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ASSOCIATION OF INSOMNIA WITH CANCER RISK IN THE AGING POPULATION: FINDINGS FROM THE INDONESIA HEALTH SURVEY 2023

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ABSTRACT

Introduction: Insomnia and sleep disturbances are increasingly recognized as contributors to chronic diseases such as cancer. Older adults are particularly vulnerable to this disease, yet evidence from Indonesia remains limited. **Methods:** This study examined the association between insomnia and cancer among Indonesians aged ≥60 years using nationally representative data from the 2023 Indonesia Health Survey (SKI). A cross-sectional analysis was conducted on 97,339 older participants. The primary outcome was self-reported cancer diagnosis, and the main exposure was sleep difficulty. The covariates included age, gender, education, marital status, region, and employment. Associations were tested using chi-square analysis with complex survey design adjustments in SPSS (version 27). **Results:** A significant association was found between insomnia and cancer diagnosis ($p<0.001$), with a higher prevalence among those reporting sleep difficulties. The effect size for the association was small but meaningful (Cramer's V = 0.032; 95% CI: 0.028–0.036), indicating a weak yet statistically significant relationship. Gender, education, marital status, region, and employment were also significantly associated with cancer. **Conclusion:** These findings suggest that insomnia may contribute to cancer risk in Indonesia's elderly population, although the strength of the association is small. Incorporating sleep health into public health strategies for aging populations remains essential.

Keywords: cancer risk, elderly population, Indonesia Health Survey, insomnia, sleep disturbance.

HUBUNGAN INSOMNIA DENGAN RISIKO KANKER PADA POPULASI LANSIA: TEMUAN DARI SURVEI KESEHATAN INDONESIA TAHUN 2023

ABSTRAK

Pendahuluan: *Insomnia dan gangguan tidur semakin dikenal sebagai faktor yang berkontribusi terhadap penyakit kronis seperti kanker. Lansia merupakan kelompok yang sangat rentan terhadap penyakit ini, namun bukti penelitian dari Indonesia masih terbatas.* ***Metode:*** *Penelitian ini menganalisis hubungan antara insomnia dan kanker pada penduduk Indonesia berusia ≥60 tahun menggunakan data representatif nasional dari Survei Kesehatan Indonesia (SKI) tahun 2023. Analisis cross-sectional dilakukan pada 97.339 responden lansia. Luaran utama penelitian adalah diagnosis kanker berdasarkan laporan responden, sedangkan paparan utama adalah kesulitan tidur. Kovariat penelitian meliputi usia, jenis kelamin, pendidikan, status perkawinan, wilayah tempat tinggal, dan status pekerjaan. Hubungan antarvariabel diuji menggunakan analisis chi-square dengan penyesuaian desain survei kompleks menggunakan SPSS versi 27.* ***Hasil:*** *Ditemukan hubungan yang signifikan antara insomnia dan diagnosis kanker ($p < 0,001$), dengan prevalensi kanker yang lebih tinggi pada responden yang melaporkan kesulitan tidur. Besaran efek hubungan tersebut tergolong kecil namun*

bermakna (Cramer's V = 0,032; 95% CI: 0,028–0,036), yang menunjukkan hubungan lemah tetapi signifikan secara statistik. Jenis kelamin, tingkat pendidikan, status perkawinan, wilayah tempat tinggal, dan status pekerjaan juga berhubungan signifikan dengan kanker. ***Kesimpulan:*** *Temuan ini menunjukkan bahwa insomnia dapat berkontribusi terhadap risiko kanker pada populasi lansia di Indonesia, meskipun kekuatan hubungannya relatif kecil. Integrasi aspek kesehatan tidur dalam strategi kesehatan masyarakat bagi populasi lansia tetap menjadi hal yang penting.*

Kata Kunci: *gangguan tidur, insomnia, populasi lansia, risiko kanker, Survei Kesehatan Indonesia.*

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INTRODUCTION

Cancer is a leading cause of death worldwide, and its burden continues to rise, particularly among the aging population (Prathap et al., 2024). With increasing global life expectancy, a growing proportion of older adults are becoming susceptible to chronic diseases, including cancer(Schiza & Bouloukaki, 2020). Indonesia, like many other low- and middle-income countries, is currently undergoing a significant demographic shift, characterized by a rapidly expanding elderly population. This transition highlights the urgent need to identify and understand the key determinants contributing to the disease burden in this vulnerable age group(Mahendradhata et al., 2017). Among the emerging factors receiving growing research attention is sleep disturbance, particularly insomnia, which has been increasingly recognized as a potential contributor to a wide range of chronic health conditions, including cancer (Schiza & Bouloukaki, 2020).

Insomnia is highly prevalent among older adults and is typically characterized by difficulties in initiating or maintaining sleep, early morning awakenings, and feelings of non-restorative sleep (Patel et al., 2018; Ningrum et al., 2025). Epidemiological studies have shown that poor sleep quality in older adults can lead to adverse health outcomes, including immune suppression, inflammation, hormonal imbalances, and oxidative stress, all of which are biologically plausible mechanisms for cancer development (Disorders et al., 2006; He et al., 2024). These biological disruptions are potential mechanisms underlying cancer initiation and progression. Although international interest in the relationship between sleep disorders and chronic diseases has increased in recent years, empirical evidence specifically exploring the

association between insomnia and cancer risk in older adult populations remains limited, particularly in Southeast Asian contexts such as Indonesia (Leite, 2025; Al Maqbali et al., 2022; Garbarino et al., 2021).

While some global studies have reported a possible association between sleep disturbances and elevated cancer risk, the results remain inconclusive, and population-based studies from low- and middle-income settings are scarce. In Indonesia, there is a notable lack of large-scale representative studies that assess the impact of insomnia on cancer prevalence among the elderly (Alfian et al., 2024; Oakman et al., 2018). This significant gap in the literature impedes the formulation of holistic public health strategies that incorporate sleep health into chronic disease prevention. This is especially critical in aging societies, where sleep disorders and cancer are increasingly prevalent. Understanding this association within the Indonesian context is vital for informing public health policy, guiding screening strategies, and designing age-appropriate interventions (Jiang et al., 2024; Mao et al., 2021). Therefore, this study aimed to investigate the association between insomnia and cancer diagnosis among individuals aged ≥ 60 years in Indonesia, utilizing data from the 2023 Indonesia Health Survey (Survey Kesehatan Indonesia/SKI).

METHODS

Data Source and Study Design

This study utilized secondary data from the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia, SKI), a nationally representative cross-sectional survey conducted by the Indonesian Ministry of Health. The SKI 2023 employed a complex multistage stratified cluster sampling design to collect comprehensive health data from all provinces in Indonesia. Data collection covered a wide range of demographic, socioeconomic, and health-related variables.

Study Population

The study population consisted of individuals aged ≥ 60 years, classified as elderly according to the WHO criteria. From the full SKI dataset, a subpopulation of 97,339 older respondents was identified for analysis.

Inclusion and Exclusion Criteria

Inclusion Criteria: Respondents aged 60 years or older. Respondents with complete data on key variables, including age, gender, education level, marital status, region, employment status, sleep status, and cancer diagnosis, were included. Exclusion Criteria: Respondents younger than 60 years and respondents with missing or

incomplete data on any of the variables of interest.

Variables and Measurements

The primary outcome in this study was physician diagnosed cancer. Cancer status was obtained from respondents self-reported information indicating whether they had ever received a formal diagnosis of cancer from a healthcare professional. This measure was recorded as a binary variable, distinguishing between respondents who reported a confirmed cancer diagnosis and those who had never been diagnosed. Because the Indonesia Health Survey (SKI 2023) did not include clinical verification, cancer type, stage, or treatment history, the variable reflects general cancer status rather than disease-specific classifications. Despite this limitation, self-reported physician diagnoses have been widely used in large epidemiological datasets and are considered acceptable for population-level surveillance.

The main independent variable was insomnia, conceptualized through the presence of self-reported sleep difficulties. In line with established epidemiological approaches to sleep assessment in older adults, insomnia was measured by asking respondents whether they had experienced any form of sleep disturbance. These disturbances included difficulty initiating sleep, difficulty maintaining sleep, early morning awakenings, and perceiving their sleep as non-restorative or unrefreshing. Respondents were categorized as having insomnia if they reported any of these sleep difficulties and as not having insomnia if they reported none. Although self-report measures do not capture clinical insomnia as defined by diagnostic manuals, they are considered reliable indicators of sleep health in large-scale population surveys, particularly among older adults.

In addition to the main variables, several sociodemographic characteristics were included as covariates based on prior evidence linking them to both sleep and cancer outcomes. These covariates consisted of age, gender, education, marital status, region of residence, and employment status. Age was grouped into three categories representing early, middle, and advanced older adulthood (60–69, 70–79, and ≥80 years), which aligns with gerontological research conventions. Gender was classified as male or female. Education level was categorized into low (no schooling or primary education), medium (secondary education), and high (tertiary education). Marital status included single, married, and divorced or widowed. Region of residence distinguished between urban and rural areas, reflecting differences in healthcare access and environmental exposures. Employment status identified respondents who were still working and

those who were not, including retirees and individuals unable to work.

All variables were recoded to enhance analytical clarity and ensure consistency with international epidemiological standards. This approach facilitated accurate interpretation of associations, minimized classification errors, and supported the production of nationally representative estimates when combined with the survey's complex sampling design.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics (Version 27). Descriptive statistics were calculated to summarize the respondent characteristics. The chi-squared (χ^2) test was used to examine the bivariate associations between cancer diagnosis and the independent variables. To account for the intricate survey design, which included stratification, clustering, and unequal likelihood of selection, sampling weights from the dataset were applied, guaranteeing more precise and representative values. Weighted estimates were generated to ensure national-level representativeness. Statistical significance was set at $p < 0.05$.

Ethics Approval

This study was conducted in compliance with all applicable ethical guidelines and regulations regarding data use and the confidentiality of participants. Data access was granted under a confidentiality agreement with the Indonesian Ministry of Health (agreement no. FRM/SMKI-PUSDATIN/70/0108/2024). Ethical approval for the use of secondary data was registered and approved under ticket number 240675B7CC9C4327. The SKI 2023 data are publicly available upon request through the official Ministry of Health platform at: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/

RESULTS

Table 1 shows that among 97,339 older adults, most were aged 60–69 years (68.3%, *n*=66,435), followed by 70–79 years (24.9%, *n*=24,282) and 80–112 years (6.8%, *n*=6,622). The sex distribution was balanced, with slightly more females (51.0%, *n*=49,677) than males (49.0%, *n*=47,662). Regarding education, the majority had a low education level (68.7%, *n*=66,862), 24.3% had a medium education (*n*=23,619), and 7.0% had a high education (*n*=6,858). Most respondents were married (68.4%, *n*=66,554), while 30.4% were divorced (*n*=29,563), and 1.3% were single (*n*=1,222). Slightly more participants resided in urban areas (54.1%, *n*=52,671) than in rural areas (45.9%, *n*=44,668). Two-thirds reported being employed (67.8%, *n*=66,010), and 32.2% were not working (*n*=31,329). Most of the participants

reported no sleep difficulties (87.7%, *n*=85,366), whereas 12.3% reported sleep difficulties (*n*=11,973). Only 0.3% of the participants reported a physician-diagnosed cancer (*n*=293), while 99.7% did not (*n*=97,046).

Table 1. Frequency distribution of Respondent Characteristic among elderly (n=97,339)

Variable	Frequency (n)	Percent (%)
Age (Years)		
60-69	66435	68.3%
70-79	24282	24.9%
80-112	6622	6.8%
Jenis Kelamin		
Male	47662	49.0%
Female	49677	51.0%
Education level		
Low	66862	68.7%
Medium	23619	24.3%
High	6858	7.0%
Marital Status		
Single	1222	1.3%
Married	66554	68.4%
Divorced	29563	30.4%
Region		
City	52671	54.1%
Village	44668	45.9%
Job		
Doesn`t work	31329	32.2%
Work	66010	67.8%
Insomnia		
Yes	11778	12.3%
No	83774	87.7%
Diagnose Cancer		
Yes	293	0.3%
No	97046	99.7%

Table 2 presents the chi-square tests (two-sided, α=0.05) assessing the association between sociodemographic and health variables and physician-diagnosed cancer among older adults (total cancer cases = 293; 0.3%). Age showed no significant association with cancer (p=0.170): 60–69 years, n=203 (0.2%); 70–79 years, n=78 (0.1%); and 80–112 years, n=12 (~0.0%). In contrast, sex was significantly associated (p<0.001), with more cases among women than men (women, n=208, 0.2%; men, n=85, 0.1%). Education level was also significant (p<0.001): low, n=143 (0.1%); medium, n=97 (0.1%); high, n=53 (0.1%). Marital status showed a significant association (p=0.004): married n=192 (0.2%), divorced n=98 (0.1%), single n=3 (~0.0%). Region of residence was strongly associated (p<0.001), with more cases in urban areas than in rural areas (urban n=221, 0.2%; rural n=72, 0.1%). Employment status was significant (p<0.001), with more cases among those not working than among those working (not working, n=156, 0.2%; working, n=137, 0.1%). Sleep difficulty was also statistically associated (p<0.001); 59 individuals with sleep problems (0.1%) and 221 without sleep problems (0.2%) had cancer. Although statistically significant, the absolute differences for most comparisons were small because of the low overall prevalence. The totals across subgroups sum to 293 cases for all variables except sleep difficulty, where 13 cases appear to have missing sleep data; overall, 293 (0.3%) reported cancer and 97,046 (99.7%) did not.

Table 2. Chi-squared analysis (n=97,339)

Variable	With Cancer (N)	%	Without Cancer (N)	%	p-value
Age(Years)					
60-69	203	0.2%	66232	68.3%	
70-79	78	0.1%	24204	24.9%	0.170
80-112	12	0.0%	6610	6.8%	
Gender					
Male	85	0.1%	47577	48.9%	<0.001
Female	208	0.2%	49649	50.8%	
Education level					
Low	143	0.1%	66719	68.7%	
Medium	97	0.1%	23522	24.2%	<0.001
High	53	0.1%	6805	7.0%	
Marital status					
Single	3	0.0%	1219	1.3%	
Married	192	0.2%	66362	68.2%	<0.004
Divorced	98	0.1%	29563	30.4%	
Region					
City	221	0.2%	52450	53.9%	<0.001
Village	72	0.1%	44596	45.8%	
Job					
Work	137	0.1%	31192	32.0%	<0.001
Doesn`t Work	156	0.2%	65854	67.7%	
Insomnia					
Yes	59	0.1%	11719	12.3%	
No	221	0.2%	83553	87.4%	<0.001
Diagnose cancer					
Yes	15	0.0%	2646	2.8%	.000
No	265	0.3%	92626	96.9%	

*p=<0.05

DISCUSSION

This section describes the outputs generated in the methodology. Elaborate and compare your results with those of previous research performed in the past. This study analyzed the characteristics associated with cancer diagnosis among older Indonesian adults using data from the 2023 Indonesia Health Survey (SKI). The overall prevalence of self-reported cancer diagnosis among the elderly was low (0.3%), consistent with earlier findings from national-level reports(Santoso et al., 2021). However, several sociodemographic and health-related factors were significantly associated with cancer diagnosis. Cancer prevalence was slightly higher among females than among males, aligning with national data suggesting a greater burden of breast and cervical cancers among women in Indonesia (Mardela et al., 2017; Sung et al., 2021). The gender disparity may reflect both biological susceptibility and improved health-seeking behavior among elderly women (Nair et al., 2021; Rata Mohan et al., 2025). Age, although not statistically significant in this study, remains an established risk factor for cancer, as documented by global research. Other studies have consistently shown a marked

increase in cancer incidence and mortality with advancing age, particularly beyond 70 years (Li et al., 2024; Xiang et al., 2022). Education level was strongly associated with cancer diagnosis. Elderly individuals with higher education levels were more likely to be diagnosed, likely due to increased awareness, better access to healthcare, and a higher likelihood of undergoing screening (Prathap et al., 2024; Carethers & Doubeni, 2020). Marital status also showed a significant association; being married was linked to a higher reported diagnosis, potentially reflecting social support that facilitates access to health services (Pandey et al., 2019). The region of residence (urban vs. rural) significantly influenced cancer prevalence. Urban residents reported more diagnoses, possibly because of better diagnostic infrastructure and health services in cities. This urban-rural gap in health access has been well-documented in both national and global studies (Bhatia et al., 2022; Systems & Vol, 2017).

Employment status and sleep disturbance were both significantly associated with cancer diagnosis. The correlation between employment and cancer may involve reverse causality, where individuals who develop cancer are forced to leave the workforce due to declining health (De Felice et al., 2022; Blinder & Gany, 2020). Sleep disturbance, particularly insomnia, is increasingly recognized as both a symptom and potential risk factor for cancer, mediated through mechanisms such as hormonal dysregulation, circadian rhythm disruption, inflammation, and oxidative stress (Irwin, 2019). Meta-analyses have found that poor sleep is associated with an increased risk of breast, prostate, and colorectal cancers, particularly in older populations (Lin et al., 2019; Asri et al., 2024).

This study had several limitations. First, its cross-sectional design means that causal relationships cannot be established between the variables. Self-reported data may have underreported or misclassified cancer diagnoses (Hammerton & Munafò, 2021). Lack of clinical validation: The data did not include cancer type, stage, or treatment information. Survivorship bias: Patients who died from cancer prior to the survey were not represented. Potential residual confounding: Lifestyle, genetic predisposition, and environmental exposures were not included because of data constraints (D'Onofrio et al., 2020).

The findings of this study have important implications for public health. Targeted cancer education and screening interventions are urgently needed for older Indonesians, especially those in rural areas with lower education levels. Health systems should also improve cancer surveillance and support services, particularly in under-

resourced areas. Policymakers must consider integrating geriatric-specific strategies into national cancer control programs, acknowledging that aging and cancer are converging public health priorities.

CONCLUSION

Using the nationally representative SKI-2023 data, the prevalence of self-reported cancer among older Indonesians was low (0.3%). Significant differences were observed by gender, education, marital status, residence, employment, and sleep difficulty, while age group differences were not significant. Higher case proportions among women, urban residents, those not working, and respondents with sleep problems likely reflect differences in access, awareness, and comorbidity profiles rather than causal effects. Given Indonesia's aging population, the cancer burden is likely to rise. Priorities include equitable screening/diagnostics (especially in rural areas), timely referral and treatment, targeted health education, and the incorporation of sleep health into geriatric assessments. The findings should be interpreted in light of the cross-sectional design and self-reports. Longitudinal, clinically verified studies are needed to refine the risk pathways and guide resource allocation.

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