Inequalities in Working and Health Expectancies at Older Ages in South Korea

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Background

Populations are ageing at an unprecedented rate across the Asia-Pacific region, and this can largely be attributed to declining fertility and increasing life expectancy. In 2016, 17.2% of the population in East and North-East Asia, which includes the aged societies of Japan and South Korea, was over 60 years old; this is projected to increase to 36.8% in 2050 (United Nations ESCAP, 2017). As the number of older persons surpasses the number of the working-age population, the old-age support ratio will decrease; in East and North-East Asia it is estimated to drop from 6.3% in 2016 to 2.1% in 2050 (United Nations ESCAP, 2017). This has important implications for the financial security of older persons, who traditionally relied on family for support. However, as families become smaller and have less capacity to assist, there will be a greater dependence on pension systems and social protection programmes to provide sufficient security for older adults, particularly older women. One potential response to help mitigate the substantial old-age support ratio decrease is to increase the retirement age so that individuals remain in the working-age population for longer.

It is generally recognised that working is associated with better health compared to retirement, but this seems to vary by gender, socioeconomic status, amount of work, job quality, and context (Baxter et al., 2021; Kikkawa & Gaspar, 2022). Adults with chronic diseases are less likely to work beyond retirement or even retire early compared to older adults without chronic diseases (de Wind et al., 2018; Giang & Le, 2018). However, many individuals continue working into older age due to financial need, particularly in rural areas, regardless of their health status (Di Gessa et al., 2018; Giang & Le, 2018).

We take South Korea (Korea, hereafter) as a case study to try and understand the relationship between health, socioeconomic status, and working beyond retirement age. Korea provides an interesting context because it has one of the highest life expectancies, but compared to other OECD countries it also has the highest proportion of individuals aged 70+ participating in the labour force (33.1%) and about half of older persons live in relative poverty (OECD, 2018). Korea has a comprehensive healthcare system, but they lack adequate social protection measures for older persons, and while their non-contributory Basic Pension scheme covers 70% of the older population, it is only equivalent to 5.5% of average earnings (OECD, 2018). Additionally, the retirement age is relatively low at 60 years old, but many people are forced into early retirement around age 55 and subsequently take on second careers which often tend to be poor quality in terms of status, security, and pay (OECD, 2018). Those who tend to work at older ages are more likely to be male, skilled manual workers or self-employed (Lee & Yeung, 2021). In terms of health, chronic diseases are the leading causes of death and there is a shift towards ageing-related diseases like Alzheimer's disease (Park et al., 2023). Multimorbidity incidence has also been increasing over time, with a cumulative incidence of 31.8% from 2008-2018 (T. W. Lee et al., 2022). Multimorbidity is also more prevalent in rural Korea and amongst the lower educated (Yi et al., 2019).

In this paper, we use a discrete-time multistate modelling approach to estimate how long older adults in Korea spend working beyond retirement age with 0 disease, 1 disease, and multimorbidity. We further explore how this might vary by sex, education, and urban/rural geography.

Methods

Data are from waves 1-8 of the nationally-representative Korean Longitudinal Study of Aging (KLoSA) (Korea Employment Information Service, 2023). Surveys were conducted biannually from 2006-2020 for adults ≥45 years old, and collected information on demographics, family, health, employment, and socioeconomic status. The baseline sample included 10,254 participants and a refreshment sample of 920 individuals was added in the fifth wave. Our analytical sample was limited to participants aged 60-105 years old with complete demographic, health, and employment data who were present for at least two waves, resulting in a total of 7,593 individuals.

A count of the following self-reported chronic conditions is used to define disease status: arthritis, cancer, chronic lung disease, diabetes, heart disease, hypertension, liver disease, psychiatric problems, and stroke. Multimorbidity is defined as the presence of two or more of these chronic diseases. An individual was categorised as "Working" if they reported that they were employed for income or if they were unpaid family workers working at least 18 hours a week, and "Not working" if they were unemployed but looking for a job, if they were unpaid family workers working less than 18 hours a week, or if they were retired or never had a clear job. Age was included as a continuous variable from 60-105 years. Sex was defined as male or female. Marital status was defined as married or not married, of which the latter group includes individuals who are divorced, widowed, or never married. Education was dichotomised into low (middle school or less) and high (at least secondary school). Geographic residence was defined as urban or rural.

At each wave, participants are categorised into different states of working and disease and they can either remain in that state or transition to a subsequent state. We include the following seven states in our analysis: "0 disease, Working", "0 disease, Not working", "1 disease, Working", "1 disease, Not working", "Multimorbidity, Working", "Multimorbidity, Not working", and "Death". Death is considered an absorbing state, so individuals cannot leave once they enter. We do not allow for reverse transitions between disease states because of the chronic nature of the included conditions, but individuals can begin in any state, remain in the same state, or move between states, as depicted by the direction of the arrows in Figure 1.

We use multinomial logit models to predict the probability of transitioning between different states. The models include terms for linear age, quadratic age, and marital status, stratify by sex, education, and geography, and are weighted using the longitudinal weights provided by KLoSA which correct for attrition. All covariates are interacted with the origin state to allow each transition to have its own set of coefficients. Future analysis will also examine the interaction between education and geography. The predicted transition probabilities were input into discrete-time multistate Markov models to estimate state and life expectancy from age 60, separately by sex, education, and geography using the standard approach. This involves computing expectancies conditional on an initial age of 60 and then obtaining a weighted average for each sex across these values. The weights correspond to the distribution of individuals in each state at age 60, but to account for small sample sizes, we take the average distribution for ages 60-69. Future analysis will additionally estimate expectancies that do not average over the initial distribution because it may not be representative of the typical individual experience. This is because very few individuals will begin working at or above age 60, so the initial distribution consists of a mix of individuals who have either worked for a very long time, or who never work past age 60. The 95% confidence intervals were computed based on asymptotic theory and the delta method, and the underlying variance-covariance matrix of the multinomial logit model accounts for the complex survey design of the data (Schneider, 2023).

Statistical analyses were conducted in Stata 17 (StataCorp, 2021) and figures were created in R version 4.2.1 (R Core Team, 2022). Expectancy estimates and confidence intervals were obtained in Stata based on the package *dtms* developed by Schneider (2023).

Preliminary results

Table 1 provides information on participant characteristics at baseline. Our sample includes slightly more females (56.2%) than males and the average age of participants is 67.3 years. Only 21.7% of females are working compared to 50.1% of males. Over 90% of males are married, whereas only 61.4% of females are married. Females tend to be lower educated, with 82.9% having low education compared to 54.2% of males. Most participants live in urban areas (73%). More females enter the study with 1 disease or multimorbidity than males.

Total life expectancy

We estimated life expectancy at age 60, which was 23.9 years (95% CI: 23.4-24.5) for males and 28.6 years (95% CI: 27.8-29.4) for females. These values are comparable with those provided by Statistics Korea for 2020 (Male: 23.4, Female, 28.2) (Statistics Korea, 2021). High educated individuals and those from rural areas have higher life expectancy than their low educated and urban counterparts.

Working and not working life expectancy

Figure 2 shows that males have almost double the working life expectancy (WLE) at age 60 compared to females (8.5 years vs. 4.8 years). Accordingly, females have a much greater not working life expectancy (NWLE). When we stratify by education, we observe that low educated individuals have greater WLE than their high educated counterparts and high educated individuals have greater NWLE than their low educated counterparts (Figure 3). The most striking differences are seen when comparing individuals from urban and rural areas. WLE for rural females is 6.8 years compared to 3.9 years for urban females, and WLE for rural males is 11.5 years compared to 7.3 years for urban males (Figure 4). We found that there is usually a large difference between WLE and NWLE, but for rural males this difference is substantially smaller. The difference between NWLE and WLE for rural males is only 1.6 years, whereas the difference is 8.9 years for urban males, 15.5 years for rural females, and 20.7 years for urban females.

Time spent with 0 disease, 1 disease, and multimorbidity

Individuals spend more of their WLE with 0 disease while they spend more of their NWLE with 1 disease or multimorbidity (Figure 2). Females spend a larger proportion of both their WLE and NWLE with 1 disease and multimorbidity than males, and this is also consistent across education and geography. In absolute terms, the high educated spend more of their NWLE and the low educated spend more of the WLE with 1 disease and multimorbidity than their counterparts, but proportionally there is little difference (Figure 3). Rural individuals spend more of their WLE with multimorbidity than urban individuals and urban individuals spent slightly more of their WLE with 0 disease (Figure 4). For NWLE, there are no substantial differences.

Discussion

To the best of our knowledge, this is the first paper to use a discrete-time multistate modelling approach to estimate working and health expectancies in Korea and describe inequalities by sex, education, and urban/rural geography. We find that males have higher WLE than females, regardless of education or geography, which is in line with previous studies (Dudel et al., 2023; Dudel & Myrskylä, 2017). Females spend more time with 1 disease and multimorbidity and have consistently higher NWLE and longer total life expectancy. The low educated have higher WLE than the high educated and spend more of their WLE with 1 disease and multimorbidity while the high educated spend more of their NWLE with 1 disease and multimorbidity. This is contradictory to other studies which have found that the high educated usually have longer WLE (Dudel et al., 2023; Dudel & Myrskylä, 2017). Individuals from rural areas also have higher WLE and spend more of their working years with multimorbidity compared to urban individuals.

These findings could indicate that the low educated and rural dwellers are working longer despite their poorer health while their high educated and urban counterparts stop working earlier, potentially because of their poorer health. However, these patterns may also be attributed to differences in diagnosis and resources for disease management due to the stark urban/rural inequalities in healthcare service availability and that rural dwellers in Korea tend to be older and have poorer health (Jang et al., 2016; Kim et al., 2021). The different pattern of WLE by education we find in this study compared to those conducted in the United States or Germany may be related to the fact that in Korea, many older persons tend to participate in more manual or agricultural work which do not require a high level of education (Y. Lee & Yeung, 2021).

These findings have important implications for the welfare of older adults, particularly those with low education and living in rural areas, who are working longer and in poorer health than their urban counterparts. It is important that these individuals are provided with sufficient health, social, and financial resources so that working becomes a choice rather than a necessity.

References

Baxter, S., Blank, L., Cantrell, A., & Goyder, E. (2021). Is working in later life good for your health? A systematic review of health outcomes resulting from extended working lives. *BMC Public Health*, *21*(1), 1356. https://doi.org/10.1186/s12889-021-11423-2

de Wind, A., Scharn, M., Geuskens, G. A., van der Beek, A. J., & Boot, C. R. L. (2018). Predictors of working beyond retirement in older workers with and without a chronic disease—Results from data linkage of Dutch questionnaire and registry data. *BMC Public Health*, *18*(1), 265. https://doi.org/10.1186/s12889-018-5151-0

Di Gessa, G., Corna, L., Price, D., & Glaser, K. (2018). The decision to work after state pension age and how it affects quality of life: Evidence from a 6-year English panel study. *Age and Ageing*, *47*(3), 450–457. https://doi.org/10.1093/ageing/afx181

Dudel, C., Loichinger, E., Klüsener, S., Sulak, H., & Myrskylä, M. (2023). The Extension of Late Working Life in Germany: Trends, Inequalities, and the East–West Divide. *Demography*, *60*(4), 1115–1137. https://doi.org/10.1215/00703370-10850040

Dudel, C., & Myrskylä, M. (2017). Working Life Expectancy at Age 50 in the United States and the Impact of the Great Recession. *Demography*, *54*(6), 2101–2123. https://doi.org/10.1007/s13524-017-0619-6

Giang, L. T., & Le, D. D. (2018). Working Beyond the Traditional Retirement Ages: How does Chronic Health Condition Influence Older Workers in Vietnam. *Ageing International*, *43*(2), 158–173. https://doi.org/10.1007/s12126-017-9301-y

Jang, I.-Y., Jung, H.-W., Lee, C. K., Lee, Y. S., Kim, K., Kim, K. W., Oh, H., Ji, M.-Y., Lee, E., & Kim, D. H. (2016). Rural and Urban Disparities in Frailty and Aging-Related Health Conditions in Korea. *Journal of the American Geriatrics Society*, *64*(4), 908–911. https://doi.org/10.1111/jgs.14074

Kikkawa, A., & Gaspar, R. (2022). Trends and Characteristics of Labor Force Participation Among Older Persons in Developing Asia: Literature Review and Cross-Country Assessment. *Journal of Population Ageing*. https://doi.org/10.1007/s12062-022-09377-3

Kim, M., An, D., & Lim, J. (2021). Urban-Rural Gap of Healthcare and Cultural Service Accessibility in South Korea. In A. A. Batabyal, Y. Higano, & P. Nijkamp (Eds.), *Rural–Urban Dichotomies and Spatial Development in Asia* (pp. 91–126). Springer. https://doi.org/10.1007/978-981-16-1232-9_5

Korea Employment Information Service. (2023). *User's Guide for the 2020 Korean Longitudinal Study of Ageing (KLoSA)*. https://survey.keis.or.kr/eng/klosa/userguide/List.jsp

Lee, T. W., Chung, J., Song, K., & Kim, E. (2022). Incidence and predictors of multimorbidity among older adults in Korea: A 10-year cohort study. *BMC Geriatrics*, *22*(1), 565. https://doi.org/10.1186/s12877-022-03250-w

Lee, Y., & Yeung, W.-J. J. (2021). The Country That Never Retires: The Gendered Pathways to Retirement in South Korea. *The Journals of Gerontology: Series B*, *76*(3), 642–655. https://doi.org/10.1093/geronb/gbaa016

OECD. (2018). *Working Better with Age: Korea*. https://www.oecd-ilibrary.org/content/publication/9789264208261-en

Park, S., Kim, M. S., Yon, D. K., Lee, S. W., Ward, J. L., McLaughlin, S. A., Mehlman, M. L., Koyanagi, A., Smith, L., Jacob, L., Agampodi, S. B., Beiranvand, M., Choi, D.-W., Hong, S. H., Hosseinzadeh, M., Kim, C., Kim, G. R., Kim, J., Kim, K., … Shin, J. I. (2023). Population health outcomes in South Korea 1990–2019, and projections up to 2040: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Public Health*, *8*(8), e639–e650. https://doi.org/10.1016/S2468-2667(23)00122-6

R Core Team. (2022). *R: A language and environment for statistical computing* [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Schneider, D. C. (2023). *dtms. A Stata package to estimate discrete-time multistate models.* [Computer software]. https://user.demogr.mpg.de/schneider/

StataCorp. (2021). *Stata Statistical Software: Release 17* [Computer software]. StataCorp LLC.

Statistics Korea. (2021). *Life Tables for Korea, 2020*. https://kostat.go.kr/board.es?mid=a20108060000&bid=11746&act=view&list_no=415656&tag=&nPage=1&ref_bid=

United Nations ESCAP. (2017). *Ageing in Asia and the Pacific: Overview* (Ageing in Asia and the Pacific, p. 21). United Nations. https://hdl.handle.net/20.500.12870/841

Yi, J. Y., Kim, H., & Chi, I. (2019). Urban–rural differences in multimorbidity and associated factors in China and Korea: A population-based survey study. *Geriatrics & Gerontology International*, *19*(11), 1157–1164. https://doi.org/10.1111/ggi.13771

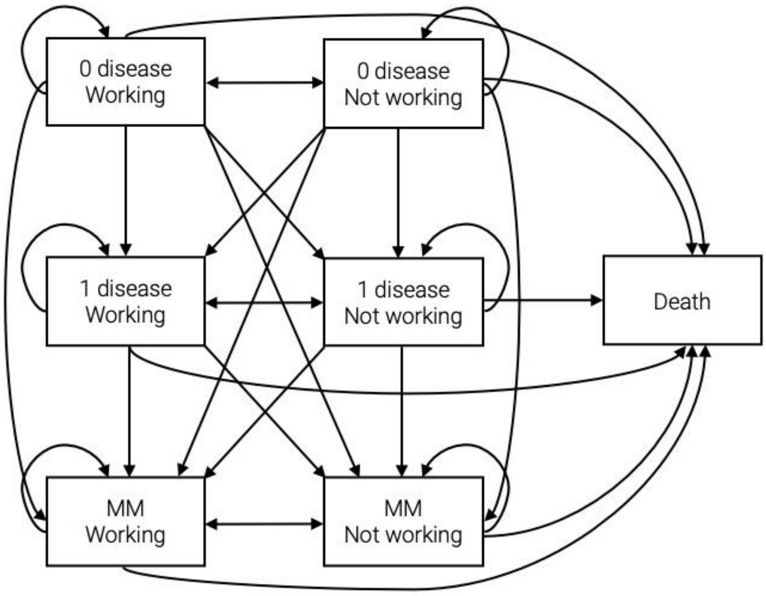

Figure 1. State space depicting transitions between states of disease, working status and death

Table 1. Characteristics of study sample. Data are from 8 waves of the Korean Longitudinal Study of Aging (KLoSA)

	Male (N=3327)	Female (N=4266)	Overall (N=7593)
Age (years)			
Mean (SD)	66.5 (6.70)	67.9 (7.79)	67.3 (7.36)
Median [Min, Max]	64.0 [60.0, 93.0]	65.2 [60.0, 97.6]	64.7 [60.0, 97.6]
Employment status			
Not working	1659 (49.9%)	3340 (78.3%)	4999 (65.8%)
Working	1668 (50.1%)	926 (21.7%)	2594 (34.2%)
Marital status			
Not married	254 (7.6%)	1645 (38.6%)	1899 (25.0%)
Married	3073 (92.4%)	2621 (61.4%)	5694 (75.0%)
Education			
Low	1803 (54.2%)	3537 (82.9%)	5340 (70.3%)
High	1524 (45.8%)	729 (17.1%)	2253 (29.7%)
Urban/rural			
Urban	2452 (73.7%)	3123 (73.2%)	5575 (73.4%)
Rural	875 (26.3%)	1143 (26.8%)	2018 (26.6%)
Initial state			
0 disease, Working	925 (27.8%)	396 (9.3%)	1321 (17.4%)
0 disease, Not working	668 (20.1%)	1099 (25.8%)	1767 (23.3%)
1 disease, Working	497 (14.9%)	347 (8.1%)	844 (11.1%)
1 disease, Not working	570 (17.1%)	1216 (28.5%)	1786 (23.5%)
Multimorbidity, Working	246 (7.4%)	183 (4.3%)	429 (5.7%)
Multimorbidity, Not working	421 (12.7%)	1025 (24.0%)	1446 (19.0%)

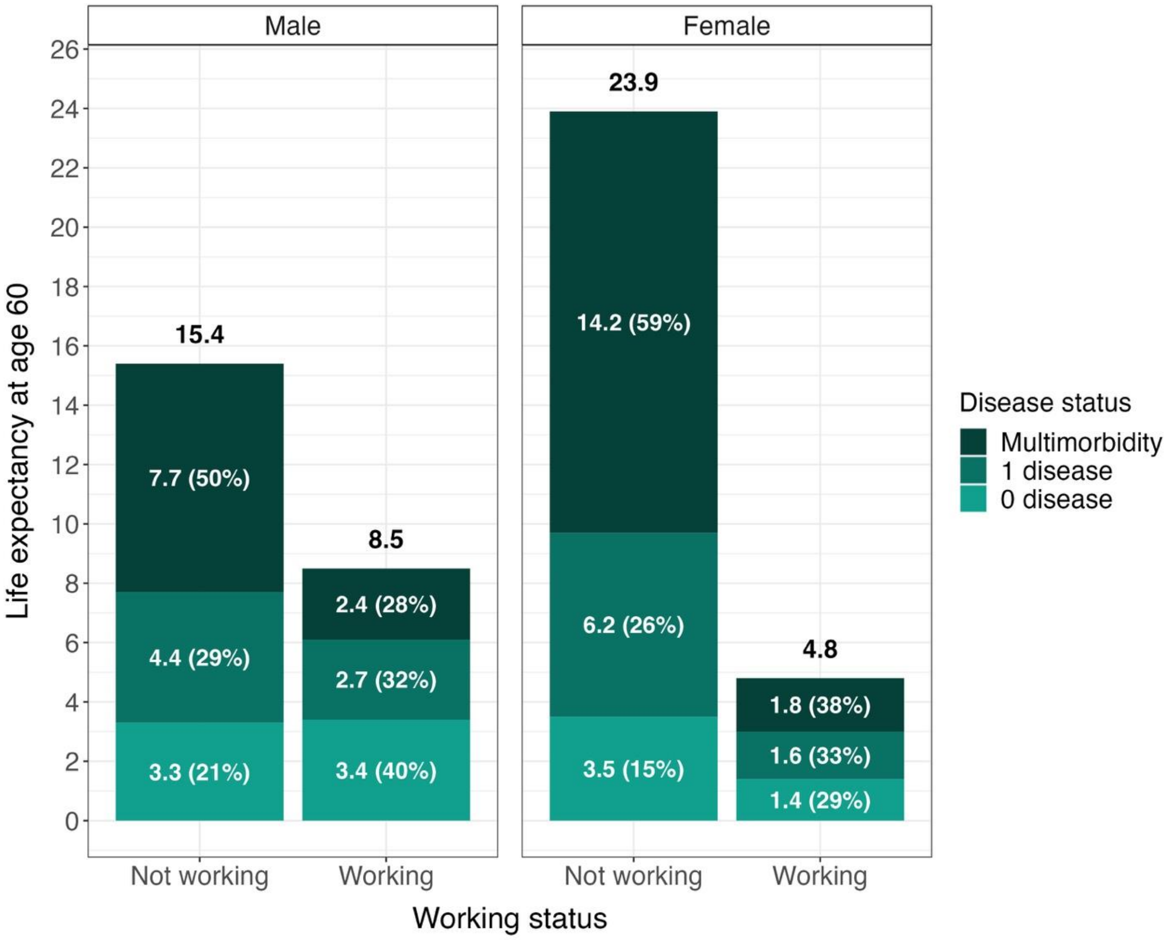

Figure 2. Working and not working life expectancy at age 60, by sex and disease status using data from 8 waves of the Korean Longitudinal Study on Aging (KLoSA). The values atop each “Not working” and “Working” bar represent the not working life expectancy (NWLE) and working life expectancy (WLE). The sum of NWLE and WLE equals the total life expectancy at age 60.

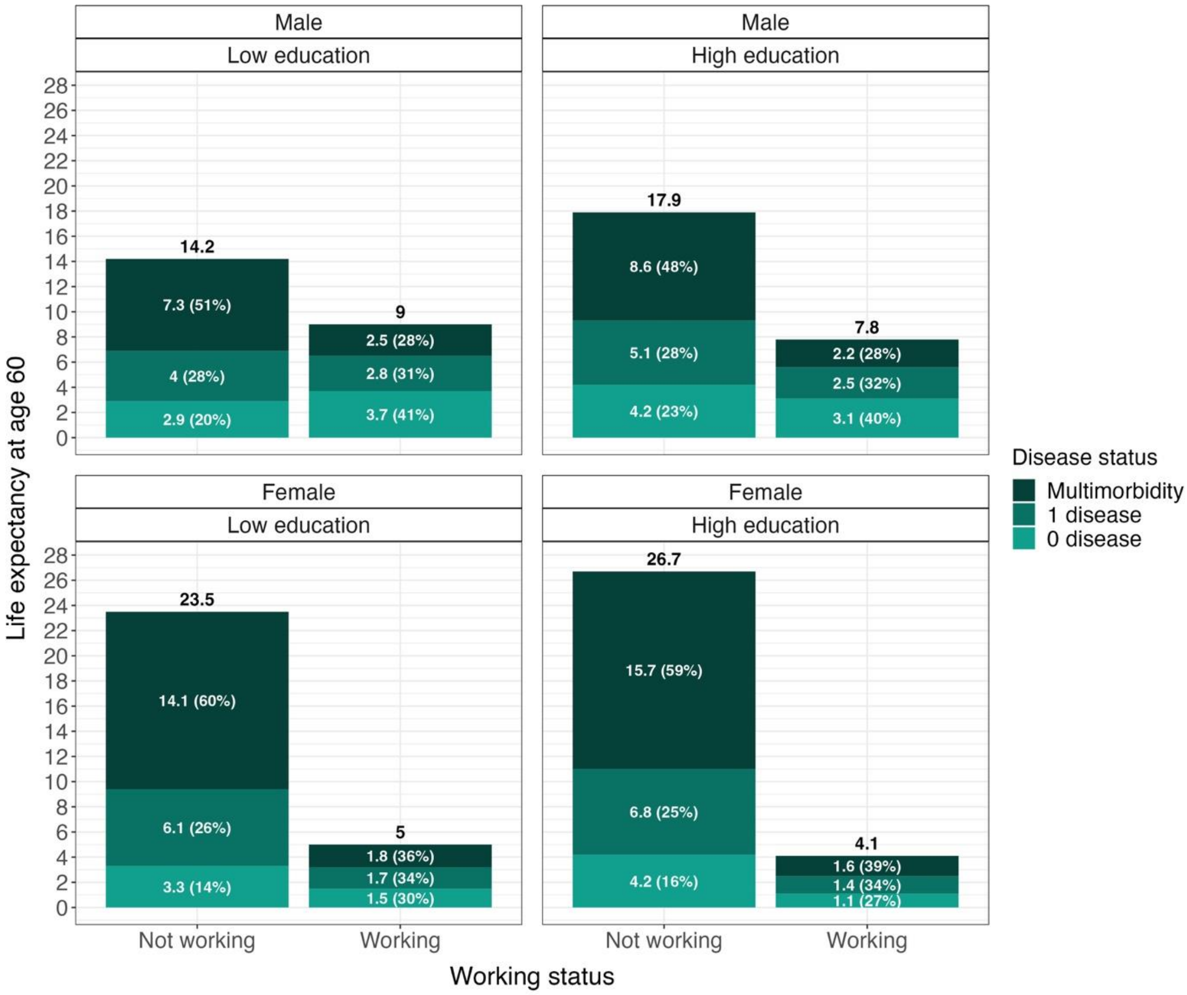

Figure 3. Working and not working life expectancy at age 60, by sex, disease status, and education using data from 8 waves of the Korean Longitudinal Study on Aging (KLoSA). The values atop each "Not working" and "Working" bar represent the not working life expectancy (NWLE) and working life expectancy (WLE). The sum of NWLE and WLE equals the total life expectancy at age 60.

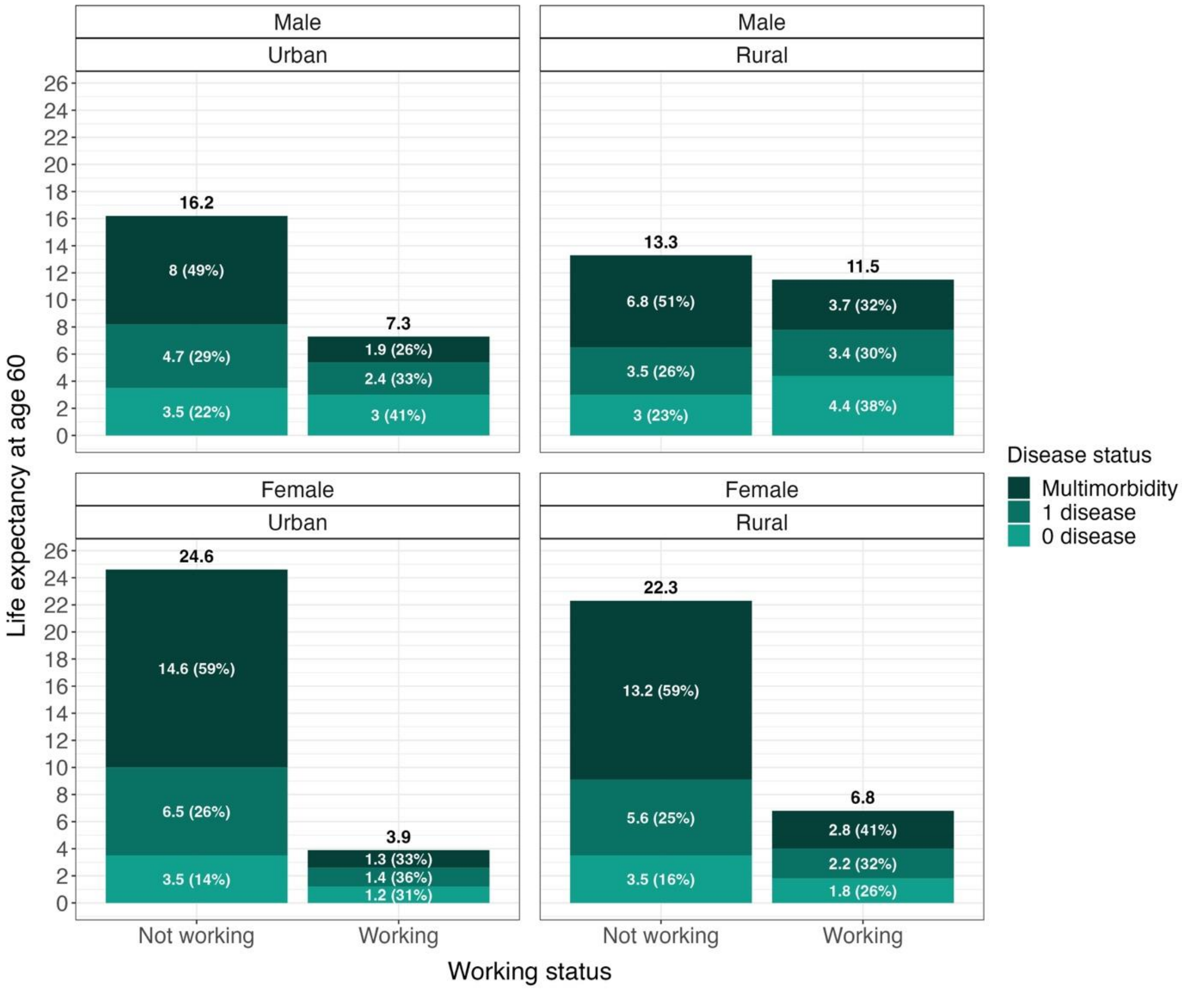

Figure 4. Working and not working life expectancy at age 60, by sex, disease status, and urban/rural geography using data from 8 waves of the Korean Longitudinal Study on Aging (KLoSA). The values atop each "Not working" and "Working" bar represent the not working life expectancy (NWLE) and working life expectancy (WLE). The sum of NWLE and WLE equals the total life expectancy at age 60.