ;  $p=0.015$ ) (Table 2).

Multimorbidity was commonly observed. The most frequently reported conditions were cardiovascular diseases (73.0%), musculoskeletal diseases (46.0%) and urinary system diseases (44.0%) (Table 3).

According to the Barthel Index, high functional capacity was found in 71.0% of participants, moderate capacity in 23.0%, and low capacity in 6.0%. Overall functional capacity did not differ significantly by sex (exact  $p=0.063$ ) (Table 4). Significant differences were observed between age groups (exact  $p=0.001$ ); the proportion of participants with high functional capacity decreased with increasing age (Table 5). Marital status also differentiated functional capacity (exact  $p=0.032$ ): widowed participants more often had moderate or low functional capacity than married participants (Table 6).

In the total study group, 77.0% of participants were independent in personal hygiene, 66.0% in washing and bathing, 74.0% in mobility on level surfaces, 51.0% in stair use, and 76.0% in dressing and undressing. The greatest limitations concerned stair use: 41.0% required physical assistance or supervision, and 8.0% were unable to use stairs even with assistance (Table 7).

Age was significantly associated with all five analysed functional domains. Differences were observed within personal hygiene (exact  $p=0.006$ ), washing and bathing ( $p<0.001$ ), mobility on level surfaces ( $p=0.001$ ), stair use ( $p<0.001$ ), and dressing and undressing ( $p=0.007$ ). The proportion of fully independent participants generally decreased with increasing age (Table 8).

DISCUSSION

The studied rural population was characterised by a predominance of women, a substantial proportion of people living alone or widowed and frequent coexistence of chronic diseases. Cardiovascular, musculoskeletal and urinary system diseases were reported most frequently. A similar health-burden profile has been described in other older populations. Wróblewska et al., in a study of 504 community-dwelling adults aged ≥65 years, reported high frequencies of hypertension, osteoarthritis and heart failure [12].

Despite their advanced age, most participants retained a high level of functional capacity. This finding is broadly consistent with findings of Błaszczyk-Bębenek et al., who reported a relatively high level of independence among 133 adults aged 70-96 years, with no significant differences between sex groups [14]. In the present study, overall functional capacity was likewise not significantly associated with sex.

Age was one of the most important factors associated with functional capacity. The proportion of participants with high capacity decreased across

successive age groups, and a similar pattern was observed in individual activities of daily living. The study of Fidecki et al. also reported better functioning in the youngest age group and among people living with a partner [8].

Marital status differentiated functional capacity: widowed participants more often had moderate or low capacity than married participants. Similar associations have been reported in geriatric populations [15–17]. Pang et al. demonstrated an increased risk of disability associated with widowhood [18], whereas Jakubowska et al. highlighted the importance of place of residence and marital status for self-efficacy in older adults [19].

Functional limitations were not evenly distributed across the assessed activities. The use of stairs was the most demanding domain, followed by washing and bathing. Similar mobility-related problems in older adults have been reported in other studies [8,20,21]. The study findings indicate that assessment of the overall functional score should be complemented by analysis of individual activities because this may help identify areas in which loss of independence emerges earliest.

The study has limitations related to its pilot nature and small sample size, which was not representative of the entire population of older rural residents. Some information was based on self-report. Women were overrepresented, limiting conclusions concerning men. In addition, small numbers in some subgroups and response categories may have reduced the power and stability of the analyses. Therefore, the observed associations should be interpreted cautiously and confirmed in larger studies.

## CONCLUSIONS

1. High functional capacity predominated among adults aged  $\geq 60$  years living in rural areas and was observed in 71.0% of participants.
2. Age was significantly associated with functional capacity, with independence in basic activities of daily living decreased with increasing age.
3. Marital status significantly differentiated functional capacity, with moderate or low capacity occurring more often among widowed than married participants.
4. Functional limitations were not evenly distributed across activities, with the greatest difficulties concerned stair use and washing and bathing.

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