risk, independent of mean total sleep time and mean sleep midpoint. Similarly, a ~31-minute increase in sleep onset time irregularity was associated with a 29% increased risk of hypertension (1.29 [1.18, 1.42]).

Conclusion: These novel findings provide insight into the potential important impact of sleep irregularity on cardiovascular health. Further assessment of day-to-day fluctuations in sleep duration and timing for potential effects on next-day blood pressure and other cardiovascular health outcomes are warranted.

Support (If Any): This was an unfunded investigator-initiated study. De-identified data were provided by Withings for unrestricted investigator-led analysis. PE serves as a consultant for Withings.

0205

SLEEP NEED: MORE INFLUENTIAL ON HEALTH AND DAYTIME FUNCTION THAN SLEEP DURATION?

Hannah Scott[1], Sarah Appleton[1], Amy Reynolds[1], Tiffany Gill[2], Yohannes Melaku[1], Robert Adams[1], Peter Catcheside[1], Michael Perlis[3]
Flinders Health and Medical Research Institute: Sleep Health, Flinders University [1] Adelaide Medical School, The University of Adelaide [2] Behavioral Sleep Medicine Program, Department of Psychiatry, University of Pennsylvania [3]

Introduction: Most prior research into relationships between sleep and health and daytime functioning have focused on average sleep duration or efficiency and ignored individual differences in sleep need. This study tested if sleep need is more strongly correlated with self-rated health and daytime function than sleep duration.

Methods: Data were drawn from the 2019 Sleep Health Foundation online survey of adult Australians (N=2,044, aged 18-90 years). Hierarchical multiple regressions assessed variance explained (R2 and R2 change) by demographics (Model 1: age, sex, BMI), self-reported sleep duration (Model 2: Model 1 + weighted variable of typical weekday/weekend sleep duration), and individual sleep need (Model 3: Model 2+ rating on a 5-point scale to 'how often you get enough sleep to feel your best the next day') on daytime function items for fatigue, concentration, motivation, and overall self-rated health (visual-analog scale from 0-100).

Results: Sleep need explained an additional 17.5–18.7% of the variance in fatigue, concentration, motivation, and health rating (all $p < 0.001$ for R2 change) in Model 3. In contrast, Model 2 showed that sleep duration alone only explained an additional 2.0–4.1% variance in these outcomes after accounting for demographic variables. Findings were similar when stratified by sex. Sleep need also explained greater variance for older adults than for younger and middle-aged adults, especially on health rating (Model 3: R2 change = 0.11 for ages 18-24y, 0.14 for 45-54y, 0.27 for 75y+).

Conclusion: Sleep need appears to explain considerably more variance in daytime function and self-rated health than sleep duration. The effect of sleep need on other daytime consequences, and in clinical populations, needs further exploration. Validated assessments of sleep need are also needed to elucidate its importance for understanding the effect of sleep on health and functioning.

Support (If Any): The 2019 Sleep Health Foundation online survey was supported by the not-for-profit Sleep Health Foundation using an unrestricted grant from Merck Sharp & Dohme (Australia) which did not inform nor restrict study design, methodology, or presentation.

0206

REST-ACTIVITY RHYTHMS ARE ASSOCIATED WITH SLEEP CHARACTERISTICS AND COGNITIVE FUNCTIONS IN PEOPLE WITH HEART FAILURE OVER 6 MONTHS

Sangchoon Jeon[1], Samantha Conley[1], Meghan O'Connell[1], Raymond Yang[1], Nancy Redeker[1]
Yale School of Nursing [1]

Introduction: People with Heart failure (HF) often suffer from sleep deprivation and poor cognitive function. The purpose of this study was to examine the extent to which repeatedly measured rest-activity rhythms (RARs) measured with wrist actigraphy predict sleep characteristics and cognitive function in people with HF.

Methods: We measured insomnia severity (ISI), sleep quality (Pittsburgh sleep quality index: PSQI), sleepiness (Epworth sleepiness scale: ESS), psychomotor vigilance (Psychomotor vigilance test: PVT), and quality of life (Euroqol 5D) among people with HF patients who participated in a randomized controlled trial of cognitive behavioral therapy for insomnia vs. HF self-management education at baseline, 3-, and 6-months post-intervention. We performed cosinor analysis with 24-hour rest-activity counts obtained with 7 days of wrist actigraphy at each time point and calculated the circadian quotient, which represents the strength of RARs. We used the Generalized Linear Mixed Model with random intercepts to examine the association between the circadian quotient, sleep characteristics, cognitive function, and quality of life after adjusting for time-group interactions over 6 months. Statistical significance for standardized coefficients was accepted at 5% type I error.

Results: The analysis included 162 participants with HF and insomnia (Insomnia severity index >7) who completed actigraph monitoring for at least 7 days at baseline There was no significant change in the mean circadian quotient (Mean=0.78, SD=0.16) over 6 months. After adjusting for significant intervention effects, a greater circadian quotient was statistically associated with lower insomnia severity (-0.11±0.05), sleepiness (-0.12±0.05), sleep quality (-0.15±0.05), longer sleep duration (0.33±0.04) and better sleep efficiency (0.13±0.05). The circadian quotient was positively associated with cognitive function measured by fewer PVT lapses (-0.11±0.05) and quality of life (0.12±0.05).

Conclusion: In addition to the significant intervention effects for insomnia, HF patients may benefited from strengthening RAR to improve sleep characteristics, cognitive function, and quality of life. Further research to assess the contributions of RAR in people who received the intervention for insomnia and the HF self-education separately is recommended.

Support (If Any): R01NR016191 and P20NR014126

0207

MOTHERS' ADVERSE CHILDHOOD EXPERIENCES AND PROTECTIVE FACTORS ARE ASSOCIATED WITH REST-ACTIVITY RHYTHMS IN THEIR CHILDREN

Eileen Condon[1], Sangchoon Jeon[2], Lois Sadler[2], Nancy Redeker[2]
University of Connecticut School of Nursing [1] Yale School of Nursing [2]

Introduction: Mothers' history of adverse childhood experiences (ACEs; e.g. maltreatment, household dysfunction) are associated with poor health outcomes in their children, but mechanisms underlying this intergenerational transmission are poorly understood. Given links between circadian rhythm and the stress-response system, we test the hypothesis that maternal ACEs influence child

health through disrupted rest-activity rhythm (RAR) in the mother and child. We also explore whether mothers' benevolent childhood experiences (BCEs) are protective against disrupted RAR.

Methods: We conducted a cross-sectional pilot study of maternal-child dyads with preschool-age children. Mothers reported history of childhood adversity (ACEs Scale, Childhood Trauma Questionnaire) and protective factors (BCE Scale). Dyads wore wrist actigraphs for 8-10 days and mothers completed daily electronic diaries. Nonparametric measures of RAR (e.g. interdaily stability [IS], intradaily variability [IV]) were calculated. We used linear regression to examine associations between mothers' childhood history and maternal and child RAR measures, controlling for household size and maternal employment.

Results: Maternal-child dyads (N=20) identified as white (75%), Black (15%), and Hispanic/Latina (10%). Mean child age was 4.2 years (40% female). Average household size was 4.5 ±.1.1 and 65% of mothers were employed. Forty-two percent of mothers reported 1-2 ACEs and 25% reported 3 or more ACEs. Maternal childhood history was not associated with mothers' RAR. However, maternal ACEs and CTQ total score were associated with decreased child IS (ACEs: β= -0.47, SE=0.01, p=.02; CTQ total: β= -0.53, SE=.01, p=.001) and increased child IV (ACEs: β=0.29, SE=.01, p=.051; CTQ total: β=0.38, SE+.00, p=.03). CTQ subscales revealed maternal childhood physical abuse (β= -0.54, SE=.01, p<.0001), emotional abuse (β= -0.42, SE=.00, p=.002), and sexual abuse (β= -.73, SE=.00, p<.0001) were associated with decreased child IS, while maternal childhood emotional neglect was associated with increased child IV (β= 0.39, SE=.01, p=.04). Maternal BCEs were associated with decreased child IV (β= -0.44, SE=.01, p=.03).

Conclusion: Maternal ACE history may influence child health through effects on children's circadian rhythm (i.e. decreased synchronization, increased fragmentation), while maternal BCEs may protect against rhythm fragmentation. Additional research is needed to support these novel preliminary findings.

Support (If Any): National Institute of Nursing Research (K99NR018876) and American Nurses Foundation.

0208

DAYTIME ALERTNESS QUANTIFICATION AND MODELLING: RESULTS FROM A LARGE OBSERVATIONAL STUDY

Shawn Barr[1], Gary Garcia-Molina[1]
Sleep Number Labs [1]

Introduction: Subjective alertness variations throughout the day can be characterized using the two-process model (TPM) of sleep regulation, which combines sleep homeostasis and the circadian rhythm to derive a theoretical daytime alertness curve. The TPM has been adopted to model the effect of sleep deprivation on memory, circadian misalignment, temperature regulation, and brain function; however, despite its broad influence, evidence supporting the TPM-derived alertness comes largely from small-scale, controlled studies. Here, we show that a similar three-parameter alertness measure can scale to a large study sample under real-world conditions.

Methods: Subjective alertness was voluntarily rated on a scale from 1 to 10 by Sleep Number smart bed users (N=22 499) through the SleepIQ app. Three age groups (18–40, 41–65, and 66–90 years) were analyzed. A 3-parameter version of the TPM-derived alertness curve was fit to the self-rated alertness responses using nonlinear least-squares fitting.

Results: A total of 65 528 sleep sessions were gathered over 95 days and analyzed. Overall, subjective alertness followed a similar trend to that reported in published literature: mean hourly alertness increased in the morning, dipped slightly in the afternoon, increased during the evening, and dropped again during the night. In contrast to previous studies, mean alertness ratings only changed by approximately 1 unit from low to high, and a greater increase in alertness occurred from afternoon to evening. Age-group analyses found that youngest sleepers' mean daily alertness was more stable throughout the day, and the amplitude of alertness variation decreased with age. These experimental results showed high agreement with model prediction (R2=0.96, P<0.001).

Conclusion: Overall, our results were similar to previous reports, with the exception of a small absolute change over the course of the day (about 1 unit) and an evening peak in alertness that was more pronounced in our data. These results show that the TPM-derived alertness can effectively predict daily alertness trends in a large sample under real-world conditions.

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0209

THE EFFECT OF TIME OF DAY OF COVID-19 VACCINATION AND OTHER COVARIATES ON SIDE EFFECTS

Sara Abbaspour[1], Wei Wang[2], Gregory Robbins[1], Elizabeth Klerman[1]
Massachusetts General Hospital [1] Brigham and Women's Hospital / Harvard Medical School [2]

Introduction: Circadian rhythms have critical roles in human health. We quantified the effect of time-of-day of COVID-19 vaccination and other covariates on self-reported side effects post vaccination.

Methods: The dataset was created from MassGeneralBrigham (MGB) electronic health records and REDCap survey that collected self-reported symptoms for 1-3 days after each immunization. Variables are demographics (age, sex, race, and ethnicity), vaccine manufacturer, clock time of vaccine administration/appointment, any COVID-19 diagnosis/positive test prior to vaccination, any history of allergy, and any note of epinephrine self-injection (e.g., EpiPen) medication. Time of day groupings were morning (6 am–10 am), midday (10 am–2 pm), late afternoon (2 pm–6 pm) or evening (6 pm–10 pm). Side effects were classified as Allergic (Rash; Hives; Swollen lips, tongue, eyes, or face; Wheezing) and Non-Allergic (New Headache, New Fatigue, Arthralgias, Myalgias, Fever) symptoms. The study was approved by the MGB IRB.Machine learning (ML) techniques (e.g., extreme gradient boosting) were applied to the variables to predict the occurrence of side effects. Stratified k-fold cross validation was used to validate the performance of the ML models. Shapley Additive Explanation values were computed to explain the contribution of each of the variables to the prediction of the occurrence of side effects.

Results: Data were from 54,844 individuals. On day 1 after the first vaccination, (i) females, people who received the Moderna vaccine, and those with any allergy history were more likely to report Allergic side effects; and (ii) females, people who received the Janssen vaccine, those who had prior COVID-19 diagnosis ,and those who received their vaccine in the morning or midday and were more likely to report