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# Rural and Urban Disparities in Frailty and Aging-Related Health Conditions in Korea

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## To the Editor

Disparities in health status between urban and rural dwellers have been demonstrated in several populations.[1–4] Whether rural dwellers suffer from a greater burden of frailty and aging-related health conditions than urban dwellers is not known. Understanding such differences may help us tailor medical and public health interventions for aging population

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**Author contributions:**

IYJ designed the study, conducted the field study, collected data, performed statistical analysis, interpreted data, and revised the manuscript. HWJ designed the study, performed statistical analysis, interpreted data, and drafted the manuscript. DHK, KIK, KWK and EJL designed the study, interpreted data, and revised the manuscript. CKL, HJO, and MYJ performed the field study, collected data, and revised the manuscript. YSL provided funding, designed the study, interpreted data, and revised the manuscript. All authors read and approved the final manuscript.

in the respective regions. To this end, we determined the prevalence of frailty and aging-related conditions between the 2 population-based cohorts of rural and urban dwellers in Korea: the Aging Study of PyeongChang Rural Area (ASPRA) and the Korean Longitudinal Study on Health and Aging (KLoSHA).

The ASPRA cohort, established in 2014, is a population-based cohort study of 382 rural dwellers who are ≥65 years of age and reside in 2 towns in PyeongChang County (total population size: 43,660; ≥65 years: 22.0%), located 180 kilometers east of Seoul. This cohort includes 95% of the eligible people in the study area and its sociodemographic characteristics are similar to those of a national sample of rural population, except higher proportions of individuals who are currently working in agriculture (53.4% vs. 25.1%) and who had no formal education (44.8% vs. 22.6%). The KLoSHA enrolled 693 urban dwellers in 2005 who were ≥65 years and lived in Seongnam City, one of the largest satellite cities of Seoul (total population size: 931,019; ≥65 years: 6.6%).[5–7] We analyzed data from 484 participants who were randomly sampled from the census. In both studies, participants underwent a comprehensive evaluation by geriatricians, including the Cardiovascular Health Study (CHS) frailty,[8] multimorbidity, basic and instrumental activity-of-daily-living disability, Mini-Mental State Examination, Center for Epidemiological Studies Depression Scale, Mini-Nutritional Assessment Short-Form, and incontinence. We compared the prevalence of frailty and each condition between rural and urban dwellers after adjusting for age and sex, using linear regression for continuous variables and logistic regression for dichotomous variables. To determine a single screening test for frailty, we evaluated the discrimination ability of each frailty component in identifying frailty using C statistics.

Compared with urban dwellers from the KLoSHA cohort, rural dwellers from the ASPRA cohort had older age (74.4 years vs. 70.9 years), higher proportion of woman (56.3% vs. 52.5%), and lower education level (5.1 years vs. 7.9 years) (Table). Rural dwellers had higher prevalence of frailty than urban dwellers (17.4% vs. 10.3%), mainly due to higher prevalence of exhaustion (33.2% vs. 23.8%) and weakness (50.9% vs. 15.8%); slowness (8.4% vs. 26.9%) was less common. The frailty component with the highest discrimination ability was low activity (C statistic: 0.90) in rural dwellers and weight loss (C statistic: 0.88) in urban dwellers. Rural dwellers had higher prevalence of multimorbidity (31.9% vs. 21.3%), activity-of-daily-living disability (14.9% vs. 5.4%), and instrumental activity-of-daily-living disability (38.5% vs. 18.2%). Cognitive dysfunction, depression, malnutrition risk and incontinence did not differ between the two populations.

Older Koreans living in rural communities have a disproportionately greater burden of frailty and aging-related health conditions than those in urban communities. Better health status of urban dwellers compared with rural dwellers has been previously reported,[1–4] but health status was self-reported and did not include aging-related conditions. We assessed the frailty using the validated CHS criteria[8] and found remarkable differences in frailty components between rural and urban dwellers. Although mobility impairment is generally considered a single best marker of frailty,[9] low activity outperformed other components of frailty to identify frailty in rural dwellers and weight loss did better in urban dwellers. Our results suggest that the choice of a screening test for frailty should be dependent on the characteristics of the population. Compared with urban dwellers, only a small fraction of

rural dwellers had slowness and almost half of rural dwellers had weakness. Multimorbidity and disability were more common among rural dwellers. These findings call for medical and public health interventions targeting different components of frailty for rural dwellers. Limited access to health care and resources in rural areas are barriers to eliminate the disparities in age-related health conditions between urban and rural populations. Our study highlights that the choice of frailty screening tests and interventions need to be tailored for the characteristics of rural and urban populations.

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**Table**

Burden of Frailty and Geriatric Conditions in Older Adults Living in Rural versus Urban Communities in Korea

| | ASPRA (Rural Communities) | | | KLoSHA (Urban Communities) | | |
|---|---|---|---|---|---|---|
| **Characteristics** | **Men % or mean (± SD)** | **Women % or mean (± SD)** | **Total % or mean (± SD)** | **Men % or mean (± SD)** | **Women % or mean (± SD)** | **Total % or mean (± SD)** |
| Sample size | 167 | 215 | 382 | 230 | 254 | 484 |
| Age, years | 73.7 (± 6.3) | 74.9 (± 6.6) | 74.4 (± 6.5) | 70.4 (± 4.6) | 71.0 (± 5.3) | 70.9 (± 5.2) |
| Education level, years * | 7.8 (± 5.0) | 3.1 (± 4.7) | 5.1 (± 5.3) | 8.6 (± 5.8) | 7.4 (± 5.5) | 7.9 (± 5.6) |
| Medical aid (monthly income < USD 500) * | 5.4 | 6.0 | 5.8 | 6.1 | 7.1 | 6.6 |
| Living alone | 12.6 | 30.7 | 22.8 | 14.3 | 17.3 | 15.9 |
| Frailty status by CHS criteria | | | | | | |
| Robust | 42.2 | 20.6 | 30.0 | 43.9 | 22.4 | 32.6 |
| Prefrail | 47.0 | 57.0 | 52.6 | 52.6 | 61.0 | 57.0 |
| Frail | 10.8 | 22.4 | 17.4 | 3.5 | 16.5 | 10.3 |
| Components of frailty | | | | | | |
| Exhaustion * | 26.3 | 38.6 | 33.2 | 15.7 | 31.1 | 23.8 |
| Low activity * | 19.8 | 20.0 | 19.9 | 20.4 | 26.8 | 23.8 |
| Slowness * | 5.4 | 10.7 | 8.4 | 16.5 | 36.2 | 26.9 |
| Weakness * | 30.7 | 66.7 | 50.9 | 9.5 | 22.0 | 15.8 |
| Weight loss * | 15.0 | 21.4 | 18.6 | 21.3 | 28.7 | 25.2 |
| Multimorbidity *† | 23.4 | 38.6 | 31.9 | 23.5 | 19.3 | 21.3 |
| ADL disability * | 10.8 | 18.1 | 14.9 | 3.5 | 7.1 | 5.4 |
| IADL disability * | 22.8 | 33.0 | 38.5 | 15.7 | 20.5 | 18.2 |
| Cognitive dysfunction (MMSE <24) | 16.8 | 46.0 | 33.4 | 15.2 | 46.1 | 31.4 |
| Depression (CES-D ≥21) | 8.0 | 18.7 | 14.1 | 7.0 | 22.4 | 15.1 |
| At risk for malnutrition (MNA <12 or NSI≥3) | 30.5 | 43.7 | 37.9 | 32.3 | 46.6 | 39.7 |
| Incontinence | 5.4 | 10.7 | 8.4 | 1.5 | 6.3 | 3.9 |

Abbreviations: ADL, activity of daily living; ASPRA, Aging Study of PyeongChang Rural Area; CES-D, Center for Epidemiological Study of Depression Scale score; CHS, Cardiovascular Health Study; IADL, instrumental activity of daily living; KLoSHA, Korea Longitudinal Study on Health and Aging; MMSE, Mini-Mental Status Examination score; MNA, Mini-Nutritional Assessment short form score; NSI, the Nutrition Screening Initiative score; SD, standard deviation; USD, United States dollar.

* $P < 0.05$ comparing rural dwellers vs. urban dwellers after adjusting for age and sex

† Multimorbidity was defined as having ≥2 chronic conditions among the following: angina, arthritis, asthma, cancer excluding minor skin cancer, chronic lung disease, congestive heart failure, diabetes, heart attack, hypertension, kidney disease, and stroke.