

### DIFFERENCES IN CAUSES OF ACTIVITY LIMITATION BY SEX AND AGE

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#### ABSTRACT

##### Background and Objective

Activity is part of people's daily lives, and activity limitation (AL) causes could be physical and mental problems. This study analyzes the causes of AL by sex and age group in adults.

##### Material and Methods

This study analyzed records surveyed using the Korea National Health and Nutrition Survey Questionnaire during 2013–2017. The subjects were 1597 men and 2249 women aged 30–79 years. The questionnaire assessed AL causes, and a chi-squared test analyzed age- and sex-based differences.

##### Results

Among the subjects, 45.8% men and 51.2% women reported AL occurrence. AL was prevalent among 18.5% men and 20.5% women in their 30s, and these numbers were correspondingly 60.9 and 60.6% for participants in their 70s. None reported one reported among men participants in their 30s. However, 3.2 and 3.9% of women in their 70s reported  $\geq 3$  AL causes. The most cause of AL for all ages is musculoskeletal problems. The main AL cause among people in their 30s was musculoskeletal and mental problems, whereas those in their 70s reported multiple causes, such as vision, hearing, respiratory, and musculoskeletal problems. Stroke, cancer, and hearing problem occurrences were significantly different between men and women, and women reported higher AL rate than men ( $p < 0.05$ ).

##### Conclusion

AL causes varied more among older adults than younger adults. Musculoskeletal problems are a major cause of AL for all ages. In addition, the proportion of occurrence of mental problems was relatively high in young adults. Therefore, different healthcare methods should be developed to resolve AL in different populations according to their age and specific problems.

**Key Words:** *activity limitation; age; cause; sex*

## INTRODUCTION

Physical activity (PA) is the most common definition of exercise, leisure, recreation, and sporting activity. In a broader sense, every activity involves active motion of muscles and movement of the body to a desired location, as in walking.<sup>1,2</sup> Therefore, different PA types depending on survey purpose and sample. For instance, the *World Health Organization's* International Physical Activity Questionnaire, which is an activity survey, includes questions on PAs, such as sports, daily walks, and cycling.<sup>3</sup> The activities of daily living (ADL) questionnaire, which is extensively used to examine older adults and patients, covers the following basic activities: bathing, restroom use, eating, and moving from one place to another.<sup>4</sup> The limitation of these activities is called activity limitation (AL), which can be caused by both physical and psychological problems.<sup>5</sup> To date, several researchers have examined AL; one study found that 43.2% of people with arthritis had AL,<sup>6</sup> and another revealed that AL is one of the hallmarks of chronic obstructive pulmonary disease (COPD).<sup>7</sup> In particular, older adults with visual problems or frailty may develop AL owing to their fear of falling.<sup>8,9</sup> In addition, people with these physical problems and those with mental problems, such as depression and anxiety, reported low PA.<sup>10</sup> Mental problems cause psychological contraction, which eventually leads to AL.<sup>11</sup> Severe AL can cause secondary health problems, such as obesity, and should be closely investigated and managed since it may negatively affect quality of life.<sup>12,13</sup>

However, most of the studies on AL focus on aging diseases, and only a few consider middle-aged people. In addition, only a few studies have investigated AL occurrence in the general population and its various causes. This study attempts to overcome the aforementioned research gap and investigates limitation-induced factors to promote PA and identify the need for

health management suitably customized to various ages and causes.

## METHODS

### *Subjects*

This study analyzed the results of the Korean National Health and Nutrition Survey (KNHNS) from 2013 to 2017. Among the initially selected 27,145 people, 3846 (1597 men and 2249 women), aged 30–79 years, were surveyed finally. The study included those participants who agreed to the use of the test and results for study purposes and correctly completed all the tests. The subjects who did not participate in filling the questionnaire on AL or who did not complete the survey were excluded. The subjects' survey participation was voluntary, and they agreed to the use of their data for research purposes. This study was approved by the Institutional Review Board (IRB) of the Korea Centers for Disease Control and Prevention (2015-01-02-6C) and IRB center of Gangneung-Wonju National University (GWNUIRB-R2020-16).

### ACTIVITY LIMITATION QUESTIONNAIRE

Data collection was performed using an AL questionnaire; "Are you currently restricted in your daily and social activities because of health or physical or mental problems?" Sixteen questions included subjective assessments of musculoskeletal and joint problems, the heart, hypertension (HTN), diabetes mellitus (DM), the lung, teeth, vision, hearing, dementia, emotional depression, mental problem, frailty, cancer, and stroke. The questions required binary (yes or no) responses, and the study allowed duplicate answers. For data analysis, diseases and problems were classified into 13 categories, and the groups were divided into non-AL and AL. Musculoskeletal problems included neck, back, knee, and joint problems; respiratory problems

included those affecting the lung and those causing asthma, breathing discomfort, and COPD; and mental problems included anxiety, depression, and personality-related and emotional problems. Prevalence analysis was performed based on the occurrence and causes of AL and the total number of AL causes.

### Statistical analysis

Analysis was performed using SPSS (25.0 IBM SPSS, New York). Each group's general characteristics were distinguished based on descriptive statistics. Furthermore, independent *t*-tests were performed on continuous variables such as height and weight, and the chi-squared test was used to analyze categorical variables. Finally, differences by age group were analyzed for p-trend using linear-by-linear association on the chi-squared test. The significance level was set at  $p < 0.05$ .

## RESULTS

### General characteristics

Table 1 depicts participants' characteristics. Among the participants, 45.8% of men and 51.2% of women had AL. Age was significantly higher in the AL group ( $p < 0.05$ ) than all other groups. However, body weight and body mass index (BMI) were significantly higher in the non-AL group for men and AL group for women. The BMI chi-squared result was not significantly different among men but significant among women ( $p < 0.05$ ). The non-AL women included a higher number of normal BMI participants than other groups, whereas there was a high proportion of women with overweight and obesity in the AL group ( $p < 0.05$ ).

### Activity limitation causes

Table 2 depicts the significance of the AL cause according to age and sex through the

**TABLE 1** Characteristics of Study Subjects

| Variables                   | Men<br>(n=1597) |             | Women<br>(n=2249) |              |
|-----------------------------|-----------------|-------------|-------------------|--------------|
|                             | Non-AL          | AL          | Non-AL            | AL           |
| n (%)                       | 865 (54.2%)     | 732 (45.8%) | 1098 (48.8%)      | 1151 (51.2%) |
| Age, years                  | 56.3±14.5       | 64.8±12.2*  | 58.1±15.2         | 65.4±11.9*   |
| Age groups, p-value         |                 | <0.001*     |                   | <0.001*      |
| 30s                         | 132 (81.5%)     | 30 (18.5%)  | 151 (79.5%)       | 39 (20.5%)   |
| 40s                         | 173 (75.2%)     | 57 (24.8%)  | 211 (68.1%)       | 99 (31.9%)   |
| 50s                         | 210 (59.7%)     | 142 (40.3%) | 217 (53.3%)       | 190 (46.7%)  |
| 60s                         | 153 (43.8%)     | 196 (56.2%) | 193 (37.5%)       | 322 (62.5%)  |
| 70s                         | 197 (39.1%)     | 307 (60.9%) | 326 (39.4%)       | 501 (60.6%)  |
| Height, cm                  | 168.6±7.1       | 166.0±6.9*  | 154.6±7.3         | 153.1±6.6*   |
| Weight, kg                  | 68.9±11.8       | 65.8±11.6*  | 57.1±9.7          | 57.9±9.5*    |
| BMI, kg/m <sup>2</sup>      | 24.2±3.3        | 23.8±3.5*   | 23.9±3.6          | 24.7±3.6*    |
| BMI classification, p-value |                 | 0.582       |                   | <0.001*      |
| Normal                      | 526 (53.5%)     | 460 (46.7%) | 697 (52.0%)       | 643 (48.0%)  |
| Over-weight                 | 281 (55.2%)     | 228 (44.8%) | 306 (43.0%)       | 405 (57.0%)  |
| Obesity                     | 40 (58.8%)      | 28 (41.2%)  | 66 (43.4%)        | 86 (56.6%)   |

BMI, body mass index.

\* $p < 0.05$ .

chi-squared test. Musculoskeletal problems accounted for the highest proportion for both sex and all ages. Among men, the prevalence values were 7.4% for participants in their 30s and 28.0% for those in their 70s. Among women, the figures were 10.5 and 48.2% for those in their 30s and 70s, respectively. Furthermore, in the 30s–50s group, the second most common AL cause was mental problems, whereas among those in their 70s, the proportions of AL from frailty, stroke, respiratory problems, and vision and hearing problems increased ( $p < 0.05$ ). In general, the causes of AL in young people were mostly musculoskeletal and mental problems; however, the number of causes increased with age. Furthermore, the causes of AL included HTN, DM, and dental problems.

#### **Activity limitation number**

Table 3 depicts the results of a chi-squared test that was performed on the change in AL number according to sex and age. Among both men and women, the proportion of people with AL increased with age. For instance, 81.5% men in their 30s were non-AL; however, among the men in their 70s, only 39.1% were non-AL. Similarly, 79.5% of the women in their 30s were non-AL; however, only 39.4% of the women in their 70s were non-AL. The results were statistically significant for both men and women. One AL cause was reported by 17.3% men and 18.3% women in their 30s and 46.8% of the men and women in their 70s. One woman reported  $\geq 3$  AL causes in their 30s. However, 3.2% of men and 3.9% of women in their 70s reported  $\geq 3$  AL causes.

## **DISCUSSION**

AL is a major health problem that can be caused by mental or physical problems.<sup>5</sup> Although it most commonly occurs in older adults, people of any age may be affected as a result of congenital disability, unexpected accidents, and post-sickness sequelae.<sup>14,15</sup> AL refers to the

inability to perform sports and leisure activities and can also mean the inability to perform basic activities essential to daily living, such as eating, bathing, and moving from one place to another.<sup>1</sup> AL not only involves physical discomfort but also includes disability, which makes the performance of basic activities difficult and, thereby, causes severe health loss.<sup>16</sup>

Disease and AL has a mutual relationship, since disease may cause AL and, conversely, the latter may cause the former. For example, disability may cause obesity,<sup>17</sup> and obesity has also been reported to cause disability.<sup>18</sup> Unless this endless cycle of cause and effect is addressed, inactivity with AL will eventually lead to chronic diseases, such as DM and cardiovascular disease (CVD).<sup>19</sup> Earlier studies on AL and disability predominantly focused on older adults and chronic diseases.<sup>6,7,14</sup> Therefore, this study classified causes of AL into 13 categories among men and women aged above 30 years and analyzed their differences according to sex and age group.

The study identified musculoskeletal problems as the dominant AL cause across all sex and age groups. Earlier studies have shown that arthritis is the most common cause of disability in older adults, and 23% of people with ADL problems are patients with knee arthritis.<sup>20,21</sup>

The most commonly occurring condition in patients with musculoskeletal problems is back pain, which continues to increase from their 20s to 60s. In particular, more than 30% of 40- to 59-year-olds experience back pain.<sup>22</sup> While the waist and knee are weight-bearing joints, pain in joints unaffected by weight, such as the shoulder, also causes AL, probably because pain and discomfort result in overall inactivity and reduction in the quality of life.<sup>23</sup>

Furthermore, mental problems were prevalent among 9.9% men and 8.4% women in their 30s. It is interpreted that the occurrence of mental problems was relatively low due to the predominance of various other diseases. Mental problems are

**TABLE 2** Causes of Activity Limitation by Age and Sex

| Causes                       | Sex | 30s        | 40s        | 50s         | 60s         | 70s         | p-trend | x2 p    |
|------------------------------|-----|------------|------------|-------------|-------------|-------------|---------|---------|
| Musculoskeletal <sup>a</sup> | M   | 12 (7.4%)  | 34 (14.8%) | 67 (19.0%)  | 107 (30.7%) | 141 (28.0%) | <0.001* | <0.001* |
|                              | W   | 20 (10.5%) | 46 (14.8%) | 115 (28.3%) | 229 (44.5%) | 399 (48.2%) | <0.001* |         |
| Respiratory <sup>b</sup>     | M   | 0 (0.0%)   | 5 (2.2%)   | 6 (1.7%)    | 7 (2.0%)    | 40 (7.9%)   | <0.001* | 0.020*  |
|                              | W   | 2 (1.1%)   | 4 (1.3%)   | 9 (2.2%)    | 12 (2.3%)   | 26 (3.1%)   | 0.380   |         |
| Mental <sup>c</sup>          | M   | 16 (9.9%)  | 10 (4.3%)  | 26 (7.4%)   | 12 (3.4%)   | 16 (3.2%)   | <0.001* | 0.078   |
|                              | W   | 16 (8.4%)  | 33 (10.6%) | 34 (8.4%)   | 34 (6.6%)   | 26 (3.1%)   | <0.001* |         |
| Stroke                       | M   | 0 (0.0%)   | 3 (1.3%)   | 17 (4.8%)   | 24 (6.9%)   | 31 (6.2%)   | <0.001* | <0.001* |
|                              | W   | 0 (0.0%)   | 2 (0.6%)   | 7 (1.7%)    | 12 (2.3%)   | 20 (2.4%)   | 0.040*  |         |
| Cancer                       | M   | 0 (0.0%)   | 3 (1.3%)   | 8 (2.3%)    | 19 (5.4%)   | 16 (3.2%)   | 0.005*  | <0.001* |
|                              | W   | 1 (0.5%)   | 6 (1.9%)   | 12 (2.9%)   | 7 (1.4%)    | 4 (0.5%)    | 0.006*  |         |
| Vision                       | M   | 2 (1.2%)   | 7 (3.0%)   | 12 (3.4%)   | 19 (5.4%)   | 27 (5.4%)   | 0.045*  | 0.088   |
|                              | W   | 1 (0.5%)   | 4 (1.3%)   | 6 (1.5%)    | 12 (2.3%)   | 20 (2.4%)   | 0.446   |         |
| Hearing                      | M   | 1 (0.6%)   | 2 (0.9%)   | 7 (2.0%)    | 11 (3.2%)   | 39 (7.7%)   | <0.001* | <0.001* |
|                              | W   | 1 (0.5%)   | 4 (1.3%)   | 6 (1.5%)    | 12 (2.3%)   | 20 (2.4%)   | 0.446   |         |
| Frail                        | M   | 0 (0.0%)   | 0 (0.0%)   | 0 (0.0%)    | 2 (0.6%)    | 30 (6.0%)   | <0.001* | 0.099   |
|                              | W   | 0 (0.0%)   | 0 (0.0%)   | 0 (0.0%)    | 5 (1.0%)    | 59 (7.1%)   | <0.001* |         |
| Heart                        | M   | 0 (0.0%)   | 2 (0.9%)   | 8 (2.3%)    | 16 (4.6%)   | 10 (2.0%)   | 0.007*  | 0.141   |
|                              | W   | 1 (0.5%)   | 4 (1.3%)   | 6 (1.5%)    | 8 (1.6%)    | 17 (2.1%)   | 0.480   |         |
| Diabetes                     | M   | 0 (0.0%)   | 3 (1.3%)   | 7 (2.0%)    | 9 (2.6%)    | 20 (4.0%)   | 0.015*  | 0.185   |
|                              | W   | 0 (0.0%)   | 4 (1.3%)   | 6 (1.5%)    | 14 (2.7%)   | 17 (2.1%)   | 0.193   |         |
| Hypertension                 | M   | 0 (0.0%)   | 1 (0.4%)   | 3 (0.9%)    | 4 (1.1%)    | 7 (1.4%)    | 0.444   | 0.986   |
|                              | W   | 0 (0.0%)   | 2 (0.6%)   | 2 (0.5%)    | 7 (1.4%)    | 10 (1.2%)   | 0.328   |         |
| Teeth                        | M   | 1 (0.6%)   | 2 (0.9%)   | 5 (1.4%)    | 2 (0.6%)    | 8 (1.6%)    | 0.483   | 0.102   |
|                              | W   | 2 (1.1%)   | 2 (0.6%)   | 5 (1.2%)    | 10 (1.9%)   | 21 (2.5%)   | 0.231   |         |
| Dementia                     | M   | 0 (0.0%)   | 0 (0.0%)   | 1 (0.3%)    | 2 (0.6%)    | 10 (2.0%)   | 0.010*  | 0.717   |
|                              | W   | 0 (0.0%)   | 0 (0.0%)   | 0 (0.0%)    | 3 (0.6%)    | 13 (1.6%)   | 0.005*  |         |

M, men; W, women.

\*p<0.05.

<sup>a</sup>Musculoskeletal problems include joint pain such as knee, neck and back pain.

<sup>b</sup>Respiratory problems include lung, asthma, breathing discomfort.

<sup>c</sup>Mental problems include anxiety, depression, personality and emotionally discomfort.

**TABLE 3** Numbers of Activity Limitation Causes across Ages and Sex

| AL number | Sex | 30s         | 40s         | 50s         | 60s         | 70s         | p-trend | x <sup>2</sup> p |
|-----------|-----|-------------|-------------|-------------|-------------|-------------|---------|------------------|
| 0         | M   | 132 (81.5%) | 173 (75.2%) | 210 (59.7%) | 153 (43.8%) | 197 (39.1%) | <0.001* | 0.007*           |
|           | W   | 151 (79.5%) | 211 (68.1%) | 217 (53.3%) | 193 (37.5%) | 326 (39.4%) | <0.001* |                  |
| 1         | M   | 28 (17.3%)  | 47 (20.4%)  | 123 (34.9%) | 163 (46.7%) | 236 (46.8%) | <0.001* | 0.434            |
|           | W   | 35 (18.4%)  | 91 (29.4%)  | 171 (42.0%) | 273 (53.0%) | 387 (46.8%) | <0.001* |                  |
| 2         | M   | 2 (1.2%)    | 7 (3.0%)    | 14 (4.0%)   | 28 (8.0%)   | 55 (10.9%)  | <0.001* | 0.784            |
|           | W   | 3 (1.6%)    | 5 (1.6%)    | 16 (3.9%)   | 40 (7.8%)   | 81 (9.8%)   | <0.001* |                  |
| ≥3        | M   | 0 (0.0%)    | 3 (1.4%)    | 5 (1.4%)    | 5 (1.5%)    | 16 (3.2%)   | 0.006*  | 0.455            |
|           | W   | 1 (0.5%)    | 3 (0.9%)    | 3 (0.7%)    | 9 (1.8%)    | 33 (3.9%)   | <0.001* |                  |

M, men; W, women.

\*p<0.05.

the most studied of AL causes and have a high prevalence in people with chronic diseases, such as cancer or CVD.<sup>24–26</sup> People with mental problems should be encouraged to resolve their issues by engaging more in PAs in case they do not have AL; however, earlier studies have reported that they have a passive attitude toward engagement in PA since they often suffer from weak self-confidence, motivation, and goal setting.<sup>27,28</sup>

Body balance can be maintained through visual and vestibular auditory function and somatosensory function. Older people often have a fear of falling, due to which vision and hearing problems are important AL factors in this population.<sup>29</sup> In particular, visual and vestibular organs complement each other in the cerebellum and help to maintain one's balance in various situations.<sup>30</sup> Furthermore, hearing problems cause disturbances in a person's communication with others and, thereby, a low quality of life<sup>31</sup>; in this study, 7.7% of older men in their 70s reported that their AL is due to hearing impairment. Furthermore, hearing loss is relatively common among older adults, with approximately 6.7% and 19–24% of people reporting 45 and 40 dB, respectively.<sup>32</sup> Therefore, active medical care, including the use of hearing aids and glasses, is a

reasonable solution for people with hearing and vision problems.

Furthermore, the highest rate of occurrence of AL, which is also caused by life-threatening diseases, such as cancer, stroke, and heart disease, was reported among men in their 60s. These diseases are no longer considered senile diseases. In an analysis conducted on Americans, the proportion of people with these diseases was found to increase in older adults in a comparison of 2000 and 2010 data; in addition, the proportion increased among middle-aged adults as well, and this phenomenon was replicated regardless of factors such as sex and race.<sup>33</sup> Stroke, in particular, can cause hemiplegia as an aftereffect. Stroke paralysis is highly prevalent and accounts for 33.7% of all paralysis patients.<sup>34</sup> Heart disease patients are often inactive due to their fears of recurrence and sudden death.<sup>35</sup> Therefore, it may be wise for them to start exercising after psychological and physical consultation from cardiac and cancer rehabilitation specialists.

Most of the AL causes discussed in this study revealed significant change because of age. Furthermore, only one person in their 30s had more than three causes of AL; however, 3.2% of men and 3.9% of women in their 70s had more

than three AL causes. These results reveal lower values than other studies but are similar to earlier results. A study by Caughey et al.<sup>36</sup> found that 80% of older people simultaneously suffer from three or more chronic diseases, including mental problems.<sup>36</sup>

In this study, the total AL values were 45.8% for men and 51.2% for women. Specifically, the occurrences of stroke, cancer, and hearing problems were significantly different between men and women, and women had higher AL rates than men ( $p < 0.05$ ). This result reveals the significance of combining sociological and physiological approaches to solve such sex-based differences. Several studies reveal that sex equality has not yet been realized in healthcare. Women reported lower hospital visit rates and participation rates than men. Furthermore, among the reported causes, medical access was higher for men than women due to the former's higher levels of education, economic activities, and social participation.<sup>37,38</sup>

HTN and dental problems were not significant for either sex; however, AL incidence was very low in all age groups. Significant sex-based differences were identified with respect to musculoskeletal problems, respiratory issues, stroke, cancer, and hearing. Furthermore, although a higher proportion of women than men had musculoskeletal problems, higher proportions of men than women were affected in all other diseases. The current study's results are expected to contribute to the future development of healthcare policies and directions, and AL problem-solving efforts should be implemented through services such as home visits.

Finally, this study has the following limitations. Although the survey was conducted using 13 categories, it did not include highly specific questions. For example, it did not examine aspects such as the type of cancer, site of muscle joint disease, and cause of depression. In addition, the people surveyed in this study were those who could visit the KNHNS research center, which

limited the study's sampling. Therefore, more investigations on large sample sizes are required to study health problems and joint diseases in more detail, and more studies on AL involving meta-analyses are required.

## CONCLUSION

Musculoskeletal problems are the main cause of AL among men and women and for all age groups. The occurrence rates of mental problems were relatively high in young adult participants. In older people, AL causes are diverse and include multiple simultaneous causes. Therefore, health-care authorities should implement age-appropriate AL healthcare methods to realize effective care efforts.

## CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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