Original Article

Sleep problems and mortality in rural South Africa: novel evidence from a low-resource setting

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ABSTRACT

Objective: Sleep problems are associated with mortality in Western populations. In low-resource settings, evidence of sleep problems and their potential association with mortality is lacking. Our study aimed to fill this gap by examining the prospective association of sleep problems with mortality among older adults in rural South Africa, as well as potential sex differences in this association.

Methods: The study was conducted in 2006 in Agincourt (South Africa), as part of the Health and Demographic Surveillance System. A community-wide sample of 4044 men and women aged 50 years or older participated in the survey. Two measures of sleep quality over the last 30 days were assessed alongside sociodemographic variables, measures of quality of life (QoL), and functional ability. Cox proportional hazard models were used to estimate hazard ratios (HR) and 95% confidence intervals (CI) for mortality risk over time associated with the two sleep measures at baseline, while allowing adjustment for other covariates.

Results: Overall, 394 deaths occurred during 3 years of follow-up. Both men and women reporting severe/extreme nocturnal sleep problems (vs none/mild/moderate) experienced a significantly greater mortality risk in models adjusted for sociodemographic variables only (HR, 1.65 [95% CI, 1.18–2.31] and HR, 1.42 [95% CI, 1.07–1.88], respectively). However, these associations were nonsignificant in fully adjusted models (HR, 1.23 [95% CI, 0.85–1.79] and HR, 1.07 [95% CI, 0.78–1.47], respectively).

Men who reported severe/extreme difficulty related to daytime function (vs none/mild/moderate) experienced a 2-fold increased mortality risk (HR, 2.01 [95% CI, 1.32–3.07]) in fully adjusted models, whereas no significant association was observed for women (1.16 [95% CI, 0.80–1.67]).

Conclusions: In this population, nocturnal sleep problems were not associated with mortality once analyses were adjusted for QoL, functional ability, and psychologic comorbidities. By contrast, severe or extreme problems with feeling unrested or unrefreshed during the day were associated with a 2-fold increased mortality risk, but this association was only significant in men.

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1. Introduction

Sleep problems represent an unmet public health problem affecting large segments of the population, especially middle-aged and older adults, with substantial costs to society in Western countries [1–4]. Sleep problems also are associated with adverse health outcomes in later life, including cardiovascular disease (CVD), psychiatric comorbidities, lower health-related quality of life (QoL), and reduced longevity [5–8]. In particular, there is a large body of evidence on the association of sleep duration, one dimension of sleep patterns, with mortality across several populations from Western countries [8–14]. Moreover, insomnia and daytime sleepiness have been associated with increased risks for all-cause mortality and CVD among older adults from high-income settings [15,16].

Whether or not these relationships are causal remains uncertain owing to the possibility of residual confounding by comorbidities of sleep problems, particularly in aging populations [17]. However, it is possible that sleep disturbances may represent a risk marker for poorer health outcomes [18].

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Importantly, most of the evidence to date comes from selected populations in high-income countries and in middle-aged individuals [13,14]. To our knowledge, there is no study that has reported on the prospective association of sleep problems with mortality outcomes among older adults from low-resource settings. Indeed, sleep problems might represent an unrecognized public health issue in many developing countries, especially in aging populations, as recently observed in several African and Asian settings [19] given the ongoing epidemiologic transition and population aging at the global level [20,21]. Moreover, factors contributing to poor sleep patterns in older adults from low-resource settings might differ from those characteristic of Western societies [19].

The Agincourt Study, part of the International Network for the Demographic Evaluation of Populations and their Health (IN-DEPTH) and the World Health Organization (WHO) Study on Global Aging and Adult Health (SAGE) multicenter collaboration on global aging and adult health [19], offers an unique opportunity to fill these gaps by examining the prospective relationship of sleep problems with mortality in a large population-based sample of older adults from rural South Africa while accounting for a number of sociodemographic variables measures of QoL, functional ability, and psychologic comorbidities [19,22].

There is a considerable body of literature suggesting potential sex differences in the health implications of sleep disturbances [15,23–26]; therefore, we investigated the associations of sleep problems with mortality separately in men and women.

2. Material and methods

2.1. Study setting and population

The MRC/Wits (Medical Research Council/Witwatersrand) Rural Public Health and Health Transitions Research Unit (Agincourt) is located in the Agincourt subdistrict of Bushbuckridge, Mpumalanga Province, northeast South Africa, which is close to the border of Mozambique. Although South Africa as a whole is considered as an upper middle income country, the study setting is a former homeland (Bantustan) and remains under resourced. Since the first democratically elected government, there has been substantial development in certain services such as electrification. For example, 89% of households had electricity while 60% owned a television in 2005; however, other key infrastructure remained poor, including provision of water and sanitation. The unemployment rate is high (36%) sustaining prior high levels of male labor migration, leading to increased migration of young women [27]. The South African noncontributory old-age pension provides critical income for women older than the age of 60 years and men older than 65 years [28].

The Agincourt health and sociodemographic surveillance system (HDSS) has been annually updated since 1992. The annual census update involves collection of basic demographic data (pregnancy outcomes, deaths, in- and out-migrations) on every individual in each household [25,26]. Although the surveillance system includes information on all deaths, there is incomplete official death notification, and hence a verbal autopsy is conducted on every death reported [29,30].

The Agincourt HDSS is supplemented by additional data collected through special add-on modules administered at less frequent but regular time intervals, including labor participation, household assets, healthcare utilization, and physical and cognitive function of older adults. The latter module provides the core data for our paper.

The total population under surveillance in 2006 was approximately 70,000 individuals living in 21 villages. In August 2006 there were 8429 men and women aged 50 years or older. From

these, we excluded those who did not live permanently in the area ($n = 1648$) and individuals who had participated in previous studies ($n = 575$). The 6206 individuals living permanently in the area were invited to participate in the Agincourt Study on Ageing during the 2006 census update. Each individual was visited up to 3 times in an effort to complete the interview, resulting in 4047 out of 6206 (65.2%) individuals who agreed to participate and complete the questionnaire. Reasons for nonparticipation in the study included being absent at time of interview ($n = 1616$; 26.0%), death ($n = 218$; 3.5%), declining to take part in the study ($n = 47$; 0.75%), or unable to answer the questions mainly due to poor health ($n = 240$; 3.9%). There were 38 participants (0.9%) who were lost to follow-up and were not included in these analyses. Three other individuals were excluded because they did not answer the questions related to sleep quality; thus, the final sample of participants with a complete set of data for these analyses included 4044 individuals.

Ethical clearance was granted by the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg, South Africa for both the MRC/Wits Rural Public Health and Health Transitions Research Unit's (Agincourt) Health and Socio-Demographic Surveillance System and add-on modules (Ref no. M960720), and the Agincourt-INDEPTH-WHO Study on Global Ageing and Adult Health (Ref no.R14/49).

2.2. Data collection

The data collection tool was adapted and shortened as part of the INDEPTH WHO-SAGE. The study background has been described in detail in previous reports [19,22]. It included questions on self-health assessment, functionality, sleep and energy, depression and anxiety, well-being, and QoL.

The questionnaire was back-translated to the local language (Shangaan). Certain amendments were made to the questionnaire following a pilot study. Fieldwork quality control followed routine systems established for the annual census update and included three levels: cross checking of forms by other fieldworkers, supervisor's check, and quality checkers' revision [22]. The short IN-DEPTH-SAGE module was administered by trained local field workers. As part of the census update routine, verbal informed consent was obtained from the participants prior to the interview.

Additional demographic data, including sex, age, marital status, nationality, and level of education were extracted from the Agincourt HDSS (2006 census update). Household asset score was extracted from 2005 data, as these were the most recent data available.

2.3. Follow-up

The 4044 participants in the 2006 study were followed up at the annual census update from 2007 to 2009, providing information on deaths up to July 31st, 2009. Participants were included in the analysis until out-migration, death, or July 31st, 2009, whichever came first. All efforts were made to follow-up on individuals who were reported to be dwelling within the Agincourt subdistrict; however, those not found in the new dwelling were censored from follow-up at the date of the move ($n = 48$; 1.2%), and those who left the study area ($n = 56$; 1.4%) were censored at the out-migration date. The main reasons for out-migration were moving to a new house, change of marital status, and study- or work-related opportunities.

2.4. Sleep variables

Sleep problems were assessed by two questions: (1) "Overall in the last 30 days, how much of a problem did you have with