

Preplanned Studies

Activities of Daily Living-Related Functional Impairment Among Population Aged 65 and Older — China, 2011–2050

Binbin Su^{1,&}; Panliang Zhong^{2,&}; Chen Chen²; Yu Wu²; Xiaoying Zheng^{2,#}

Summary

What is already known about this topic?

The elevated prevalence of functional impairment among elderly individuals in China contributes to an increased burden of care.

What is added by this report?

This report presents a comprehensive evaluation of trends in functional impairment related to activities of daily living (ADL) among the elderly population in China. Furthermore, it offers insights for future projections of these trends in this demographic group.

What are the implications for public health practice?

Addressing the care needs and functional impairment issues among the aging population in China necessitates interdepartmental collaboration.

Aging is often accompanied by diminished physical health, increased prevalence of chronic diseases, and a higher incidence of functional impairment (1). China, home to the world's largest geriatric population, experienced a 4.63% increase in the demographic aged 65 and above between 2010 and 2020 (2). The rapidly growing elderly population is exacerbating the disability issue. In 2015, China reported 40.63 million geriatric individuals with functional impairment, of whom 64.5% were rural residents (3). Utilizing data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), this research examines the factors contributing to functional impairment in China's geriatric population and makes projections for future changes in dependency among the elderly from 2019 to 2050. This study reveals that the standardized prevalence of functional impairment among Chinese adults aged 65 and above declined from 2011 to 2018 and will continue to decrease from 2018 to 2035. However, it is projected to increase after 2035, with the population of elderly individuals reaching 42.18 million by 2050. Proactive measures are needed to

address the anticipated rise in the number of disabled elderly individuals.

The study utilized data from three CLHLS waves collected between 2011 and 2018, focusing on individuals aged 65 and older. Functional impairment assessment was based on activities of daily living (ADL) (4), which include six essential activities. Each ADL was categorized into three levels of dependency: mild impairment (having one or more ADL activities with "partial independence" but none of the six ADL activities with "complete dependence on others"), moderate impairment (having one to two ADL activities with "complete dependence on others"), and severe impairment (having three or more ADL activities with "complete dependence on others"). Moreover, the functional impairment rate was estimated using age-standardization techniques.

A binomial generalized linear mixed model, which accounted for the cluster effect of years, was employed to analyze the social and economic factors influencing functional impairment. To identify the key factors associated with shifts in functional dependency between 2011 and 2018, a linear probability model was developed. Future changes in dependency among older adults from 2019 to 2050 were projected based on the estimated coefficients from the linear probability model. All statistical analyses were conducted using R (version 4.2.2; R Core Team, 2022, R Foundation for Statistical Computing, Vienna, Austria).

This study included a total of 31,114 participants. Across all waves of data collection, more than half of the participants were aged over 85 years, and the samples predominantly comprised women, individuals from rural areas, and those who had never attended school. Significantly, approximately half of the participants resided in the eastern region of China (Table 1). The standardized prevalence of functional impairment among Chinese adults aged 65 years or older exhibited a slight decline from 13.10% in 2011

TABLE 1. Basic demographic information for the three waves of the study population.

| Subgroup | 2011 | 2014 | 2018 |
|--|--------------|--------------|--------------|
| | N=9,385 | N=6,719 | N=15,010 |
| Functional impairment, <i>n</i> (%) | 2,500 (26.6) | 1,654 (24.6) | 3,980 (26.5) |
| Male, <i>n</i> (%) | 4,216 (44.9) | 3,080 (45.8) | 6,561 (43.7) |
| Rural, <i>n</i> (%) | 4,903 (52.2) | 3,619 (53.9) | 6,710 (44.7) |
| Age group, <i>n</i> (%) | | | |
| 65–74 years | 1,882 (20.1) | 1,107 (16.5) | 3,116 (20.8) |
| 75–84 years | 2,476 (26.4) | 2,152 (32.0) | 4,069 (27.1) |
| 85+ years | 5,027 (53.6) | 3,460 (51.5) | 7,825 (52.1) |
| Attended school, <i>n</i> (%) | 3,911 (41.8) | 2,887 (43.3) | 6,415 (49.8) |
| Regions, <i>n</i> (%) | | | |
| Eastern | 4,484 (47.8) | 3,223 (48.0) | 7,414 (49.4) |
| Central | 2,592 (27.6) | 1,960 (29.2) | 3,875 (25.8) |
| Western | 2,309 (24.6) | 1,536 (22.9) | 3,721 (24.8) |
| Household-income, <i>n</i> (%) | | | |
| Low-income | 1,446 (20.0) | 1,184 (22.3) | 2,308 (20.5) |
| Low-middle-income | 1,641 (22.7) | 1,095 (20.6) | 2,336 (20.7) |
| Middle-income | 1,246 (17.3) | 1,235 (23.3) | 2,195 (19.5) |
| Middle-high-income | 1,439 (19.9) | 680 (12.8) | 2,385 (21.2) |
| High-income | 1,449 (20.1) | 1,114 (21.0) | 2,051 (18.2) |
| Married, <i>n</i> (%) | 3,540 (37.8) | 2,633 (39.6) | 6,075 (40.9) |
| Living alone, <i>n</i> (%) | 1,582 (17.0) | 1,247 (18.7) | 2,359 (15.9) |
| Having medical insurance, <i>n</i> (%) | 1,446 (20.0) | 1,184 (22.3) | 2,308 (20.5) |

to 10.91% in 2018. As age increased, the prevalence of functional impairment in the elderly demonstrated an exponential growth trend. In 2018, the impairment rate was 3.78% for the 65–74 age group, 9.74% for the 75–84 age group, and 42.28% for the 85 and older group. Notably, the prevalence of functional impairment among elderly women was significantly higher than among elderly men, and the urban elderly population displayed a higher prevalence than their rural counterparts (Table 2).

Upon examining specific contributing factors, the results of the regression analysis revealed that being male [0.86, 95% confidence interval (CI): 0.79, 0.93], attending school (0.79, 95% CI: 0.72, 0.86), having a high-income level (0.83, 95% CI: 0.73, 0.93), being married (0.58, 95% CI: 0.53, 0.63), and being covered by medical insurance (0.72, 95% CI: 0.65, 0.80) all serve as protective factors mitigating the risk of functional impairment in older adults (Figure 1).

This study utilized regression models to provide preliminary predictions on the elderly functional impairment rate and population size in China from 2020 to 2050. The findings indicate that between

2020 and 2035, the functional impairment rate among the elderly in China will display a declining trend, decreasing from 10.91% in 2018 to 9.10% in 2035. However, after 2035, the functional impairment rate among the elderly will gradually increase. Additionally, based on the data estimated in this study, the population of elderly individuals aged 65 and above with ADL disabilities in China was approximately 17.75 million in 2018. By the years 2025 and 2035, the population of elderly individuals aged 65 and above with disabilities will reach approximately 20.76 million and 28.69 million, respectively. Furthermore, by the year 2050, the population of elderly individuals with disabilities will reach 42.18 million (Figure 2).

DISCUSSION

This study focuses on analyzing the changing trends and factors influencing functional impairment among the elderly population in China over the past decade. Additionally, it projects the prevalence and magnitude of functional impairment in the elderly population

TABLE 2. Prevalence of functional impairment across three levels: comparisons by sex, residential region, and age group.

| Subgroup | 2011 | 2014 | 2018 | Average annual growth rate (%) |
|-----------------------------------|-------|-------|-------|--------------------------------|
| Overall functional impairment (%) | 13.10 | 13.46 | 10.91 | -0.0257 |
| Urban | 14.40 | 15.91 | 11.79 | -0.0281 |
| Rural | 11.66 | 11.23 | 9.98 | -0.0220 |
| Male | 12.09 | 12.11 | 9.47 | -0.0342 |
| Female | 14.31 | 15.10 | 12.49 | -0.0193 |
| 65–74 years | 6.30 | 5.97 | 3.78 | -0.0705 |
| 75–84 years | 13.28 | 13.61 | 9.74 | -0.0432 |
| 85+ years | 39.59 | 36.16 | 42.28 | 0.0095 |
| Mild impairment (%) | 4.29 | 4.33 | 3.01 | -0.0496 |
| Urban | 4.29 | 4.87 | 3.20 | -0.0410 |
| Rural | 4.30 | 3.84 | 2.80 | -0.0593 |
| Male | 4.14 | 3.75 | 2.81 | -0.0537 |
| Female | 4.48 | 5.04 | 3.22 | -0.0462 |
| 65–74 years | 2.93 | 2.52 | 1.24 | -0.1149 |
| 75–84 years | 4.59 | 5.00 | 3.60 | -0.0341 |
| 85+ years | 8.92 | 7.96 | 8.80 | -0.0018 |
| Moderate impairment (%) | 6.49 | 6.33 | 5.72 | -0.0177 |
| Urban | 7.46 | 7.65 | 6.32 | -0.0235 |
| Rural | 5.41 | 5.13 | 5.10 | -0.0085 |
| Male | 5.76 | 5.86 | 5.04 | -0.0191 |
| Female | 7.35 | 6.90 | 6.48 | -0.0180 |
| 65–74 years | 2.73 | 2.28 | 1.95 | -0.0473 |
| 75–84 years | 6.53 | 6.19 | 4.74 | -0.0448 |
| 85+ years | 21.25 | 19.28 | 23.13 | 0.0122 |
| Severe impairment (%) | 2.32 | 2.80 | 2.18 | -0.0087 |
| Urban | 2.65 | 3.39 | 2.28 | -0.0216 |
| Rural | 1.95 | 2.26 | 2.08 | 0.0093 |
| Male | 2.19 | 2.50 | 1.63 | -0.0417 |
| Female | 2.47 | 3.16 | 2.79 | 0.0174 |
| 65–74 years | 0.64 | 1.18 | 0.58 | -0.0132 |
| 75–84 years | 2.15 | 2.41 | 1.40 | -0.0595 |
| 85+ years | 9.42 | 8.93 | 10.35 | 0.0135 |

Note: mild impairment was defined as having 1 or more activities of daily living (ADL) activities with “partial independence” but none of the 6 ADL activities with “complete dependence on others”; moderate impairment was defined as having 1 to 2 ADL activities with “complete dependence on others”; severe impairment was defined as experiencing “complete dependence on others” for three or more ADL activities.

from 2020 to 2050. The findings suggest a decreasing trend in the level of functional impairment among the elderly in recent years. Factors such as gender, age, residential area, access to medical insurance, and availability of medical resources play a significant role in affecting functional impairment among the elderly population.

According to the analysis and predictions in this study, the rate of functional impairment among the

elderly population in China demonstrates a temporal trend, initially characterized by a decline, followed by a subsequent increase. Notably, a consistent downward trajectory was observed in the functional impairment rate from 2020 to 2035. This finding aligns with previous pertinent investigations and supports the consensus established by prior national surveys (5). The decline could be attributable to factors such as improved healthcare (6), heightened awareness of

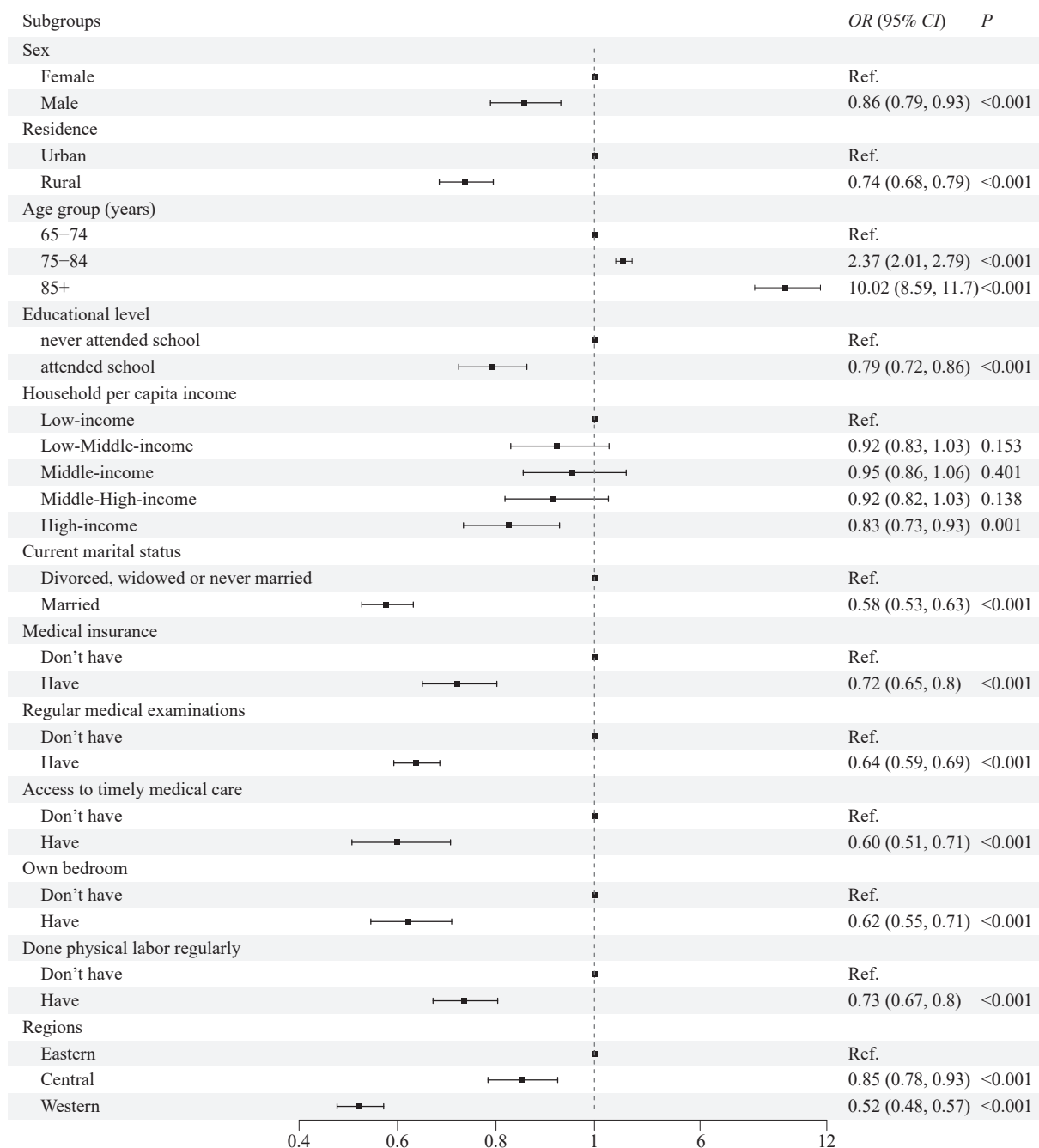


FIGURE 1. Demographic and socioeconomic influencing factors on functional impairment among older adults in China.

lifestyle-related diseases (7), and advances in medical technology (8). While these factors likely contribute to a decreased incidence of disability, they also result in extended lifespans, thereby increasing the size of the elderly population who may eventually experience disabilities. However, from 2035 to 2050, the functional impairment rate among elderly individuals will display an increasing trend. The primary reason for this is the substantial growth in the older adult population, as the negative effects of population aging

outweigh the positive impact of improved external conditions.

The magnitude of functional impairment among the elderly population in China is steadily increasing. Projections estimate that the number of elderly individuals with disabilities will rise to 28.69 million by 2035 and further to 42.18 million by 2050. Moreover, the growing issue of functional impairment among the aging population in China demands attention. The findings of this study reveal a rising

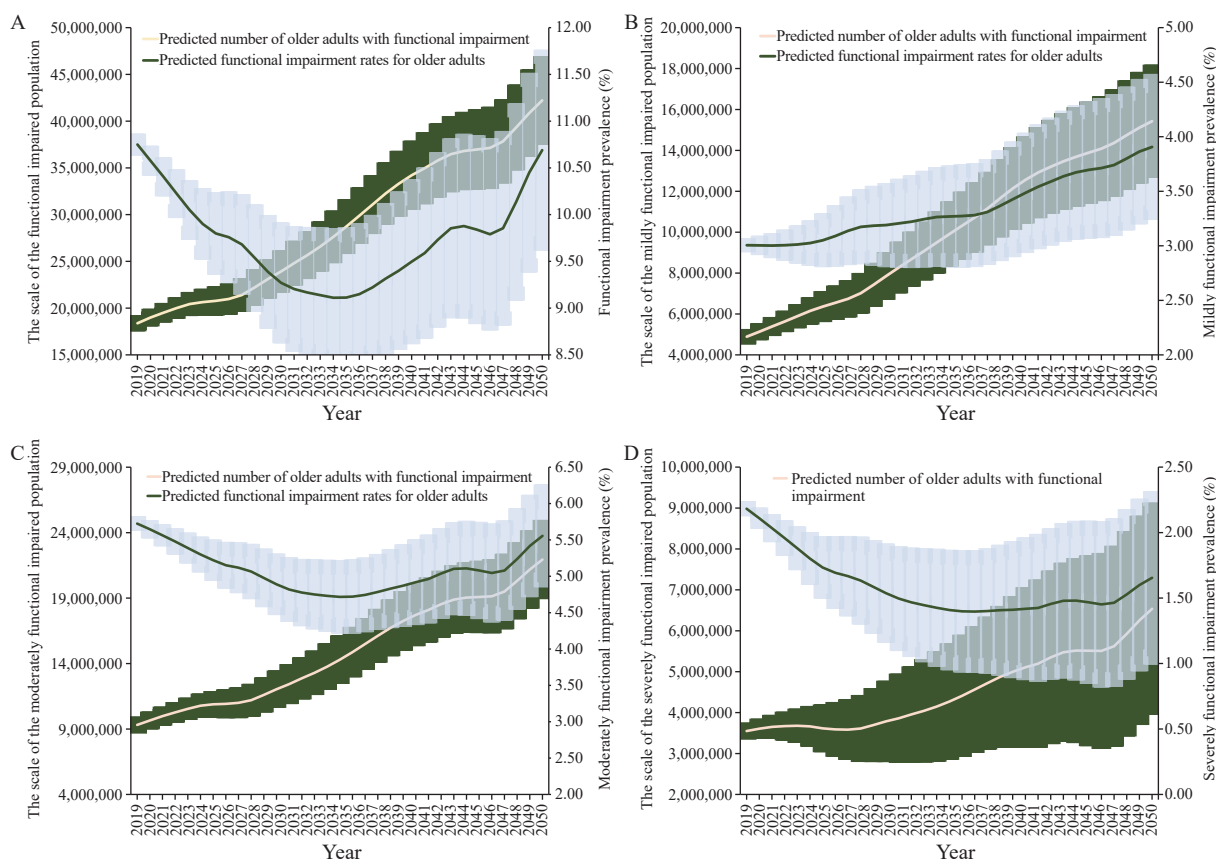


FIGURE 2. Projected functional impairment rates and the scale of functionally impaired older adults in China from 2019 to 2050. (A) total functional impairment rates and scale; (B) mild impairment rate and scale; (C) moderate impairment rate and scale; (D) severe impairment rate and scale.

trend in functional impairment rates among individuals aged 85 and above, particularly among women and elderly populations residing in rural areas. The increased prevalence of disability among women and the rural elderly population could be attributed to deeply ingrained gender roles and socioeconomic disparities that affect access to quality healthcare (9).

This study presents several limitations. First, the data on functional impairment were primarily gathered and evaluated through self-report or proxy report, which may introduce some discrepancies with the actual situation (10). Second, as noted earlier, the findings may not adequately represent older adults in the western region, considering that eight provinces in this area were not included in the CLHLS. Finally, certain potential factors contributing to the decline in dependency rates, such as the expansion of long-term care pilot projects and enhancements in health literacy, were not examined in our study due to the unavailability of relevant data.

In conclusion, this study highlights that despite general trends indicating a decrease in functional

impairment rates among older adults, the mounting concerns related to an increasing number of disabled elderly individuals and the growing functional impairment rates among specific subgroups should not be overshadowed. As a result, policy responses and interventions must adopt a comprehensive approach that not only aims at reducing functional impairment rates, but also addresses diverse health needs, taking into account age, gender, and regional disparities. A more targeted and robust medical and social insurance system is necessary to manage the anticipated rise in the number of disabled elderly individuals. Consequently, the Chinese government must implement proactive measures to address the substantial caregiving burden caused by the forthcoming aging population.

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Corresponding author: Xiaoying Zheng, zhengxiaoying@sph.pumc.edu.cn.

¹ School of Population Medicine and Public Health, Chinese Academy of Medical Sciences/Peking Union Medical College, Beijing, China;

² Department of Population Health and Aging Science, School of Population Medicine and Public Health, Chinese Academy of Medical Sciences/Peking Union Medical College, Beijing, China.

[‡] Joint first authors.

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REFERENCES

- Lynch DH, Petersen CL, Fanous MM, Spangler HB, Kahkoska AR, Jimenez D, et al. The relationship between multimorbidity, obesity and functional impairment in older adults. *J Am Geriatr Soc* 2022;70(5):1442 – 9. <http://dx.doi.org/10.1111/jgs.17683>.
- Ding ZH, Wang Y. The Change of Financial Support of Chinese Older Adults from 2010 to 2020: An Comparative Analysis of Census Data in 2010 and 2020. *Sci Res Ageing* 2023;11(4):1-18. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAIiTRKu87-SJxoEJu6LL9TJzd50ng8idt9w6paBEXsfbICkDSwl6f_jsYe7W_4iptguKsswp6oAF_6Eg5&uniplatform=NZKPT. (In Chinese).
- Hu HW, Hu XY. Care support for the disabled elderly in the context of negative population growth: logical mechanisms and governance paths. *J Huazhong Univ Sci Technol (Soc Sci Ed)* 2023;37(3):28 – 40. <http://dx.doi.org/10.19648/j.cnki.jhustss1980.2023.03.03>. (In Chinese).
- Pashmdarfard M, Azad A. Assessment tools to evaluate Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) in older adults: a systematic review. *Med J Islamic Repub Iran* 2020;34:33. <http://dx.doi.org/10.34171/mjiri.34.33>.
- Gong JQ, Wang GW, Wang YF, Chen XX, Chen YF, Meng QQ, et al. Nowcasting and forecasting the care needs of the older population in China: analysis of data from the China Health and Retirement Longitudinal Study (CHARLS). *Lancet Public Health* 2022;7(12):e1005 – 13. [http://dx.doi.org/10.1016/S2468-2667\(22\)00203-1](http://dx.doi.org/10.1016/S2468-2667(22)00203-1).
- Zeng Y, Feng QF, Hesketh T, Christensen K, Vaupel JW. Survival, disabilities in activities of daily living, and physical and cognitive functioning among the oldest-old in China: a cohort study. *Lancet* 2017;389(10079):1619 – 29. [http://dx.doi.org/10.1016/S0140-6736\(17\)30548-2](http://dx.doi.org/10.1016/S0140-6736(17)30548-2).
- Dominguez LJ, Galioto A, Ferlisi A, Pineo A, Putignano E, Belvedere M, et al. Ageing, lifestyle modifications, and cardiovascular disease in developing countries. *J Nutr Health Aging* 2006;10(2):143-9. <https://pubmed.ncbi.nlm.nih.gov/16554951/>.
- Feng QS, Zhen ZH, Gu DN, Wu B, Duncan PW, Purser JL. Trends in ADL and IADL disability in community-dwelling older adults in Shanghai, China, 1998–2008. *J Gerontol Ser B* 2013;68(3):476 – 85. <http://dx.doi.org/10.1093/geronb/gbt012>.
- Fiscella K, Williams DR. Health disparities based on socioeconomic inequities: implications for urban health care. *Acad Med* 2004;79(12):1139 – 47. <http://dx.doi.org/10.1097/00001888-200412000-00004>.
- Del Boca FK, Noll JA. Truth or consequences: the validity of self-report data in health services research on addictions. *Addiction* 2000;95(S3):S347 – 60. <http://dx.doi.org/10.1080/09652140020004278>.