



# Rural-urban health disparities among older adults in South Africa

Karl Peltzer <sup>1,2</sup>, Nancy Phaswana-Mafuya<sup>1</sup>, Supa Pengpid<sup>1,3</sup>

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# Background

- Non-communicable diseases (NCDs) have become one of the world's biggest public health problems.<sup>1</sup>
- **Aging** is often associated with **decline in health status** characterized by limited physical functioning, increase in chronic diseases as well as decrease in cognitive functioning.<sup>2,3</sup>
- **Social determinants** of non-communicable diseases include socioeconomic factors (e.g., poverty, inequality, **rural-urban differences**)<sup>4</sup> and risky health behavioural repertoire.<sup>2-4</sup>

# Background

**Rural-urban health disparities** persist in terms of sociodemographics, health care access, health status, and prevalence of chronic conditions.

## **Sociodemographics.**

Rural older adults:

- younger, more likely to be women, widowed
- lower education and income (China)<sup>5</sup>
- <hypertension, <diabetes (South Africa)<sup>7</sup>

## **Health care access.**

Urban residence:

→ better access to health care (hospital admission, private transport to health facility, shorter travel distance to health facility, private out-patient care, less often experienced catastrophic health care costs and utilization of higher-level public facilities)(South Africa).<sup>8</sup>

# Background

## Health status

rural older dwellers:

<overall health status

<quality of life than urban ones<sup>5,6,9</sup>

<level of cognitive function<sup>10</sup>

>cognitive impairment<sup>11</sup>

>functional limitation (China)<sup>12</sup>

<functional disability (Bangladesh)<sup>13</sup>

>sarcopenia<sup>12</sup>

# Background

## Urban residence:

- >prevalence of asthma morbidity,<sup>15</sup>
- >chronic lung disease,<sup>16</sup>
- >stroke,<sup>17</sup> angina,<sup>16</sup> hypertension,<sup>16,17</sup> and diabetes.<sup>7,15,16,18</sup>
- <underweight or malnutrition.<sup>6,19</sup>
- >Overweight or obesity (Iran)<sup>19</sup> (South Africa)<sup>7</sup> <USA<sup>20</sup>
- >Poor oral health, edentulism (Ghana).<sup>21</sup>



# Background

## **Mental health**

Urban residence:

> & <depression (China)<sup>16,5,22</sup>

## **Health risk behaviours**

Urban residence:

>alcohol use<sup>7,18</sup>

<vigorous physical activity (South Africa)<sup>23</sup>

<tobacco use (India)<sup>24</sup>

# Background

There is a dearth of studies examining rural-urban differences in health at older ages in the African continent, including South Africa.<sup>18</sup>

This study examines rural-urban differences among older South Africans who participated in the Study of Global Ageing and Adults Health (SAGE).

The study provides critical evidence in terms of rural-urban health disparities in relation to health status and chronic conditions among older adults for health policy planning for South Africa, the fastest aging country in the African continent.

# Methods-Design

- Cross-sectional data from SAGE,
- a population-based study
- sample of 3840 older South Africans aged 50+ years.
- A two-stage probability sample was used and it that produced representative estimates nationally and provincially by geographic type (urban and rural) and population group (Black, Coloured, Indian or Asian and White);



# Methods-Measures

***Health risk behaviours*** (daily tobacco use, problem drinking ( $\geq 10$  drinks/week), physical inactivity ( $< 600$  metabolic equivalent-minutes per week), and inadequate fruit and vegetable consumption ( $< 5$  servings a day).

***Health status variables:*** poor self-reported health status (bad or very bad general health), weak grip strength ( $< 30$  kg for men and  $< 20$  kg for women), functional disability (according to the International Classification of Functioning, Disability and Health, 50-100% were defined as severe or extreme functional disability, using the 12-item WHO Disability Assessment Schedule, version 2 (WHODAS-II), high cognitive functioning (a median score of 48 or more) and low quality of life (lowest tertile score) (assessed with the eight-item “World Health Organization Quality of Life” scale).

# Measures

*Chronic conditions:* arthritis (symptoms algorithm based), asthma (self-reported diagnosed and/or symptoms algorithm based), lung disease and depression (symptoms algorithm based, according to the International Classification of Diseases tenth revision diagnostic criteria for research for depressive episodes), obesity (standard height and weight measures,  $\geq 30$  kg/m<sup>2</sup>), and diabetes, stroke, angina and edentulism (self-reported diagnoses), anxiety (severe or extreme), sleeping problems (severe or extreme) (self-reported), measured hypertension (based on three averaged blood pressure measurements and/or taking antihypertensive medication) and measured low vision using a tumbling “E” log MAR chart.<sup>27</sup>

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# Data analysis

Odds Ratios (OR) were used to determine associations between exposure (socio-demographics and health risk behaviours) and outcome (health status and chronic conditions) variables using multivariable logistic regression;

Adjusted for age, sex, population group, education, wealth, tobacco use, alcohol use, physical inactivity and fruit and vegetable consumption

# Results

## Exposure variables by rural-urban residence (N=3840)

| Variable                                   | Rural       | Urban       | p-Value |
|--|-------------|-------------|---------|
|  | n=1276      | n=2561      |         |
|  | M (SD)      | M (SD)      |         |
| Age  | 63.6 (10.2) | 62.3 (9.4)  | <0.001  |
|  | n (%)       | n (%)       |         |
| Sex  |             |             |         |
| Female                                     | 715 (57.1)  | 1485 (55.2) | 0.404   |
| Male                                       | 561 (42.9)  | 1076 (44.8) |         |
| Population group                           |             |             |         |
| Black African                              | 920 (90.8)  | 1131 (64.8) | 0.003   |
| White African                              | 51 (4.0)    | 218 (12.2)  |         |
| Coloured                                   | 110 (3.8)   | 545 (17.8)  |         |
| Indian/Asian African                       | 22 (1.5)    | 285 (5.1)   |         |
| Education                                  |             |             |         |
| <7 years                                   | 785 (70.7)  | 901 (41.3)  | <0.001  |
| 8-11                                       | 205 (21.5)  | 846 (38.2)  |         |
| 12 or more                                 | 76 (7.7)    | 339 (20.5)  |         |
| Wealth                                     |             |             |         |
| Low  | 722 (58.8)  | (30.7)      | <0.001  |
| Medium                                     | 250 (19.7)  | (17.4)      |         |
| High                                       | 299 (21.5)  | (51.8)      |         |
| Marital status                             |             |             |         |
| Not married, single, widowed               | 129 (13.0)  | 383 (15.0)  | 0.666   |
| Married, cohabiting                        | 1115 (87.0) | 2139 (85.0) |         |
| Daily tobacco use                          | 285 (21.7)  | 523 (19.7)  | 0.602   |
| Problem drinking                           | 47 (3.1)    | 111 (4.1)   | 0.414   |
| Physical inactivity                        | 780 (58.1)  | 1673 (61.8) | 0.674   |
| Inadequate fruit and vegetable consumption | 1048 (75.1) | 1782 (64.9) | 0.268   |

## Prevalence of health status and chronic conditions by rural-urban residence

| Variable                           | Rural      | Urban       |
|------------------------------------|------------|-------------|
|                                    | n (%)      | n (%)       |
| <b>Health status</b>               |            |             |
| Poor self-rated health             | 230 (22.3) | 386 (14.9)  |
| Quality of life (low)              | 385 (36.2) | 571 (24.3)  |
| Grip strength (weak)               | 242 (28.0) | 537 (28.4)  |
| Functional disability (severe)     | 142 (14.6) | 223 (9.2)   |
| Cognitive functioning (high)       | 471 (38.9) | 1322 (58.9) |
| <b>Physical chronic conditions</b> |            |             |
| Arthritis                          | 294 (25.9) | 757 (29.8)  |
| Asthma                             | 115 (12.1) | 254 (11.7)  |
| Lung disease                       | 86 (6.4)   | 153 (6.4)   |
| Hypertension                       | 916 (77.5) | 1923 (77.2) |
| Underweight                        | 65 (5.8)   | 120 (4.1)   |
| Obesity                            | 445 (42.5) | 1118 (49.3) |
| Diabetes                           | 62 (5.6)   | 297 (11.1)  |
| Stroke and/or angina               | 93 (7.6)   | 245 (9.1)   |
| Edentulism                         | 44 (3.5)   | 324 (11.1)  |
| Low vision                         | 502 (43.4) | 1060 (43.1) |
| <b>Mental health</b>               |            |             |
| Depression                         | 38 (3.7)   | 80 (2.5)    |
| Anxiety                            | 119 (11.5) | 171 (8.5)   |
| Nocturnal sleep problem            | 123 (10.8) | 205 (8.5)   |



## Odds ratios for health status by rural-urban residence

|                                       | Rural<br>(n=2202) | Urban<br>(n=1638) |         |
|---------------------------------------|-------------------|-------------------|---------|
|                                       |                   | OR (95% CI)       | P value |
| <b>Health status</b>                  |                   |                   |         |
| <b>Poor self-rated health</b>         |                   |                   |         |
| Unadjusted                            | 1 (Reference)     | 0.61 (0.26, 1.46) | 0.260   |
| Adjusted <sup>1</sup>                 | 1 (Reference)     | 0.77 (0.38, 1.55) | 0.453   |
| <b>Quality of life (low)</b>          |                   |                   |         |
| Unadjusted                            | 1 (Reference)     | 0.57 (0.31, 1.05) | 0.068   |
| Adjusted <sup>1</sup>                 | 1 (Reference)     | 0.78 (0.44, 1.39) | 0.389   |
| <b>Grip strength (weak)</b>           |                   |                   |         |
| Unadjusted                            | 1 (Reference)     | 1.02 (0.62, 1.69) | 0.939   |
| Adjusted <sup>1</sup>                 | 1 (Reference)     | 1.05 (0.65, 1.71) | 0.831   |
| <b>Functional disability (severe)</b> |                   |                   |         |
| Unadjusted                            | 1 (Reference)     | 0.60 (0.21, 1.69) | 0.322   |
| Adjusted <sup>1</sup>                 | 1 (Reference)     | 0.65 (0.23, 1.89) | 0.423   |
| <b>Cognitive functioning (high)</b>   |                   |                   |         |
| Unadjusted                            | 1 (Reference)     | 2.25 (1.40, 3.63) | <0.001  |
| Adjusted <sup>1</sup>                 | 1 (Reference)     | 1.91 (1.27, 2.85) | 0.002   |

## Odds ratios for chronic conditions by rural-urban residence

| Chronic conditions    |               |                   |       |
|-----------------------|---------------|-------------------|-------|
| <b>Arthritis</b>      |               |                   |       |
| Unadjusted            | 1 (Reference) | 1.22 (0.78, 1.90) | 0.381 |
| Adjusted <sup>1</sup> | 1 (Reference) | 1.22 (0.83, 1.80) | 0.302 |
| <b>Asthma</b>         |               |                   |       |
| Unadjusted            | 1 (Reference) | 0.96 (0.62, 1.49) | 0.865 |
| Adjusted <sup>1</sup> | 1 (Reference) | 0.97 (0.70, 1.44) | 0.838 |
| <b>Lung disease</b>   |               |                   |       |
| Unadjusted            | 1 (Reference) | 1.00 (0.51, 1.95) | 0.998 |
| Adjusted <sup>1</sup> | 1 (Reference) | 1.01 (0.56, 1.82) | 0.962 |
| <b>Hypertension</b>   |               |                   |       |
| Unadjusted            | 1 (Reference) | 0.98 (0.59, 1.64) | 0.952 |
| Adjusted <sup>1</sup> | 1 (Reference) | 1.00 (0.67, 1.49) | 0.995 |
| <b>Obesity</b>        |               |                   |       |
| Unadjusted            | 1 (Reference) | 1.31 (0.83, 2.09) | 0.240 |
| Adjusted <sup>1</sup> | 1 (Reference) | 1.25 (0.77, 2.01) | 0.353 |
| <b>Underweight</b>    |               |                   |       |
| Unadjusted            | 1 (Reference) | 0.82 (0.49, 1.37) | 0.437 |
| Adjusted <sup>1</sup> | 1 (Reference) | 0.79 (0.37, 1.69) | 0.537 |

## Odds ratios for chronic conditions by rural-urban residence

|                                 |               |                   |        |
|---------------------------------|---------------|-------------------|--------|
| <b>Diabetes</b>                 |               |                   |        |
| Unadjusted                      | 1 (Reference) | 2.11 (1.48, 3.01) | <0.001 |
| Adjusted <sup>1</sup>           | 1 (Reference) | 2.36 (1.37, 4.04) | 0.003  |
| <b>Stroke and/or angina</b>     |               |                   |        |
| Unadjusted                      | 1 (Reference) | 1.21 (0.82, 1.77) | 0.324  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 0.94 (0.63, 1.40) | 0.743  |
| <b>Edentulism</b>               |               |                   |        |
| Unadjusted                      | 1 (Reference) | 3.43 (1.50, 7.87) | 0.004  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 2.79 (1.27, 6.09) | 0.012  |
| <b>Low vision</b>               |               |                   |        |
| Unadjusted                      | 1 (Reference) | 0.99 (0.61, 1.61) | 0.964  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 0.86 (0.55, 1.35) | 0.508  |
| <b>Depression</b>               |               |                   |        |
| Unadjusted                      | 1 (Reference) | 0.66 (0.33, 1.32) | 0.233  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 0.73 (0.33, 1.64) | 0.436  |
| <b>Anxiety</b>                  |               |                   |        |
| Unadjusted                      | 1 (Reference) | 0.73 (0.35, 1.55) | 0.406  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 0.82 (0.45, 1.50) | 0.516  |
| <b>Nocturnal sleep problems</b> |               |                   |        |
| Unadjusted                      | 1 (Reference) | 0.68 (0.32, 1.47) | 0.317  |
| Adjusted <sup>1</sup>           | 1 (Reference) | 0.82 (0.44, 1.55) | 0.539  |

# Discussion

Rural older adults in this study were predominantly Black African (90.8%), while urban ones were proportionally more white and Coloured (30%). As found in previous studies in developing countries, such as China,<sup>5,6</sup> rural older adults in this study had less education and were less wealthy than urban older adults were.

This could mean that rural older adults have less access to health care services than urban dwellers, and health care access should be improved for rural older adults in South Africa.<sup>8</sup>

# Discussion

Consistent with previous studies,<sup>10,11</sup> this study found higher cognitive functioning in urban compared to rural older adults. Better cognition in later life has been associated with higher levels of education.<sup>29,30</sup> Our urban sample had much more formal education than the rural sample, which may explain the higher levels of cognitive functioning among the urban older adults. It is possible that early and later life transitions of migration to urban areas, seeking and receiving higher levels of education impacted on the levels of cognitive functioning in South Africa.<sup>10</sup> Further studies should validate these findings and develop explanatory models that could help in describing the mechanisms responsible for the found associations



# Discussion

Health status, this study found that poor self-rated health and low quality of life was higher among rural than urban older adults, but this was not significantly higher.

Previous studies found that rural subjects reported significant lower overall health status and lower quality of life than urban dwellers.<sup>5,6,28</sup>

Poorer perceived health status and lower quality of life in rural dwellers may be related to lower socioeconomic status and higher unemployment, which in turn reduce affordability of good nutrition and access to health care .<sup>9</sup>

This highlights the importance of an integrated national development plan in which the provision of health is not in isolation but situated within a larger developmental context

# Discussion

Chronic conditions, urban residence was significantly associated with diabetes and edentulism in this study, as found in previous studies.<sup>15,16,21</sup>

The higher self-reported prevalence of diabetes in urban than rural areas may be related to a higher prevalence of combined risk factors, such as dietary changes, physical inactivity and obesity<sup>16</sup> and older adults in rural areas may have less access to being diagnosed with diabetes than in urban areas.<sup>16</sup>

Possible reasons for the higher prevalence of edentulism in urban areas may be related to dietary changes such as increased consumption of refined sugars, which may lead to caries and tooth loss,<sup>21</sup> and dental care services and tooth extractions are more likely to be available in urban than rural areas.

# Discussion

The study found that the prevalence of underweight was higher in rural than urban older adults, while the prevalence of obesity was higher among urban than rural older adults, but the differences did not reach significant levels. Previous studies<sup>6,19</sup> confirm the relationship between rural residence and underweight or malnutrition among older adults, while mixed results were found on urban-rural differences in relation to obesity.<sup>7,1</sup>

# Discussion

Previous studies<sup>5,16,22</sup> found mixed results regarding rural-urban differences and mental health indicators such as depression, while this study did not find significant differences for depression, anxiety and nocturnal sleep problems.

Surprisingly, contrary to some previous studies,<sup>7,23-25</sup> no rural-urban differences were found for behavioural risk factors of NCDs (tobacco use, problem drinking, physical inactivity and insufficient fruit and vegetable consumption).

This could mean that health risk behaviours, such as tobacco use, problem drinking, physical inactivity and inadequate fruit and vegetable consumption, have penetrated into both urban and rural areas in South Africa. Therefore, health behaviour interventions should target rural and urban dwellers equally.

# Gender differences

|                                     | Women<br>(n=2202) | Men<br>(n=1638)   |                     |
|-------------------------------------|-------------------|-------------------|---------------------|
|                                     |                   |                   | OR (95% CI) P value |
| <b>Health status</b>                |                   |                   |                     |
| <b>Poor self-rated health</b>       |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 0.97 (0.76, 1.23) | 0.800               |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 1.16 (0.78, 1.73) | 0.450               |
| <b>Quality of life (high)</b>       |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 1.31 (1.03, 1.66) | 0.411               |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 1.05 (0.76, 1.44) | 0.773               |
| <b>Grip strength (weak)</b>         |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 2.10 (1.40, 3.15) | <0.001              |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 1.99 (1.30, 3.05) | 0.002               |
| <b>ADL-severe</b>                   |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 0.96 (0.62, 1.48) | 0.852               |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 1.07 (0.66, 1.74) | 0.779               |
| <b>IADL-severe</b>                  |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 0.72 (0.57, 0.91) | 0.007               |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 0.84 (0.58, 1.23) | 0.365               |
| <b>Cognitive functioning (high)</b> |                   |                   |                     |
| Unadjusted                          | 1 (Reference)     | 1.50 (1.00, 2.23) | 0.001               |
| Adjusted <sup>1</sup>               | 1 (Reference)     | 1.50 (1.00, 2.23) | 0.001               |



# Gender differences

|                           | Women<br>(n=2202) | Men<br>(n=1638)   |         |
|---------------------------|-------------------|-------------------|---------|
|                           |                   | OR (95% CI)       | P value |
| <b>Chronic conditions</b> |                   |                   |         |
| <b>Arthritis</b>          |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 0.60 (0.47, 0.75) | <0.001  |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 0.52 (0.41, 0.67) | <0.001  |
| <b>Lung disease</b>       |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 0.68 (0.45, 1.04) | 0.074   |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 0.67 (0.49, 0.91) | 0.012   |
| <b>Obesity</b>            |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 0.59 (0.48, 0.72) | <0.001  |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 0.57 (0.43, 0.75) | <0.001  |
| <b>Underweight</b>        |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 1.56 (0.87, 2.82) | 0.111   |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 2.17 (1.31, 3.60) | 0.004   |
| <b>Diabetes</b>           |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 0.60 (0.44, 0.83) | 0.002   |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 0.48 (0.31, 0.77) | 0.003   |
| <b>Anxiety</b>            |                   |                   |         |
| Unadjusted                | 1 (Reference)     | 0.68 (0.47, 0.99) | 0.045   |
| Adjusted <sup>1</sup>     | 1 (Reference)     | 0.51 (0.28, 0.92) | 0.026   |

# Conclusions

- There are some rural-urban health disparities in South Africa, i.e. urban dwellers had a higher prevalence of diabetes, edentulism and cognitive functioning than rural ones.
- Understanding these rural-urban health variations may help in developing better strategies to improve health across geolocality in South Africa.

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Care and Family Medicine.*

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# Acknowledgement: References

1. World Health Organization (WHO). Non-communicable diseases. Available at <http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases> (accessed 17 July 2018)
2. World Health Organization (WHO). Global status report on noncommunicable diseases 2010. Geneva: World Health Organization, 2011.
3. Wu F, Guo Y, Chatterji S, et al. Common risk factors for chronic non-communicable diseases among older adults in China, Ghana, Mexico, India, Russia and South Africa: the study on global AGEing and adult health (SAGE) wave 1. *BMC Public Health*. 2015;15(1): 88. doi: 10.1186/s12889-015-1407-0.
4. Niessen LW, Mohan D, Akuoku JK, et al. Tackling socioeconomic inequalities and non-communicable diseases in low-income and middle-income countries under the Sustainable Development agenda. *The Lancet*. 2018;391(10134):2036-2046. doi: 10.1016/S0140-6736(18)30482-3.
5. Dong X, Simon MA. Health and aging in a Chinese population: urban and rural disparities. *Geriatr Gerontol Int*. 2010;10(1):85-93. doi: 10.1111/j.1447-0594.2009.00563.x.
6. Chen SH, Cheng HY, Chuang YH, Shao JH. Nutritional status and its health-related factors among older adults in rural and urban areas. *J Adv Nurs*. 2015;71(1):42-53. doi: 10.1111/jan.12462.
7. Egbujie BA, Igumbor EU, Puoane T. A cross-sectional study of socioeconomic status and cardiovascular disease risk among participants in the Prospective Urban Rural Epidemiological (PURE) Study. *S Afr Med J*. 2016;106(9):900-6. doi: 10.7196/SAMJ.2016.v106i9.10456.
8. Harris B, Goudge J, Ataguba JE, et al. Inequities in access to health care in South Africa. *J Public Health Policy*. 2011;32 Suppl 1:S102-23. doi: 10.1057/jphp.2011.35.
9. Van der Hoeven M, Kruger A, Greeff M. Differences in health care seeking behaviour between rural and urban communities in South Africa. *Int J Equity Health*. 2012;11:31. doi: 10.1186/1475-9276-11-31.
10. Xu H, Dupre ME, Østbye T, Vorderstrasse AA, Wu B. Residential mobility and cognitive function among middle-aged and older adults in China. *Res Aging*. 2019; 41(1):3-30. doi: 10.1177/0164027518770780
11. Nakamura K, Kitamura K, Watanabe Y, Shinoda H, Sato H, Someya T. Rural-urban differences in the prevalence of cognitive impairment in independent community-dwelling elderly residents of Ojiya city, Niigata Prefecture, Japan. *Environ Health Prev Med*. 2016;21(6):422-429. DOI:10.1007/s12199-016-0542-2.
12. Zimmer Z, Wen M, Kaneda T. A multi-level analysis of urban/rural and socioeconomic differences in functional health status transition among older Chinese. *Soc Sci Med*. 2010;71(3):559-567. doi: 10.1016/j.socscimed.2010.03.048.
13. Kabir ZN, Tishelman C, Agüero-Torres H, Chowdhury AM, Winblad B, Höjer B. Gender and rural-urban differences in reported health status by older people in Bangladesh. *Arch Gerontol Geriatr*. 2003;37(1):77-91.
14. Gao L, Jiang J, Yang M, Hao Q, Luo L, Dong B. Prevalence of sarcopenia and associated factors in Chinese community-dwelling elderly: Comparison between rural and urban areas. *J Am Med Dir Assoc*. 2015;16(11):1003.e1-6. doi: 10.1016/j.jamda.2015.07.020.
15. Jie Y, Isa ZM, Jie X, Ju ZL, Ismail NH. Urban vs. rural factors that affect adult asthma. *Rev Environ Contam Toxicol*. 2013;226:33-63. doi: 10.1007/978-1-4614-6898-1\_2.
16. Wu F, Guo Y, Kowal P, et al. Prevalence of major chronic conditions among older Chinese adults: the Study on Global AGEing and adult health (SAGE) wave 1. *PLoS One*. 2013;8(9):e74176. doi: 10.1371/journal.pone.0074176. eCollection 2013.
17. Duboz P, Touré M, Hane F, et al. Ageing and chronic diseases in Senegal. A comparison between rural (Ferlo) and urban (Dakar) populations. *Bull Soc Pathol Exot*. 2015;108(1):25-31. doi: 10.1007/s13149-014-0397-y.
18. Oyebo O, Pape UJ, Laverty AA, Lee JT, Bhan N, Millett C. Rural, urban and migrant differences in non-communicable disease risk-factors in middle income countries: a cross-sectional study of WHO-SAGE data. *PLoS One*. 2015;10(4):e0122747. doi: 10.1371/journal.pone.0122747. eCollection 2015.
19. Iranagh JA, Motalebi SA, Chan YM, Iranagh NA, Iranagh EA, Rasouli J. Energy and macronutrient intakes in older urban and rural Iranian adults. *Southeast Asian J Trop Med Public Health*. 2014;45(4):949-55.
20. Befort CA, Nazir N, Perri MG. Prevalence of obesity among adults from rural and urban areas of the United States: findings from NHANES (2005-2008). *J Rural Health*. 2012; 28(4):392-7. doi: 10.1111/j.1748-0361.2012.00411.x.
21. Hewlett SA, Calys-Tagoe BN, Yawson AE, et al. Prevalence and geographic distribution of edentulism among older Ghanaians. *J Public Health Dent*. 2015;75(1):74-83. doi: 10.1111/jphd.12075.
22. Li LW, Liu J, Xu H, Zhang Z. Understanding rural-urban differences in depressive symptoms among older adults in China. *J Aging Health*. 2016;28(2):341-62. doi: 10.1177/0898264315591003.
23. Pengpid S, Peltzer K, Phaswana-Mafuya N. Prevalence and correlates of physical activity among female and male adolescents and adults in South Africa. *Gender Behav*. 2018;16(1): 11193-11206.
24. Chockalingam K, Vedhachalam C, Rangasamy S, et al. Prevalence of tobacco use in urban, semi urban and rural areas in and around Chennai City, India. *PLoS One*. 2013;8(10):e76005. doi: 10.1371/journal.pone.0076005. eCollection 2013.
25. Peer N, Bradshaw D, Laubscher R, Steyn N, Steyn K. Urban-rural and gender differences in tobacco and alcohol use, diet and physical activity among young black South Africans between 1998 and 2003. *Glob Health Action*. 2013;6:19216. doi: 10.3402/gha.v6i0.19216.
26. Kowal P, Chatterji S, Naidoo N, et al. Data resource profile: the World Health Organization Study on global AGEing and adult health (SAGE). *Int J Epidemiol*. 2012;41(6):1639-49. doi: 10.1093/ije/dys210.
27. Phaswana-Mafuya N, Peltzer K. Racial or ethnic health disparities among older adults in four population groups in South Africa. *Ann Global Health*. 2018;84(1): 7-14. DOI: <https://doi.org/10.29024/aogh.13>
28. Baerholdt M, Yan G, Hinton I, Rose K, Mattos M. Quality of life in rural and urban adults 65 years and older: findings from the National Health and Nutrition Examination survey. *J Rural Health*. 2012;28(4):339-47. doi: 10.1111/j.1748-0361.2011.00403.x.
29. Andel R, Silverstein M, Kärholm I. The role of midlife occupational complexity and leisure activity in late-life cognition. *J Gerontol B Psychol Sci Soc Sci*. 2015;70(2):314-21. doi: 10.1093/geronb/gbu110.