IMS 19 WORLD CONGRESS ON MENOPAUSE

MELBOURNE
19–22 OCTOBER 2024

Exploring Sleep Disturbances Across Age and Sex with Samsung Smart Watches

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CONFLICT OF INTEREST DISCLOSURE

Commercial Interest	Eisai, Otsuka, Bayer, Diamond Therapeutics
What was Received	Consultancy fee
For What Role	Consultancy work
Commercial Interest	Eisai, Clairvoyant, Ontario Brain Institute
What was Received	Research grant
For What Role	Clinical research

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Introduction

Sleep disturbances are prevalent in women, particularly during and after menopause affecting up to 69% of women in this stage of life[1,2]

Menopausal sleep issues such as increased WASO and total awake time are associated with hormonal changes, impacting women's quality of life and daytime functioning[3,4]

Objective data on sleep disturbances in large populations has traditionally been limited[5]

Wearable technology, such as the Samsung Galaxy Watch, validated against polysomnography for sleep stage classification,[5] provides an opportunity for large-scale, objective sleep data collection[6]

WASO, wake after sleep onset.

1. Nappi RE, et al. Menopause 2021;28(8):875–82; **2.** Constantine GD, et al. Post Reprod Health 2016;22(3):112–22; **3.** Salari N. et al. Sleep Breath 2023;27:1883-1897; **4.** Maki P, et al. Menopause 2024;31:724-733; **5.** Silva FB, et al. Sleep Med. 2024 Jul;119:535-548; **6.** Redline S, Purcell SM. Sleep. 2021 Jun 11;44(6):zsab107.

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Objectives

This study leverages Samsung Health data to explore the impact of age and sex on sleep patterns in a large adult sample

Methods

Design

This observational study utilized anonymized data from the global **Samsung Health consumer database**, specifically focusing on **sleep metrics** captured via broadly available consumer **smartwatches** (Samsung Galaxy)

Data

Data collection occurred in **December 2023** and **March 2024** and captured sleep measures for participants aged **20-64** from the **USA** with **≥1 nightly sleep record.** Data was similar for both months, so March data was selected for analysis to minimize disruptions related to holidays

Participants

572,468 females

925,580 males

Outcomes

Main outcomes analyzed:

- **Wake After Sleep Onset** (WASO) ≥3 minutes
- **Total awake time**
- **Number of awakenings**
- **Total sleep duration**
- **Sleep efficiency**

Analysis

Participants were divided into **age groups** and the study also compared **sex-based differences** in sleep measures.

Statistics

Descriptive statistics were analyzed for all sleep measures

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Outcomes

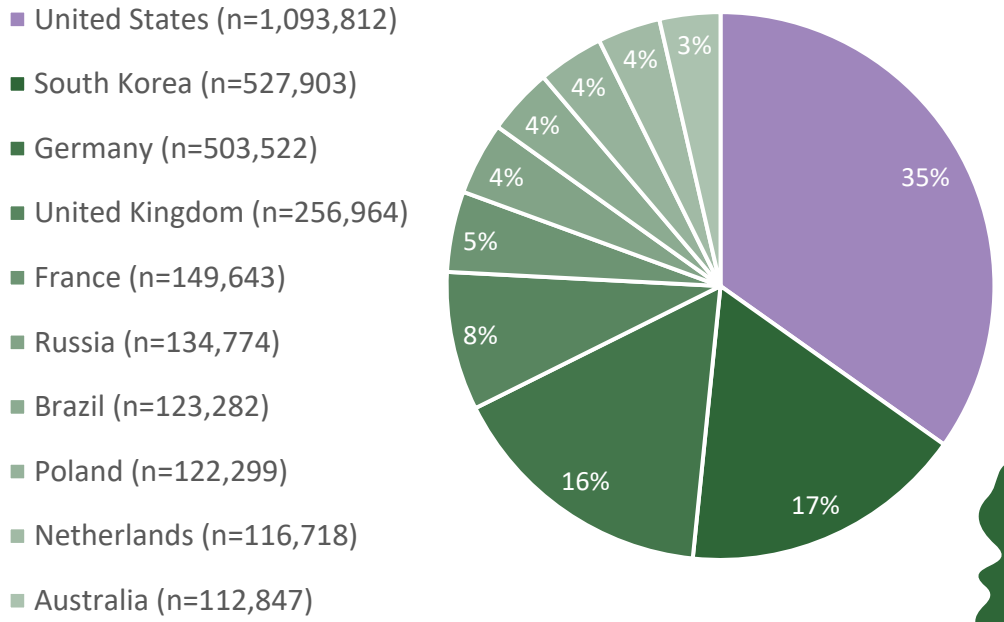
WAKE AFTER SLEEP ONSET (WASO)	The amount of time a person is awake after initially falling asleep, counting only periods where the individual is awake for ≥3 minutes. It is often used to measure sleep fragmentation—how much someone wakes up and stays awake during the night.*
TOTAL AWAKE TIME	The overall time spent awake during the entire night, regardless of how long each wake period lasts. It includes every moment of wakefulness after first falling asleep, summing up all the brief and extended periods of wakefulness across the night.*
NUMBER OF AWAKENINGS	The total count of discrete instances during the night when a person transitions from sleep to wakefulness for ≥3 consecutive minutes. Each period of wakefulness must be separated by a return to sleep, making them distinct episodes. This metric is used to assess how frequently a person experiences interrupted sleep with meaningful awakenings.
TOTAL SLEEP DURATION	The cumulative amount of time a person spends asleep during the night, from the initial onset of sleep until final awakening, excluding any periods of wakefulness. It is the total amount of actual sleep achieved.
SLEEP EFFICIENCY	The percentage of time spent asleep relative to the total time spent in bed, calculated by dividing the total sleep duration by the total time spent in bed (from lying down to final awakening) and multiplying by 100. A higher sleep efficiency indicates that a person is spending most of their time in bed asleep, while lower sleep efficiency suggests difficulty staying asleep or frequent awakenings.

*Note: Wake after sleep onset and total awake time are defined differently in other studies. The descriptions here are the definitions that were used in this study.

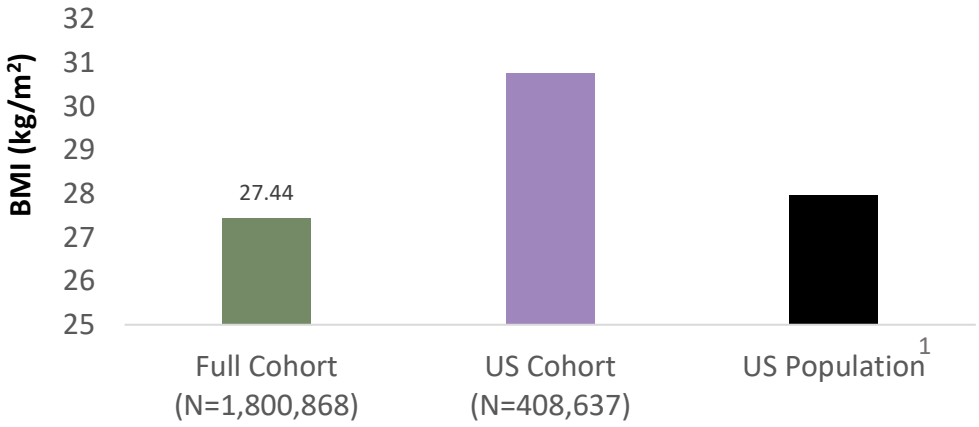
Results: Full cohort overview

Sleep measures were captured for a total of **4,509,760** participants across multiple countries

Participant breakdown from the top 10 countries for the full cohort



Mean BMI for the full cohort and US cohort

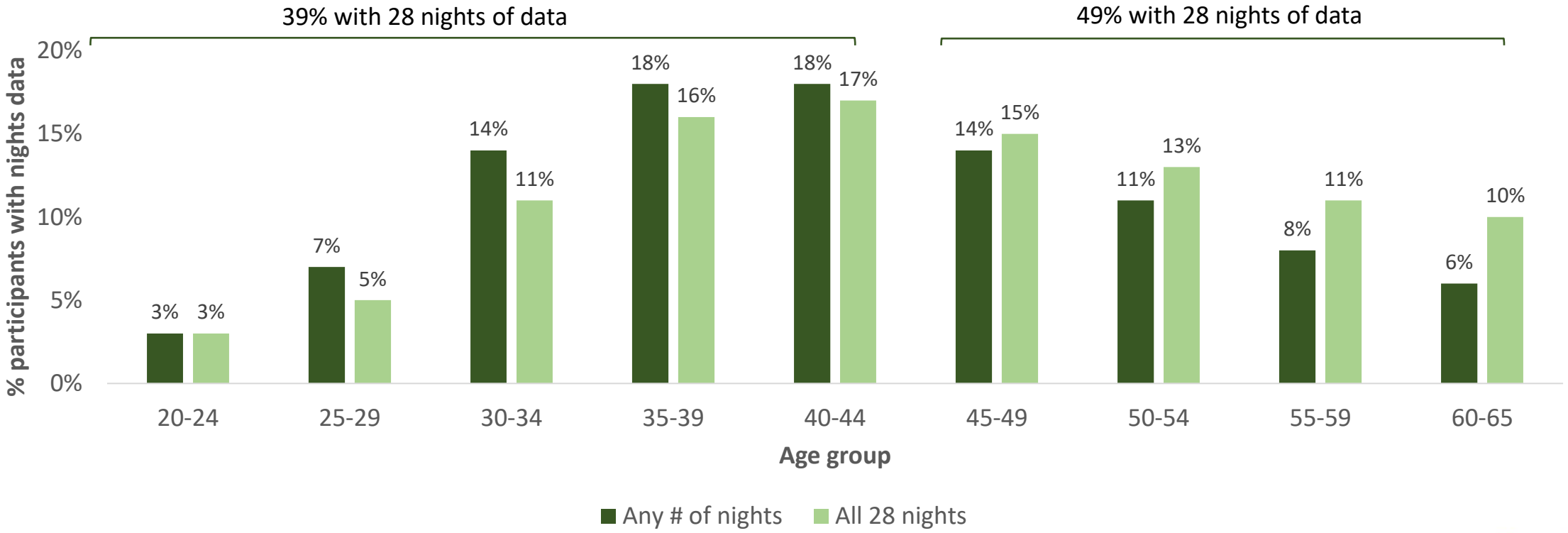


Sleep data were collected for a total of 572,468 women and 925,580 men in the US. The self-reported BMI for the US cohort was consistent with both global (full cohort) data and the overall US population.

BMI, body mass index; US, United States.

1. DQYDJ. BMI Percentile Calculator for Men and Women in the United States. Available at: https://dqydj.com/bmi-percentile-calculator-men-women-united-states/

Results: Age structure of females



Sleep tracking was most common in women aged 35-44. Among older women (45-65 years), 49% tracked sleep for all 28 nights, compared to 39% of younger women (20-44 years), suggesting older females may be more persistent with tracking their sleep.

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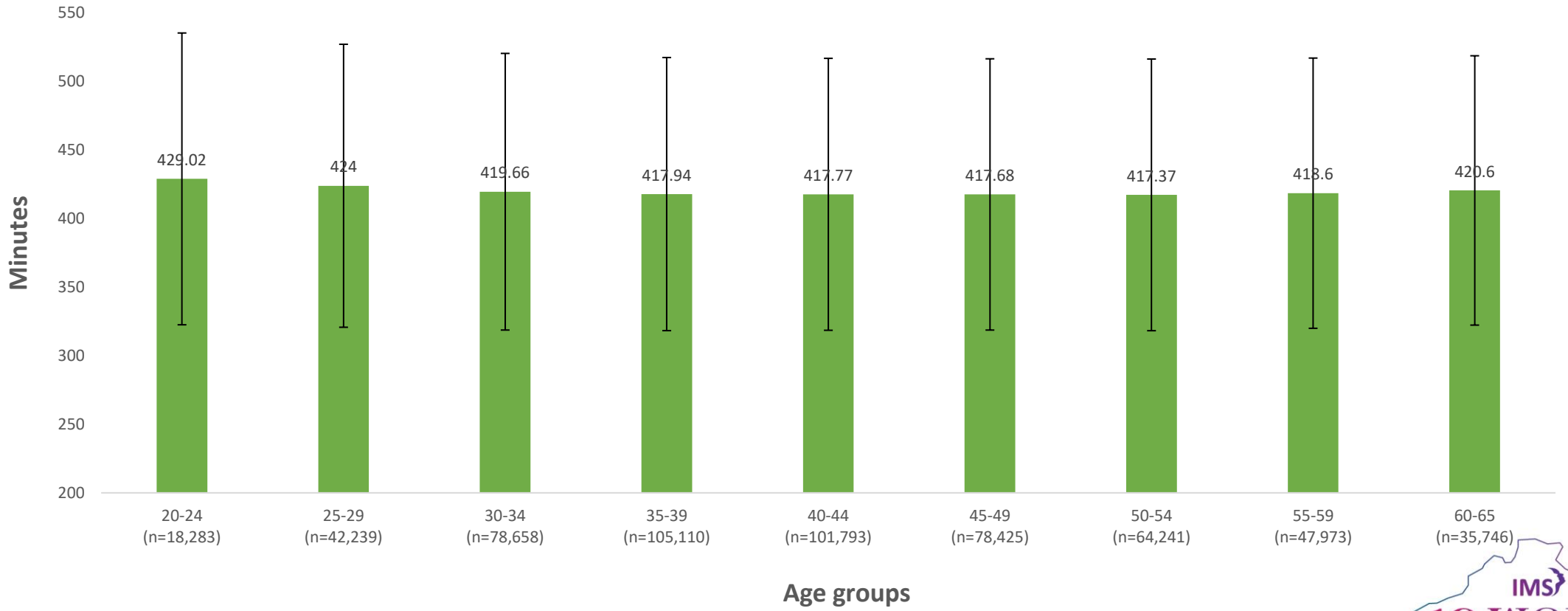
Results: Mean sleep duration



Mean sleep duration across female participants was ~7 hours at 419.02 (99.85) minutes. Average sleep duration was similar across all age groups.

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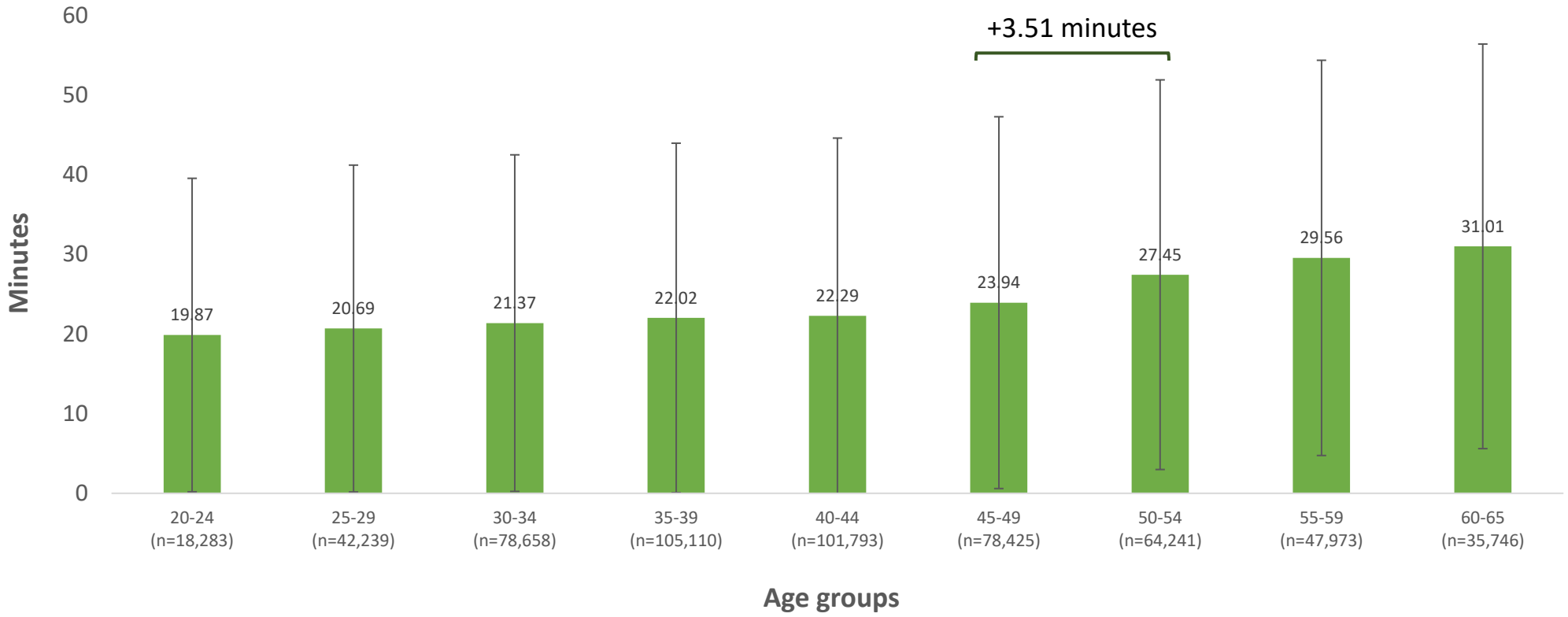
Results: Total wake after sleep onset time



Mean wake after sleep onset for female participants was 24.07 minutes, with the largest numerical increase between the 45-49 and 50-54 age groups, a period typically associated with the menopause transition.

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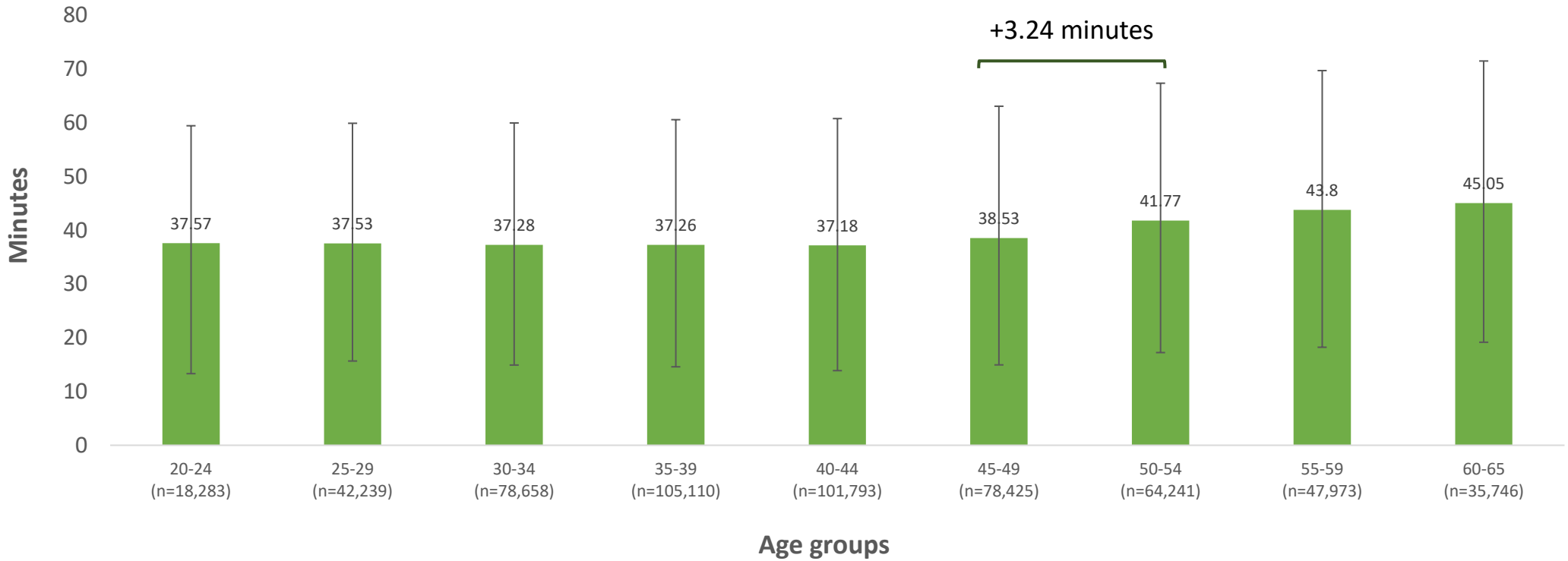
Results: Total awake time



Mean total awake time for female participants was 39.14 minutes, with the largest numerical increase between the 45-49 and 50-54 age groups.

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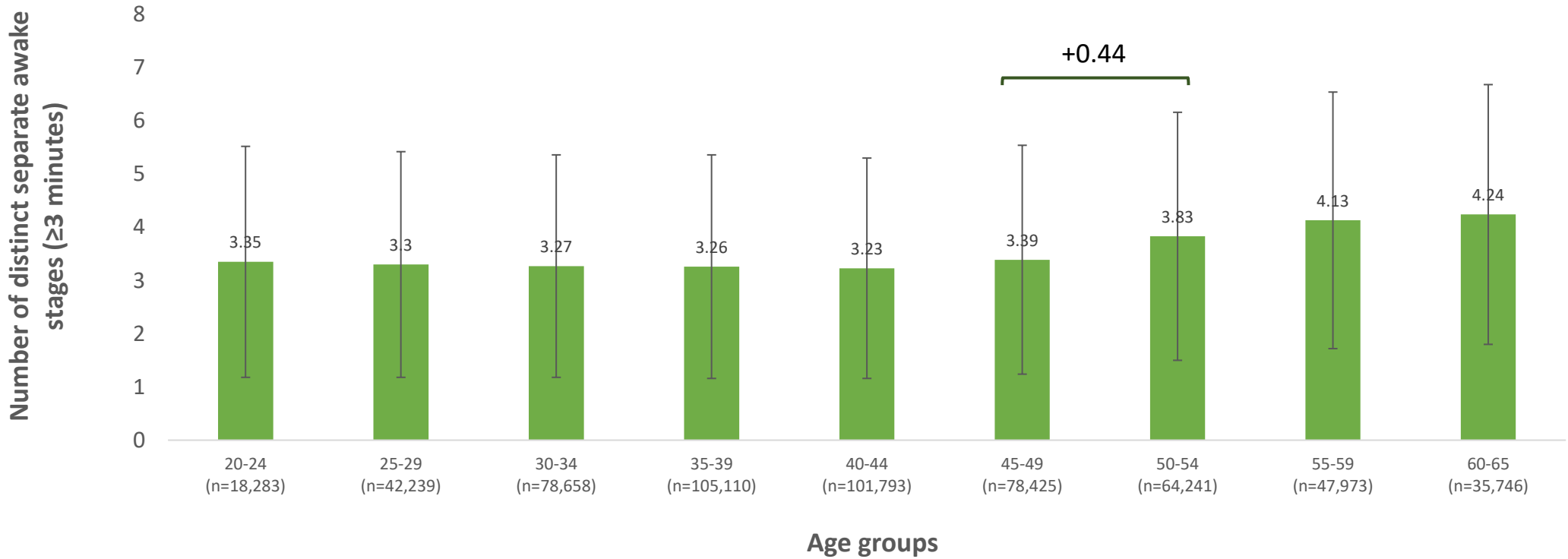
Results: Number of awakenings



Mean number of awakenings for female participants were 3.5, with women >50 years of age experiencing more awakenings than the overall average for women.

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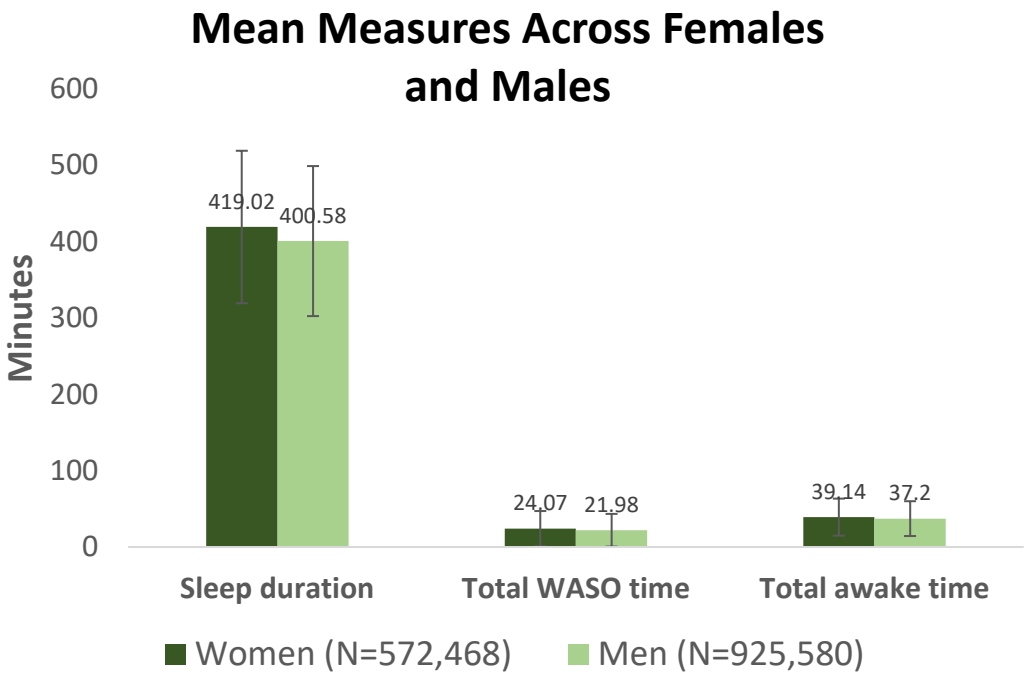
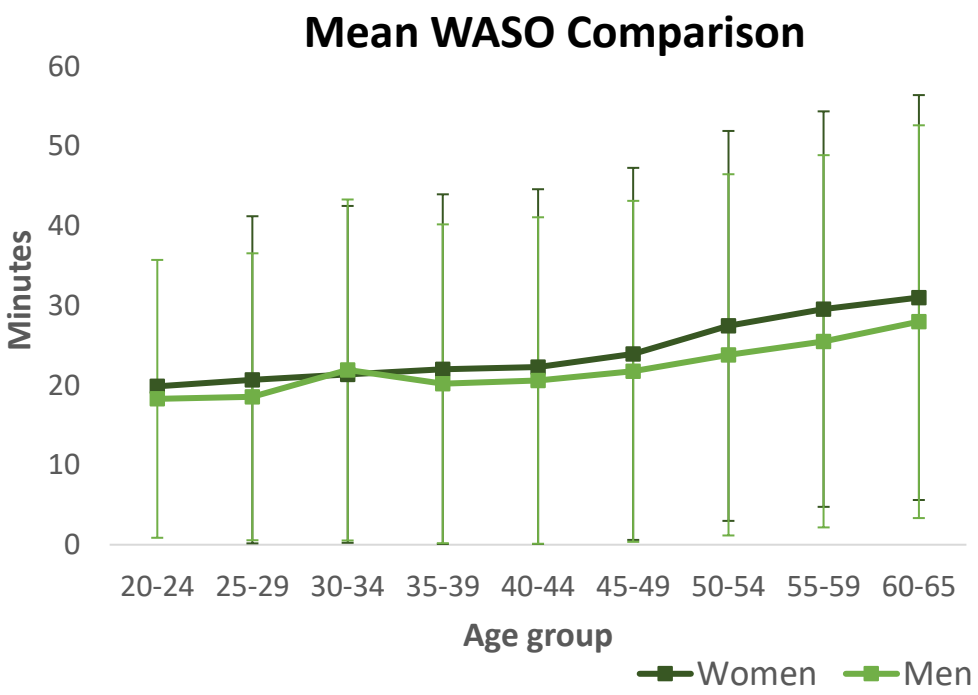
Results: Wake after sleep onset and total awake time in males





Mean sleep duration was shorter in males than females (400.58 vs. 419.02 minutes), though males experienced less wakefulness during the night. Both wake after sleep onset and total awake time were lower in males than females, with a steeper increase in these measures for women >45 years compared to men.

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Limitations

Sample Selection Bias

Data were collected from individuals who chose to use the smartwatch, introducing potential selection bias as this population may not represent the broader population.

Sporadic Measurements

The reliance on sporadic nightly measurements may lead to bias, as the nights captured might reflect unusually good or bad sleep patterns, rather than typical behavior.

Unaccounted Sleep Disruptors

The study does not account for external factors that may affect sleep, such as sleep apnea, restless legs, partner snoring, children, or pets, which could further influence the results.

Menopausal Status Not Pre-selected

The study did not preselect participants based on menopausal status, potentially affecting sleep outcomes influenced by menopause-related changes.

Conclusions: Cohort alignment and wearable validation

- The age and BMI distribution of the study cohort reflects that of the US population[1], which supports the broader relevance of the findings.
- The data trends from December 2023 (data not shown) and March 2024 were similar, indicating consistent results across different months.
- Sleep trends between age groups captured by the smartwatches align with findings from published sleep studies,[2-5] demonstrating that sleep parameters from smartwatches can be informative about population trends.
- The ESTeeM study, a prospective non-interventional study in the US, aims to address evidence gaps on sleep disturbances in women experiencing menopause, utilizing this smartwatch to gather objective data. The study design poster is available at IMS.

US, United States.

1. DQYDJ. BMI Distribution by Age Calculator for the United States. Available at: https://dqydj.com/bmi-distribution-by-age-calculator-for-the-united-states/ ; 2. Li J, et al. Sleep Med Clin. 2018 Mar;13(1):1-11; 3. Kurina LM, et al. Sleep Health. 2015 Dec;1(4):285-292; 5. Evans M, et al. Sleep 2021;44(9):zsab088; 5. Maki PM, et al. Menopause. 2024 Aug 1;31(8):724-733.

Conclusions: Impact of age and sex on sleep patterns

Sleep disturbances, including WASO and total awake time, appeared to increase with age, particularly among women ≥50 years old. These findings suggest that the menopausal transition may be associated with changes in sleep patterns.

The largest increase in WASO occurred between the 45-49 and 50-54 age groups in women, indicating a potential inflection point of sleep disturbance.

Male participants had a lower mean WASO and total awake time compared to females, and while their WASO also increased with age, this change was less pronounced than in women.

Further research is needed to better understand the implications of these findings, particularly for women in relation to menopausal status and potential interventions aimed at improving sleep quality during midlife.

WASO, wake after sleep onset.