DISPARITIES IN YOUTH SLEEP: LONGITUDINAL AND MULTILEVEL ASSOCIATIONS WITH RACISM

PREVENTION SCIENCE METHODOLOGY GROUP
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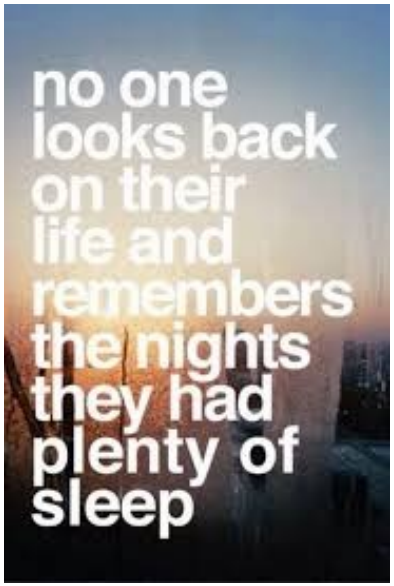
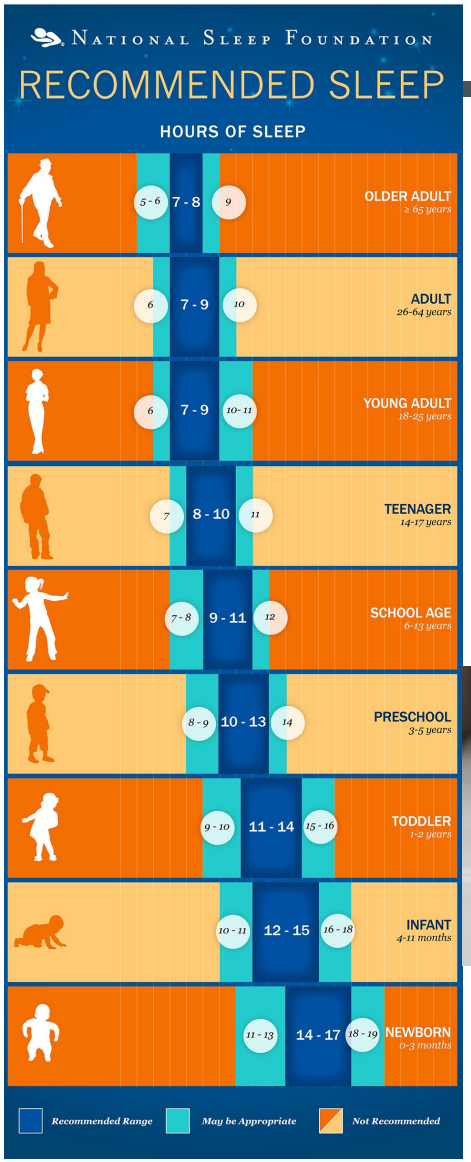
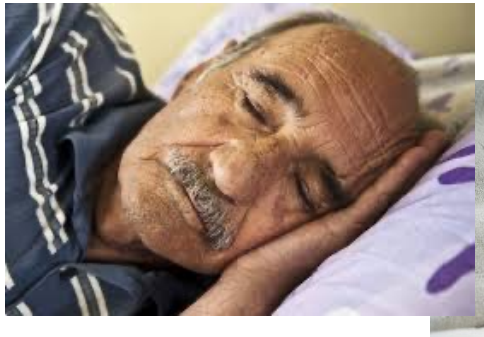


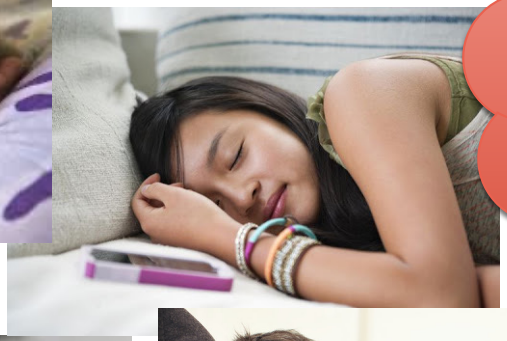
SLEEP: BIOLOGICAL NECESSITY OR WASTE OF TIME?

MOST* ANIMALS SLEEP



...HUMANS SLEEP





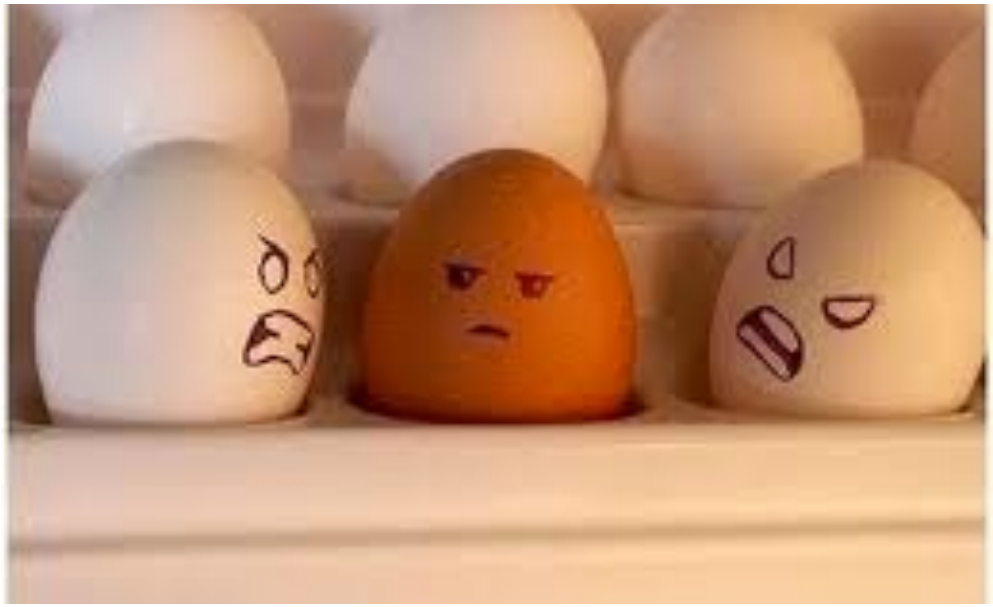
- 2/3s of Americans take something to help them sleep
- In 2021, Americans spent $65b in sleep aids
- By 2025, market projected to be $115b

DESPITE BEING A BIOLOGICAL NECESSITY, SLEEP IS SHAPED BY:

Macro-level sociocultural, environmental and systemic factors

Micro-level physical and social contexts

DISCRIMINATION & RACIAL DISPARITIES IN SLEEP



- Review of discrimination and sleep disturbances, 17/17 studies reported a significant association between discrimination and sleep

Slopen, Lewis & Williams, 2015

ROADMAP

- Race-related disparities in sleep
  - middle childhood through young adulthood
- Race-related discrimination and sleep
  - daily processes
  - reciprocal dynamics
- Macro-systems and sleep
  - C-19 pandemic
  - crime
  - school start times
- Protective functions of sleep

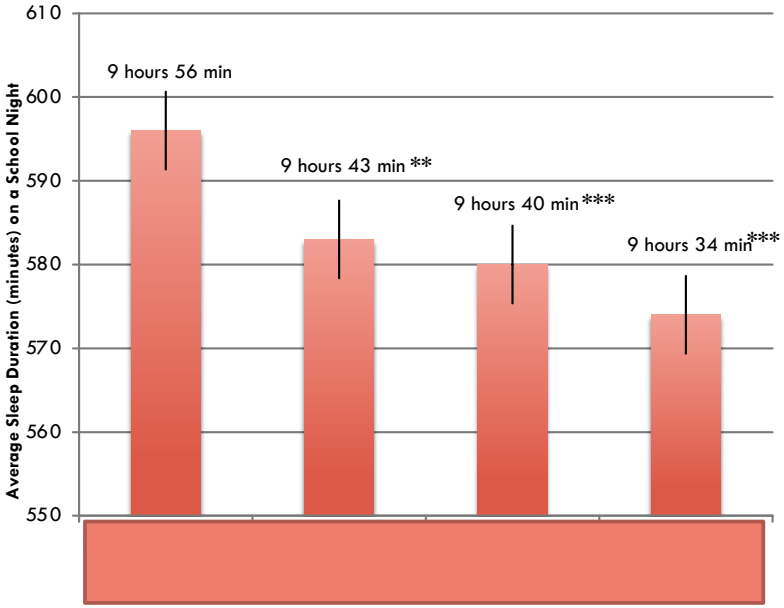
RACE-BASED DISPARITIES IN SLEEP

PATTERNS DURING MIDDLE CHILDHOOD AND YOUNG ADULTHOOD

RACIAL SLEEP DISPARITIES AMONG MIDDLE CHILDHOOD -
NYC CHILD COMMUNITY HEALTH SURVEY

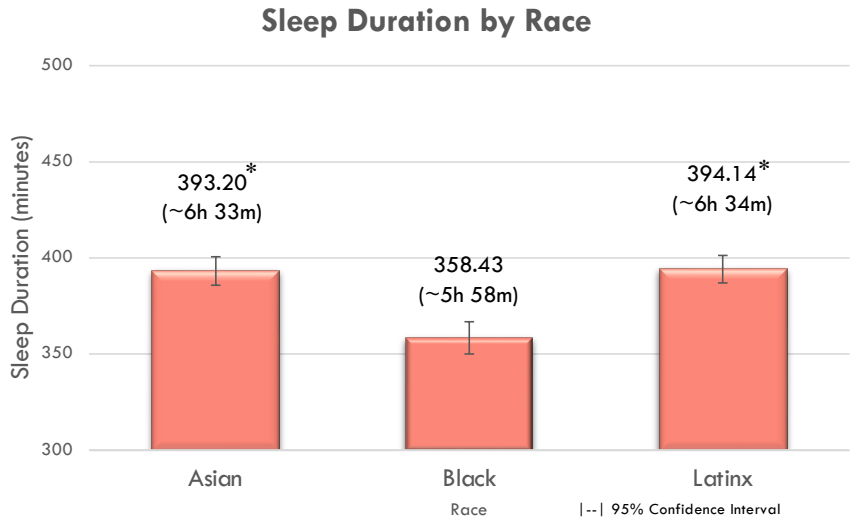
- 1389 youth ages 6-12 ($\overline{X}$ = 9.19), 2009
- Population-based analysis
- Parent report
- Sleep duration: "typical" bed and wake time on school day ($\overline{X}$ = 9h 46m, SD = 50m)

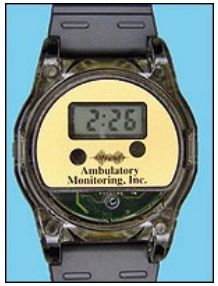
Ethnic/racial differences in sleep duration



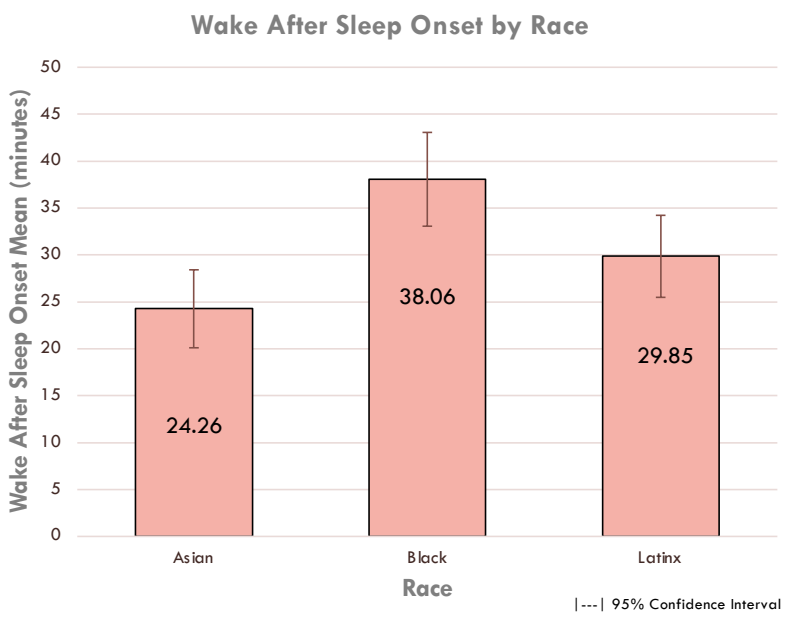
Adjusting for: bedtime, age, SES, media use, asthma, nativity, neighborhood safety, crowding, physical activity.
Yip, Cheon, Wang, Deng & Seligson, 2020

RACIAL SLEEP DISPARITIES AMONG ADOLESCENTS - ACTIGRAPHY





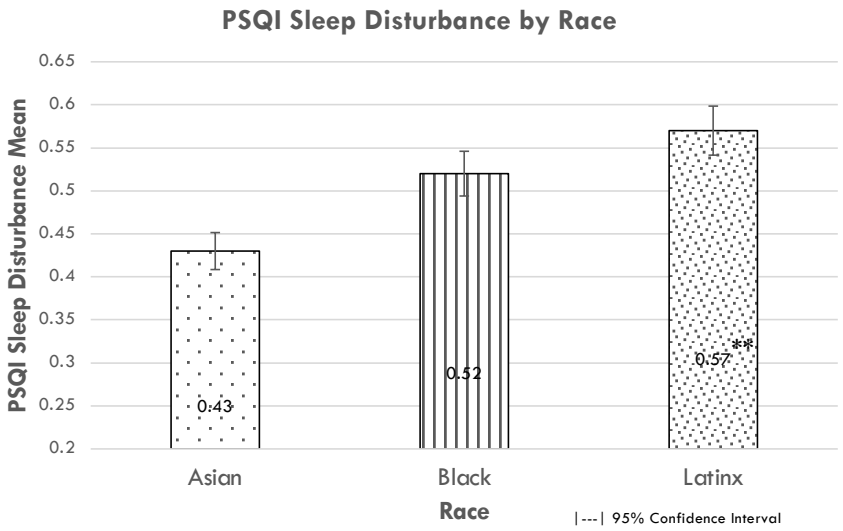
Racial differences in actigraphy
Notes: Asian (35") & Latinx (36") > Black
Average sleep duration = 7h 42m
8-10hrs/night recommended

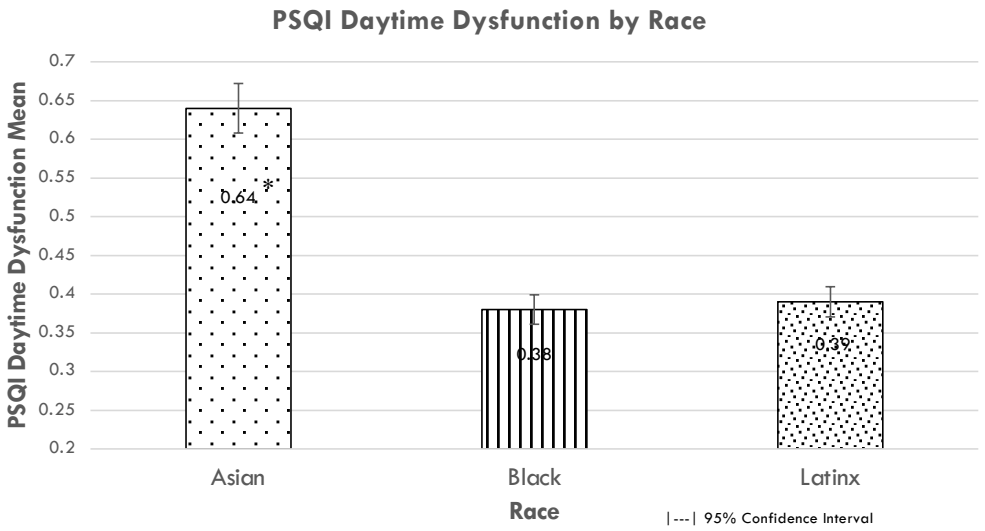


Notes: Black, Latinx > Asian**; Black > Latinx**

Yip, Cheon, Wang, Cham, Tryon & El-Sheikh, 2019

RACIAL SLEEP DISPARITIES AMONG ADOLESCENTS – SELF-REPORT

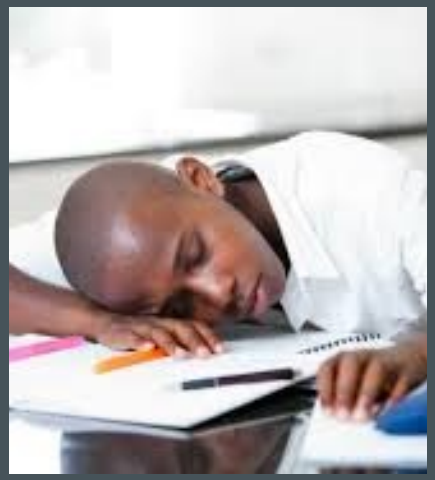




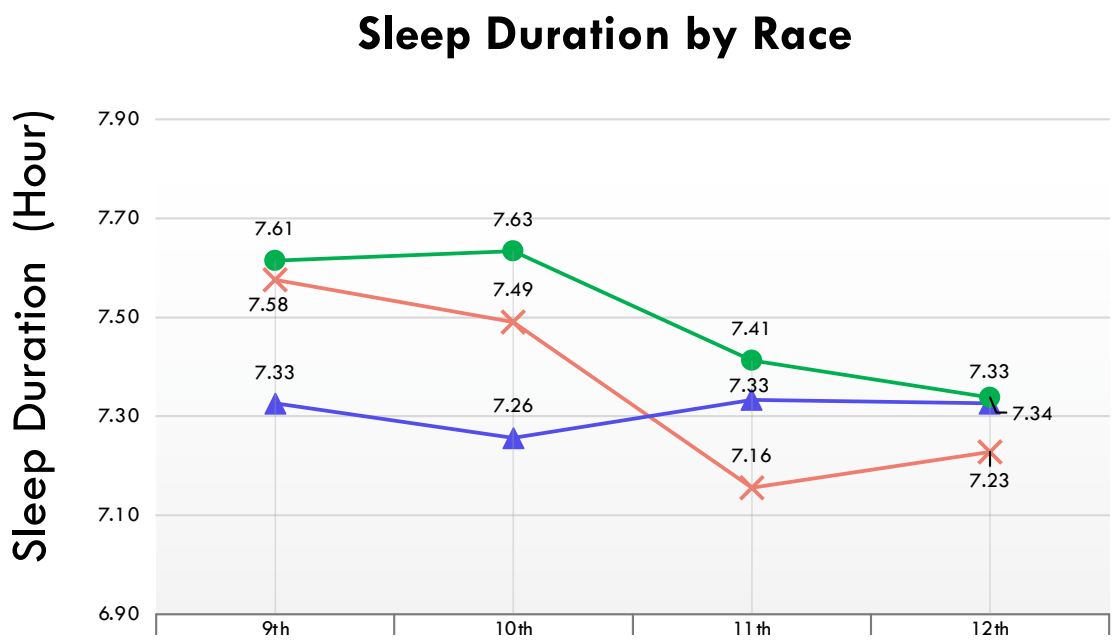
Latinx > Asian
Adjusting for: gender, weekday/end

Asian > Black, Latinx
Yip, Cheon, Wang, Cham, Tryon & El-Sheikh, 2019

DO 10-20 MINUTE DIFFERENCES IN SLEEP DURATION MATTER?



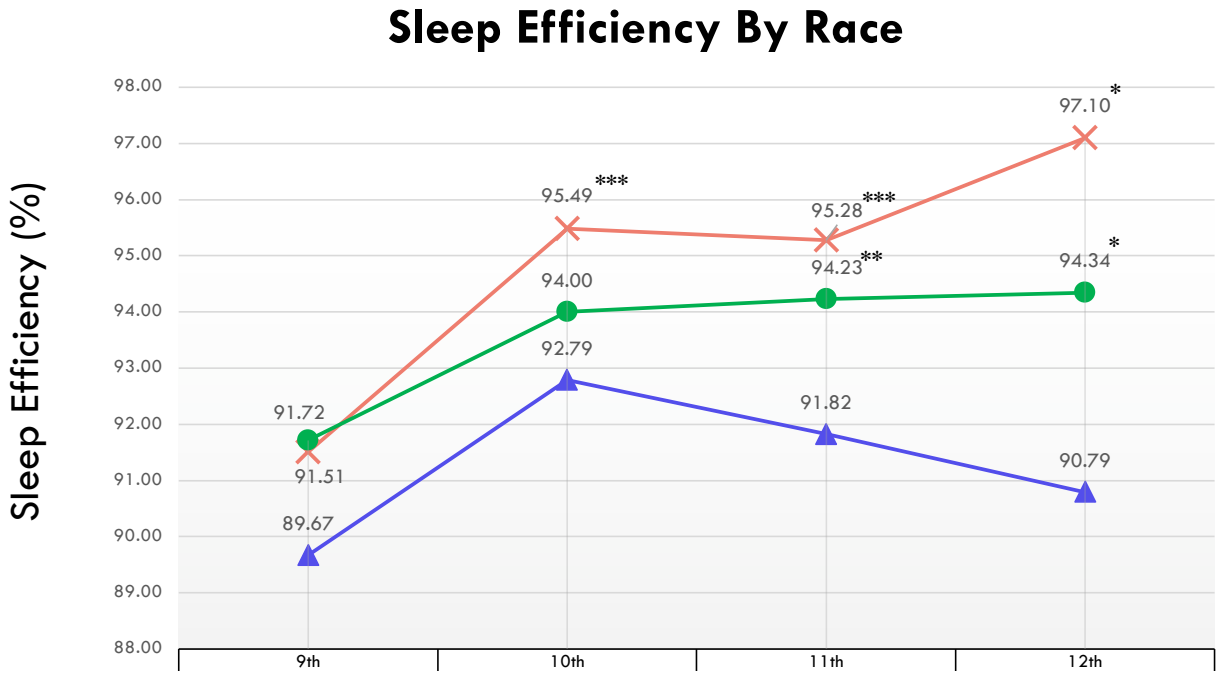
SLEEP ACROSS HIGH SCHOOL



Notes:

9th – 12th: No significant differences among groups;

SLEEP ACROSS HIGH SCHOOL



Notes:

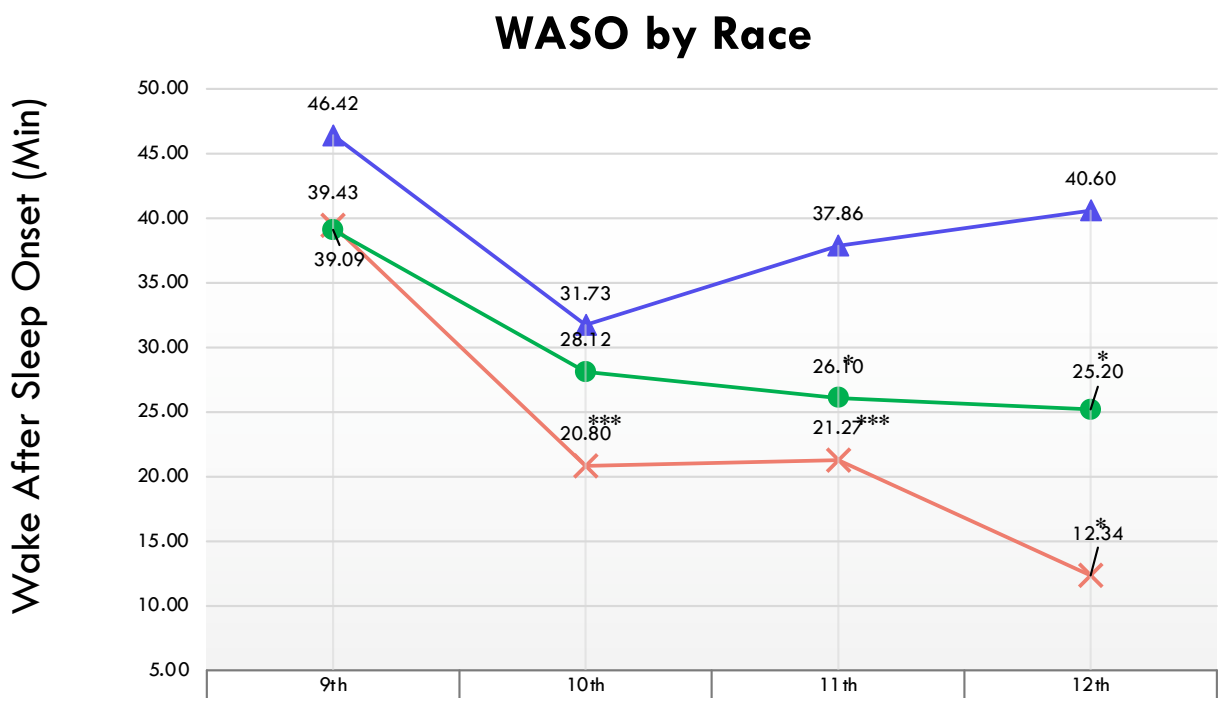
9th: No significant differences among groups;

10th: Asian*** > Black, Asian** > Latinx ;

11th: Asian*** > Black, Latinx** > Black;

12th: Asian* > Black, Latinx* > Black;

SLEEP ACROSS HIGH SCHOOL

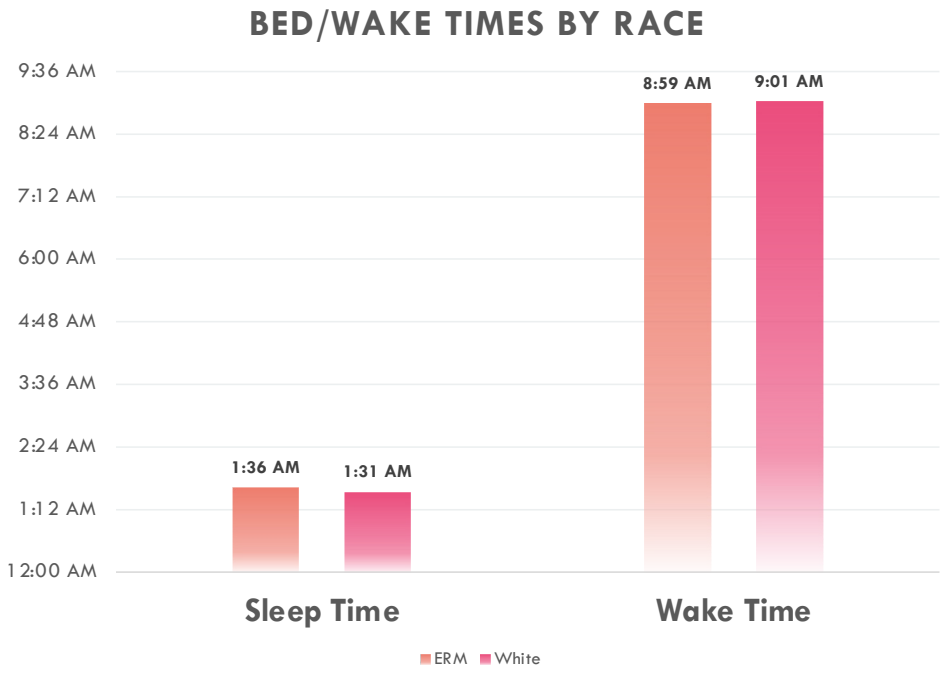


Notes:
9th: No significant differences among groups;
10th: Asian*** < Black, Asian** < Latinx ;
11th: Asian*** < Black, Latinx* < Black;
12th: Asian* < Black, Latinx* < Black;

1ST SEMESTER SLEEP DURATION (ACTIGRAPHY)

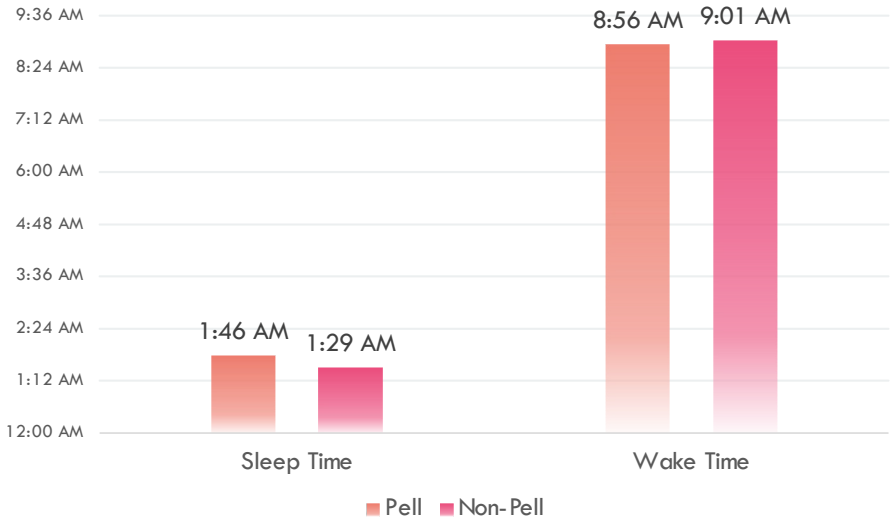
Differences in Duration
White: 7h27m
ERM: 7h20m

Duration	7h42m	SD = 1.8hrs
Wake Time	9:00 am	SD = 1.67 hrs
Bed Time	1:34 am	SD = 1.20 hrs

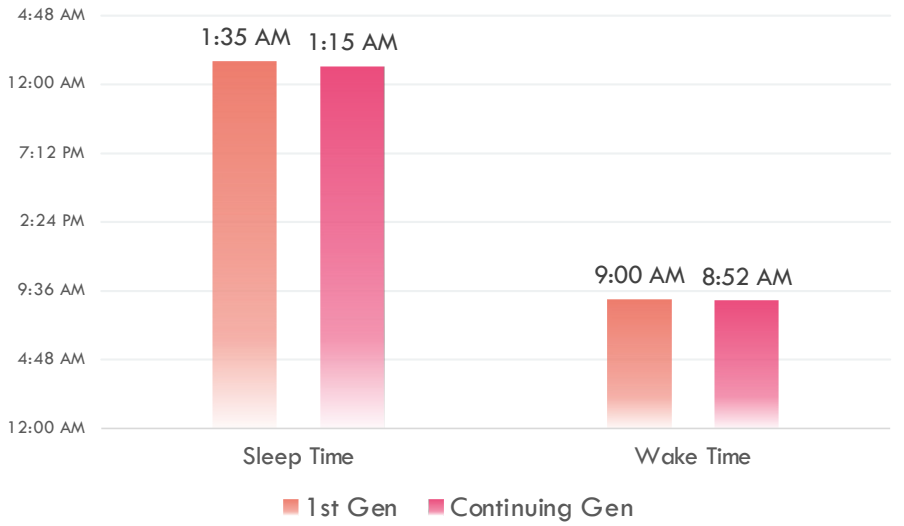


1ST SEMESTER SOCIODEMOGRAPHIC DISPARITIES

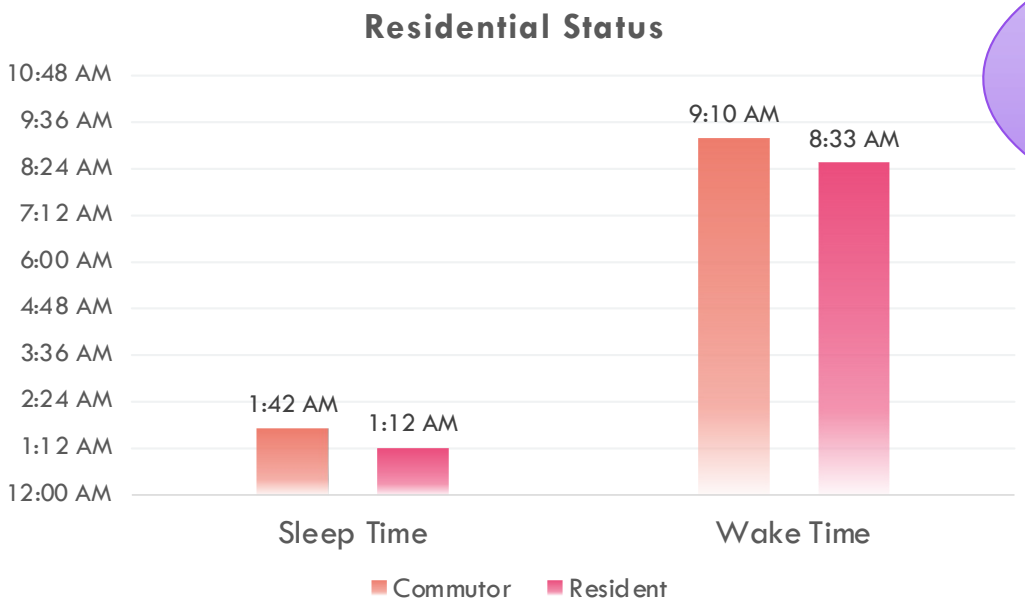
Differences in Duration
Pell: 7h09m
Non-Pell: 7h29m



Differences in Duration
1st Gen: 7h23m
Continuing Gen: 7h37m

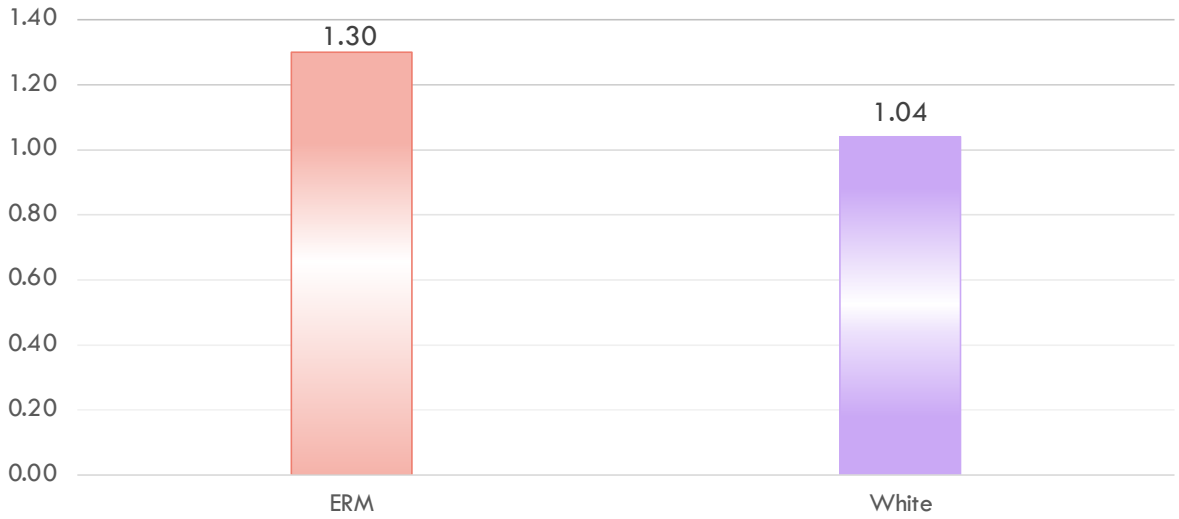


1ST SEMESTER SOCIODEMOGRAPHIC DISPARITIES



Differences in Duration*
Commuter: 7h25m
Resident: 7h21m

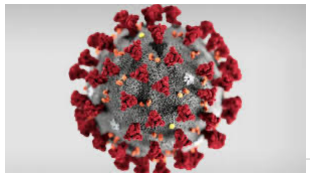
INSOMNIA SEVERITY INDEX



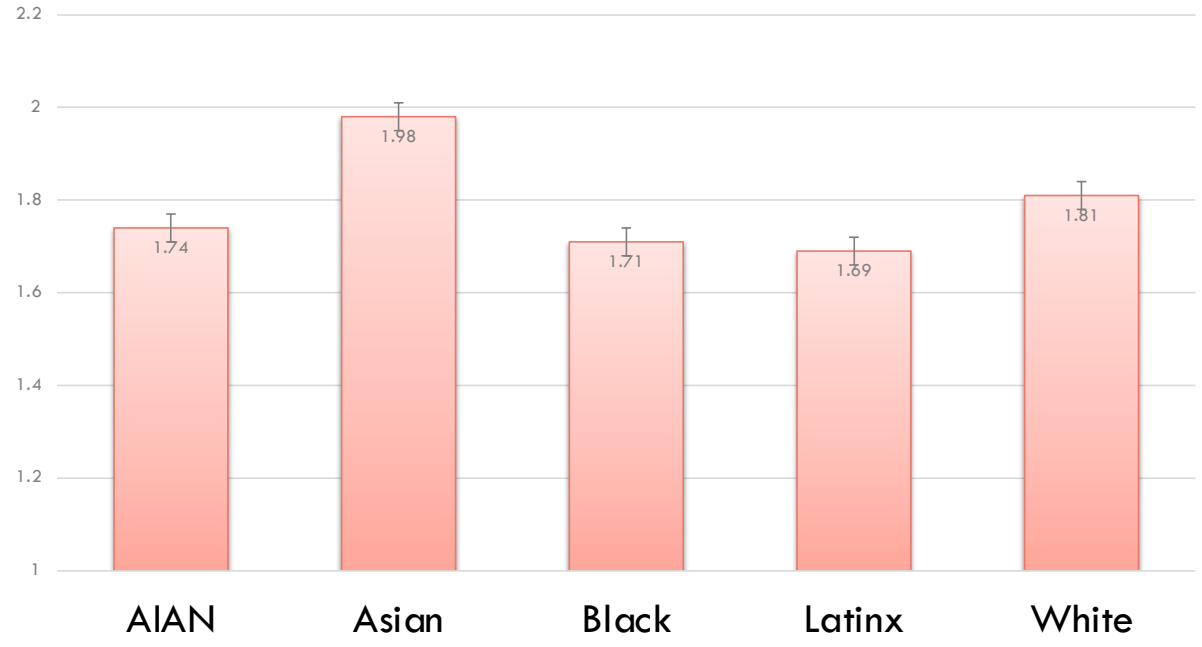
$t = -2.10$, $df = 305$, $p = .036$

SLEEP QUALITY DISPARITIES AMONG YOUNG ADULTS (18-25) DURING A PANDEMIC

"during the past month, how much did you have trouble sleeping…"
1 (= not at all) to 4 (= three or more times a week)** reverse scored



Sleep Quality



Asian > AIAN*, Black**, Latinx**, White**

Data collected April 2020, Yip et al., 2021

SUMMARY: RACIAL DISPARITIES ACROSS THE LIFESPAN

- Evidence for sleep disparities by race from middle childhood through young adulthood on various indicators of sleep
- General patterns support more and better quality sleep for White individuals compared to populations of color
- Specific disparities depends upon sleep dimension and measurement

Nat Sci Sleep. 2019; 11: 79–95.
Published online 2019 Jul 23. doi: 10.2147/NSS.S169312
PMCID: PMC6664254
PMID: 31440109

Are sleep patterns influenced by race/ethnicity – a marker of relative advantage or disadvantage? Evidence to date

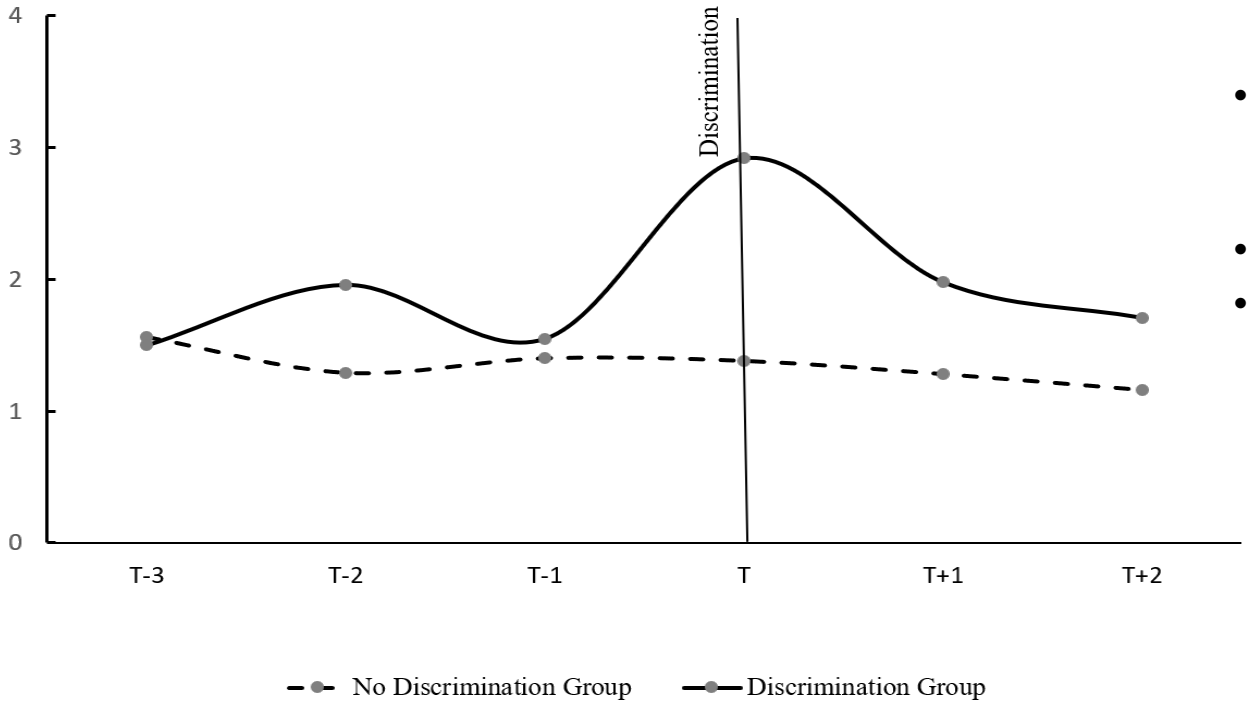
Dayna A Johnson,[1,2] Chandra L Jackson,[3,4] Natasha J Williams,[5] and Carmela Alcántara[6]

Nat Sci Slee

DISCRIMINATION AND SLEEP

Daily-level processes

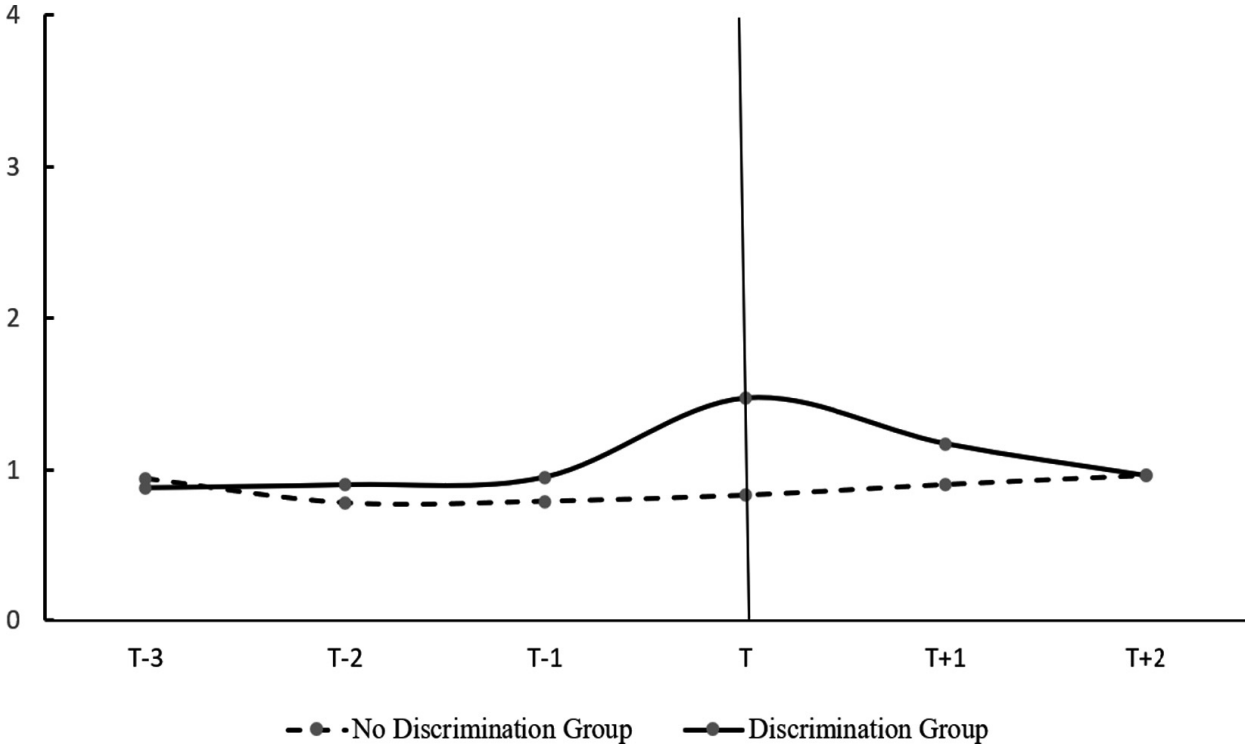
DAILY IMPACT OF DISCRIMINATION ON SLEEP DISTURBANCE



- Daily discrimination was associated with same-night increases in sleep disturbance (Cohen's *d* = .55)
- 80% reduction by T+1
- Effects were more pronounced for: girls, multiracial youth

Xie, Yip, Cham & El-Sheikh, 2021

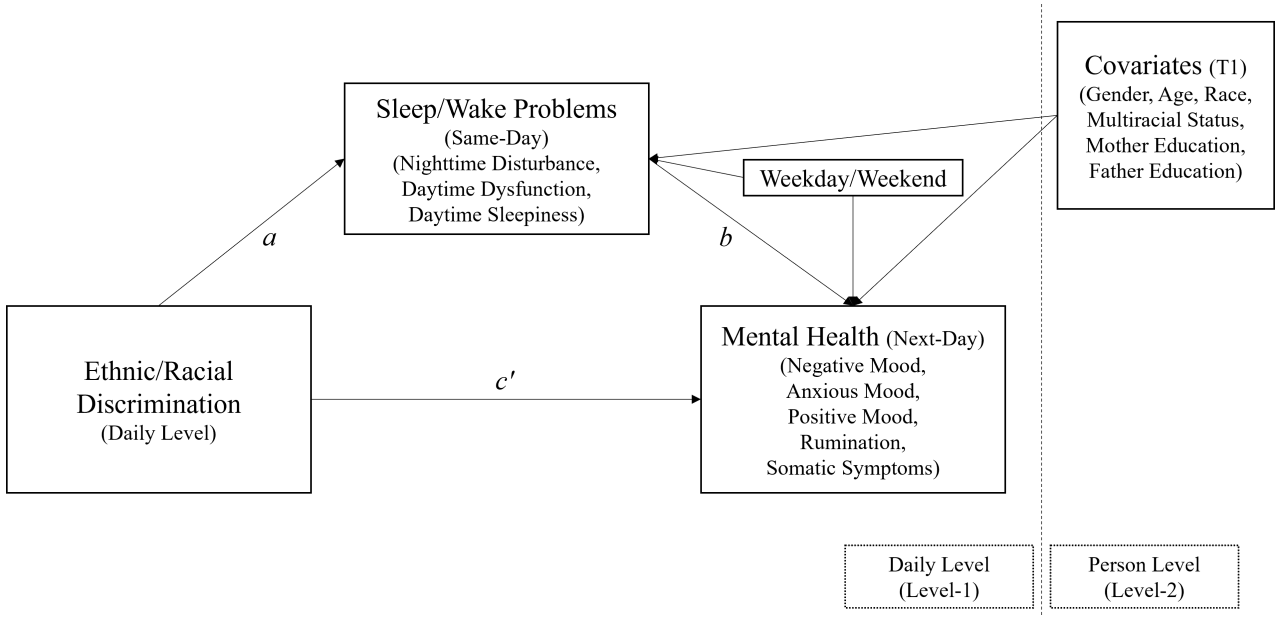
DAILY IMPACT OF DISCRIMINATION ON DAYTIME DYSFUNCTION



- Daily discrimination was associated with next-day increases in daytime dysfunction (Cohen's *d* = .51)
- 50% reduction by T+1
  - Multiracial youth reduced by a greater %
- Effects were more pronounced for: weekday discrimination, multiple reports of discrimination

Xie, Yip, Cham & El-Sheikh, 2021

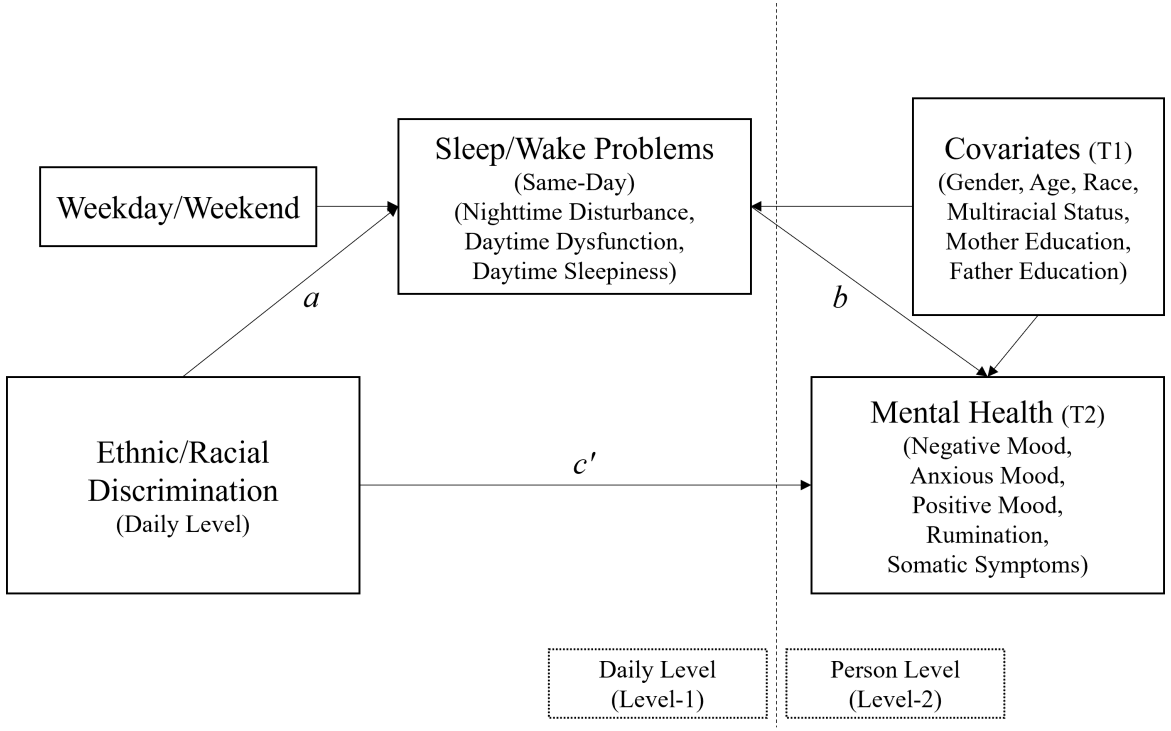
DAILY-LEVEL SLEEP MEDIATES DAILY-LEVEL DISCRIMINATION AND MENTAL HEALTH OUTCOMES (1-1-1 MODEL)



- Discrimination -> (same day) nighttime disturbance -> (next day) negative mood, anxious mood, rumination, somatic symptoms and positive mood
- Similar mediated effects for daytime dysfunction and daytime sleepiness

Yip, Xie, Cham & El-Sheikh, 2022

DAILY-LEVEL SLEEP MEDIATES DAILY-LEVEL DISCRIMINATION AND PERSON-LEVEL MENTAL HEALTH OUTCOMES (1-1-2 MODEL)



- Discrimination -> (same day) nighttime disturbance -> (past 2 weeks) negative mood, anxious mood, rumination and somatic symptoms
- Similar mediated effects for daytime dysfunction and daytime sleepiness

Yip, Xie, Cham & El-Sheikh, 2022

DISCRIMINATION AND SLEEP

Daily-level processes : reciprocal dynamics

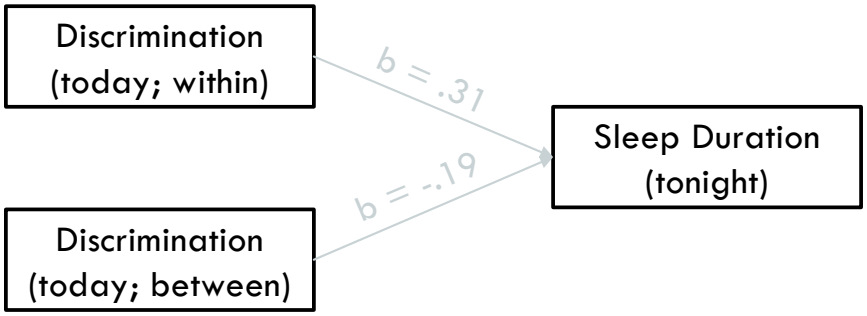
RECIPROCAL DYNAMICS BETWEEN DISCRIMINATION AND SLEEP DURATION

Discrimination is a count of 4 items

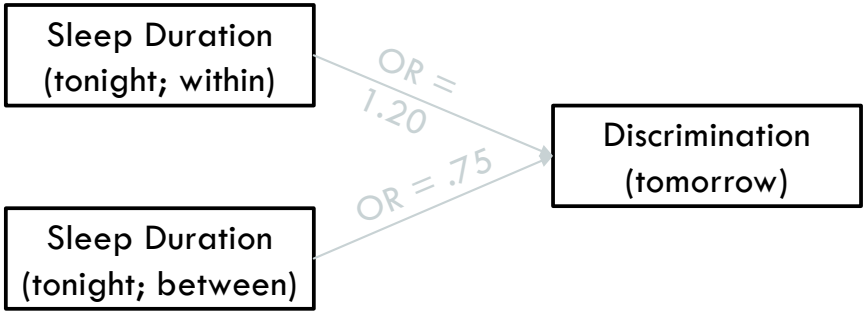
Last night, how many hours of actual sleep did you get?

Adjusts for age, gender, generational status

Discrimination → Sleep Duration



Sleep Duration → Discrimination (Dichotomized)



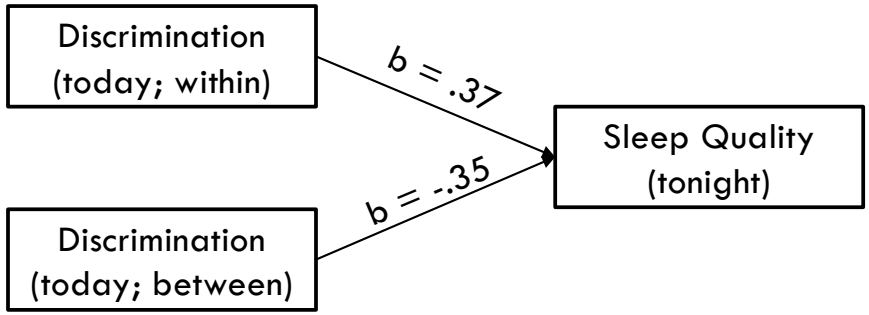
RECIPROCAL DYNAMICS BETWEEN DISCRIMINATION AND SLEEP QUALITY

Discrimination is a count of 4 items

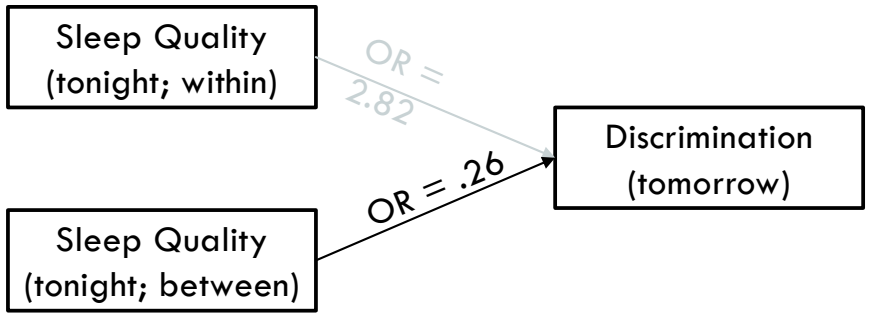
Last night, how would you rate your sleep quality overall?

Adjusts for age, gender, generational status

Discrimination → Sleep Quality



Sleep Quality → Discrimination (Dichotomized)



1 unit increase in report of sleep quality was associated with a 74% decreased likelihood of reporting discrimination the next day

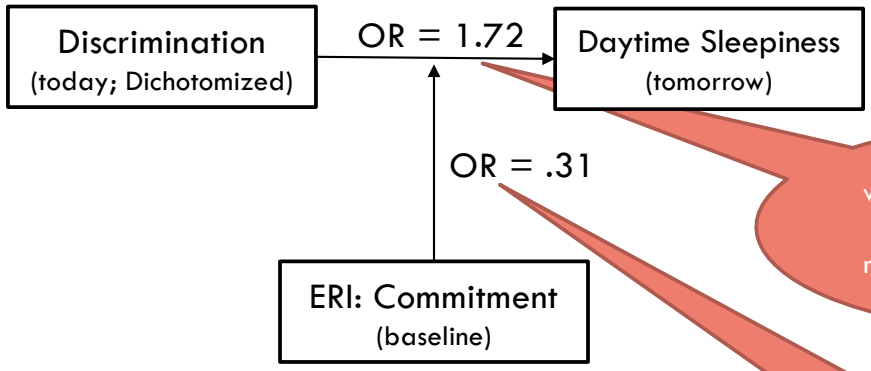
RECIPROCAL DYNAMICS BETWEEN DISCRIMINATION AND DAYTIME SLEEPINESS

Discrimination is dichotomized

Today, did you have trouble staying awake while studying, eating meals, or engaging in social activity?

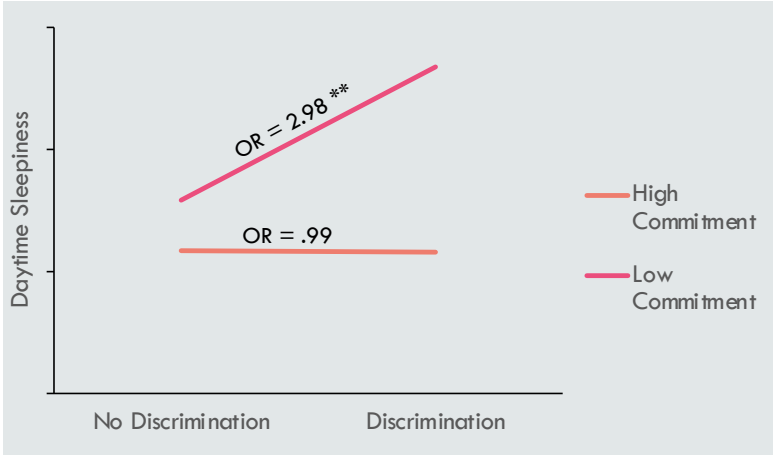
Adjusts for age, gender, generational status

Discrimination → Daytime Sleepiness (Binary)



Experiencing discrimination was associated with a 185% increased likelihood of reporting daytime sleepiness the next day

This likelihood increases to 198% for youth who report low levels of ERI commitment



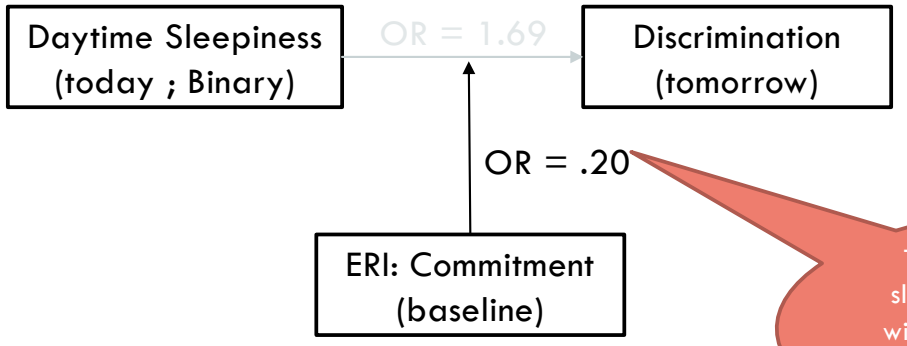
RECIPROCAL DYNAMICS BETWEEN DISCRIMINATION AND DAYTIME SLEEPINESS

Discrimination is dichotomized

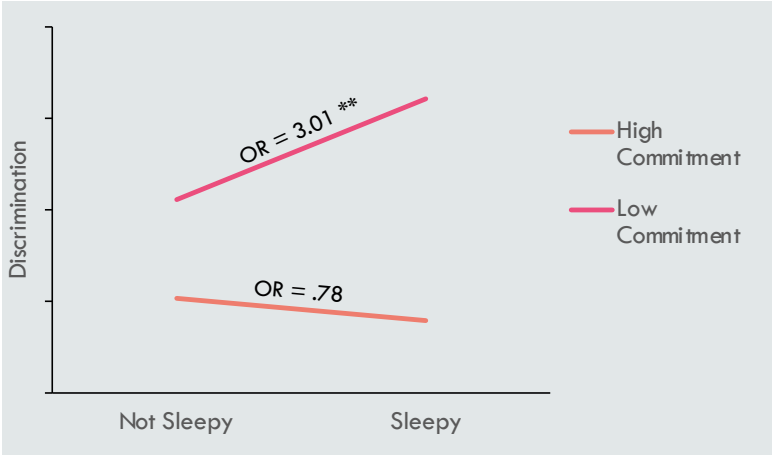
Today, did you have trouble staying awake while studying, eating meals, or engaging in social activity?

Adjusts for age, gender, generational status

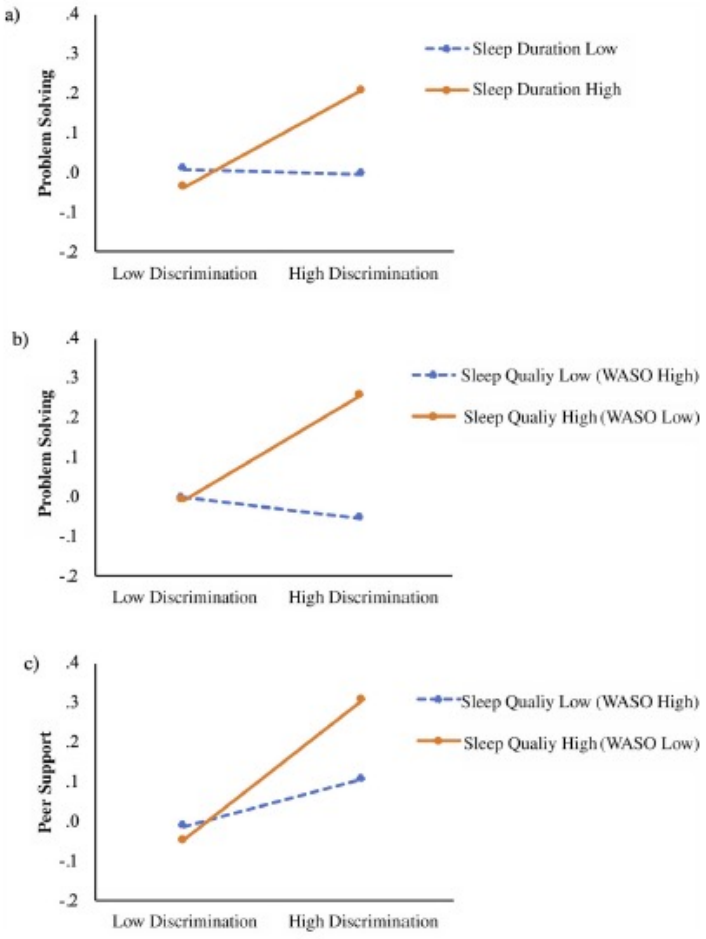
Daytime Sleepiness → Discrimination (Dichotomized)



The likelihood of daytime sleepiness being associated with same-day discrimination is 201% for youth who report low levels of ERI commitment



SLEEP FACILITATES COPING WITH DISCRIMINATION



ScienceNews for Students

ALL TOPICS LIFE HUMANS EARTH SPACE TECH

BRAIN

Sleep helps teens cope with discrimination

Just six minutes more sleep each night might boost someone's ability to deal with racial and ethnic slights

Teens who get more sleep are better able to cope with racial and cultural discrimination.

SOLSTOCK/E+/GETTY IMAGES

Wang & Yip, 2019

SUMMARY: DISCRIMINATION AND SLEEP – DAILY PROCESSES

- Evidence for same-night effects of discrimination on sleep disturbance, and next-day effects on daytime dysfunction
- Daily sleep disturbance mediates the association between daily discrimination and daily/longer-term mental health
- Evidence for reciprocal processes, i.e., sleep quality associated with lower likelihood of next-day discrimination

MACRO-SYSTEMS AND SLEEP

Structural processes: pandemics, neighborhoods, and schools

VICARIOUS RACISM AND SLEEP AMONG ASIAN AMERICAN ADULTS

How often do you hear about or see other Asian American people in public being treated unfairly because of their race?[1]

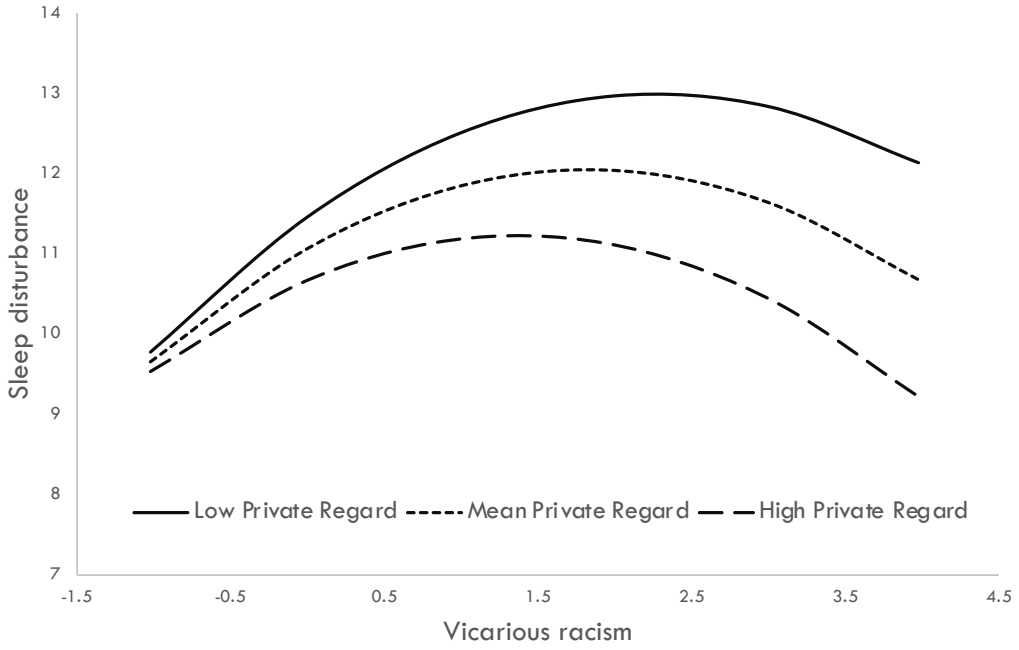
- N = 600 AA adults, ages 18-85 (mean = 38.55)
- Data collected May – July 2020, Atlanta, Chicago, Los Angeles, New Orleans, New York
- Vicarious racism was associated with more sleep disturbance (quadratic)[2]
- Moderated by ERI private regard and centrality

1. Chae, Yip et al., 2021, 2. Yip, Chung & Chae, in press

ASIAN AMERICAN ADULTS AND THE PANDEMIC:

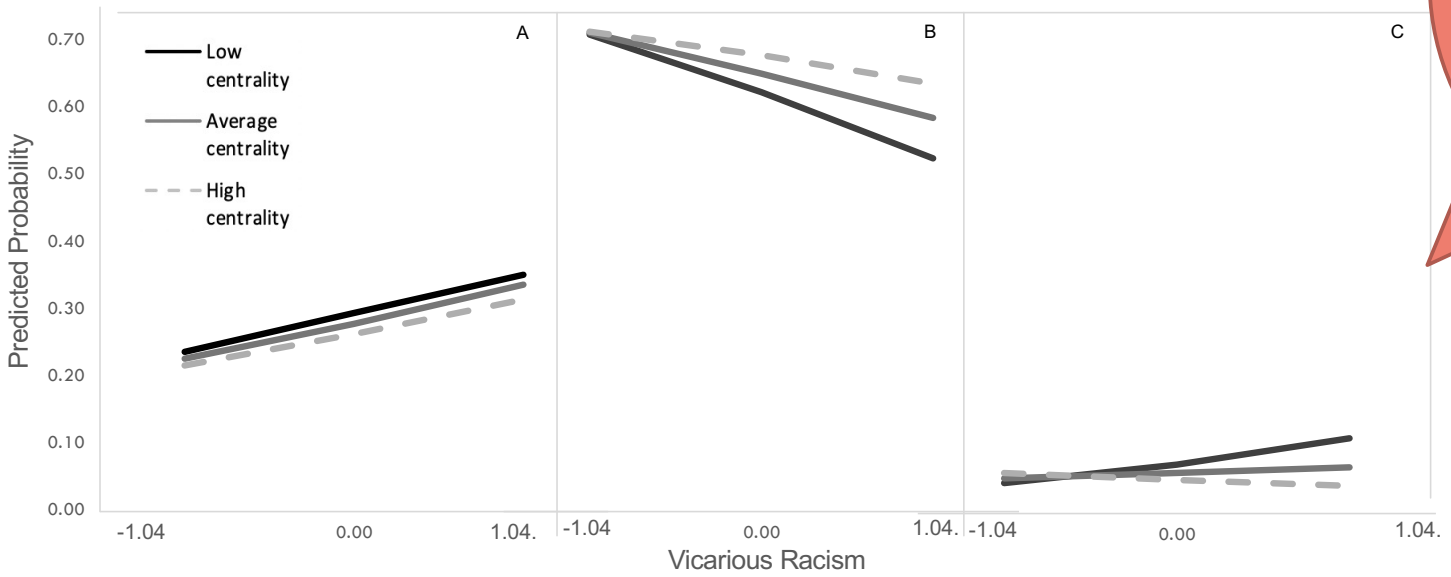
Ethnic Identity Private Regard Buffers the Association Between Vicarious Racism and Sleep Disturbance

How often do you hear about or see other Asian American people in public being treated unfairly because of their race?



Note. Low and high private regard reflect ± 1 standard deviation from the mean. Private regard and vicarious racism are mean-centered. Data collected: May – July 2020. Yip, Chung & Chae, in press

ASIAN AMERICANS AND THE PANDEMIC: CENTRALITY BUFFERS THE ASSOCIATION BETWEEN VICARIOUS RACISM AND SLEEP DURATION



Panel C probability of long sleep (> 9 hrs) compared to mid-range sleep: as VR increases, prob of long sleep was 0.12 for low centrality, 0.07 for average, and 0.04 for high centrality. Avg and high centrality n.s.

Note. Vicarious racism and centrality are depicted at the mean and ± 1 SD. Vicarious racism was associated with higher probability of short sleep (< 6hrs) and of long sleep (> 9hrs) – compared to average sleep (7-9 hrs)[2] The panels represent the predicted probability for reporting (A) short sleep (≤ 6 hours), (B) mid-range sleep (7-9 hours), and (C) long sleep (> 9 hours). Significant interaction between panels B and C. Data collected: May - July 2020. Yip, Chung & Chae, in press

SLEEP AND NEIGHBORHOOD CONDITIONS

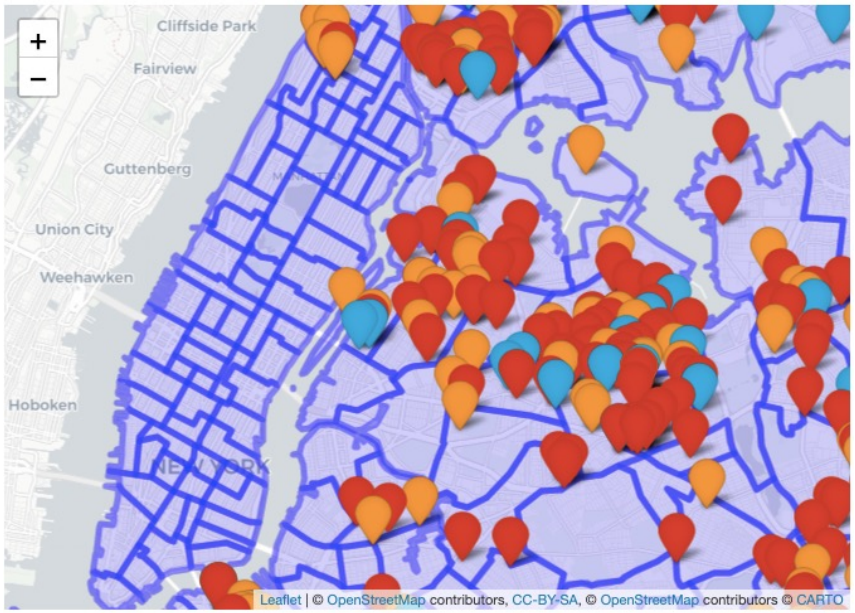
- Neighborhood cohesion and safety are associated with longer sleep duration among adults[1] and children[2]
- Feelings of safety from crime and violence are associated with better sleep US, Mexico, Ghana, S. Africa, India, China and Russia[3]
- Children have later bedtimes on evenings following a violent crime in their neighborhood[4]

1. Johnson et al., 2017, 2. Singh & Kenney, 2013, 3. Hill et al., 2016, 4. Heissel et al., 2017

NEIGHBORHOOD CRIME AND SLEEP

Crime Label	2015	2016	2017	2018	Total
Petit Larceny	45349	44923	45953	45761	181986
Harassment 2	38783	41155	41807	43450	165195
ASSAULT 3 & RELATED OFFENSES	34399	34383	33885	34627	137294
Criminal Mischief and Related Offense	30209	30716	31181	29415	121521
Grand Larceny	22431	22549	21704	20530	87214
Felony Assault	13940	14285	13673	13821	55719
Offense Against Public Ordinance Sensibility &	13150	14107	13511	12250	53018
Dangerous Drugs	15536	13577	12692	9203	51008
Robbery	11423	10449	9411	8434	39717
Miselaneous Penal Law	8916	9148	8698	8552	35314
BURGLARY	9543	8386	7684	7156	32769
Dangerous Weapons	7105	6881	5633	5080	24699
Offenses Against Public Admin	5836	5393	4984	4602	20815
Vehicle and Traffic Laws	4477	4757	4613	4733	18580
Grand Larceny of Motor Vehicle	5415	4583	4125	3863	17986
Sex Crimes	3262	3425	3589	3761	14037
Intoxicated/Impaired Driving	3705	3646	3369	2899	13619
Forgery	3345	3906	3119	2971	13341
Theft - Fraud	2592	2453	2115	1615	8775
Criminal Trespass	2483	2109	2029	1928	8549
Frauds	2038	1846	1403	1116	6403
Unauthorized Use of a Vehicle	1154	1273	1188	1065	4680
Posession of Stolen Property	1163	953	1225	1057	4398
Other Offenses Related to Theft	908	1004	878	795	3585
Rape	905	860	871	849	3485
Offenses Against the Person	822	773	799	653	3047
ADMINISTRATIVE CODE	793	724	631	727	2875
Offenses Involving Fraud	500	550	560	663	2273
ARSON	696	531	467	459	2153
NYS Laws - Unclassified Felony	301	254	303	292	1150
Murder and Non-Neglegent Manslaughter	251	235	183	201	870

Example: Day of 01/01/15



DAILY NEIGHBORHOOD VIOLENT CRIME ON ADOLESCENT SLEEP

Chung, Lorenzo, Chae, El-Sheikh,, Yip (under review)

- On days when adolescents were exposed to multiple violent crimes (> 1), they had less efficient sleep compared to days where they were exposed to no violent crimes (b = -0.68, p < 0.01, 95% CI [-1.27, -0.09])
  - there was no association with sleep duration (b = 3.57, p = 0.58, 95% CI [-9.17, 16.31])
- Adolescents' sleep efficiency was also lower on days when violent crime was elevated relative to the average violent crime level in their neighborhood (b = -0.88, p < 0.05, 95% CI [-1.57, -0.19]),
  - there was no association with sleep duration (b = -1.87, p = 0.75, 95% CI [-13.57, 9.83])

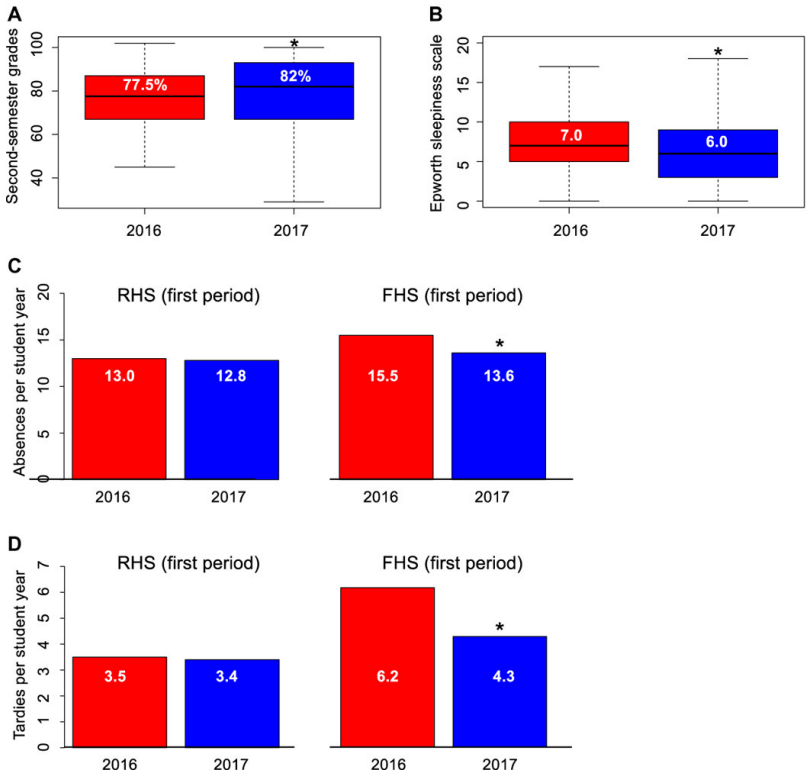
SCHOOLS AND SLEEP

How are school start times associated with sleep, what are the moderators, and do SSTs contribute to disparities?

- Meta-analyses of 28 studies, 1,774,509 youth
- Later SSTs were associated with better overall developmental outcomes, longer sleep duration, and less negative mood
- The benefits of later SSTs for reducing sleepiness was stronger for high school (vs middle school) youth, and youth in private (vs public) schools
- New SSTs between 8:30-8:59 were associated with better outcomes than new SSTs between 8:00-8:29

Yip, Wang, Xie, Ip, Fowle & Buckhalt, 2022

"SLEEP MORE IN SEATTLE"



- 2 HSs in Seattle implemented a 25-min delay in SST from 7:50 to 8:45am between 2016 and 2017
- RHS (red): n.s., 31% economically disadvantaged, 7% ethnic minorities
- FHS (blue): improvement in tardies and absences, 88% economically disadvantaged, 68% ethnic minorities
- Could delaying SST be a structural lever to reduce disparities?

Dunster et al., 2018

SUMMARY: MACRO-SYSTEMS AND SLEEP DISPARITIES

- Racism during the pandemic contributed to sleep difficulties
- Neighborhood violent crime contributes to adolescent sleep quality at the daily level
- Later SSTs are generally better for young people, but equivocal evidence linking SSTs to disparities

PROTECTIVE FUNCTIONS OF SLEEP

Moderated associations & Longitudinal processes: how are daily-level processes implicated in developmental over time?

DISCRIMINATION AND INTERNALIZING SYMPTOMS: SLEEP EFFICIENCY AND GENDER

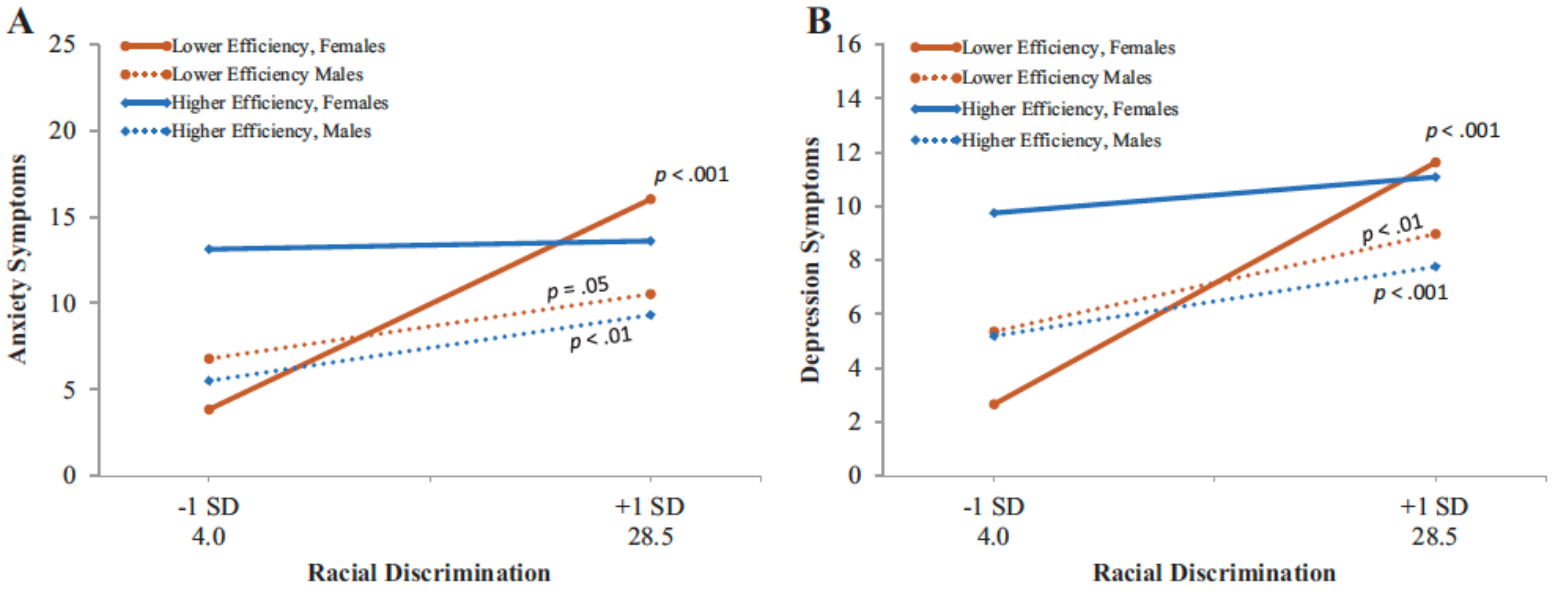


Figure 4. Racial discrimination predicting internalizing symptoms at lower and higher levels of sleep efficiency (±1 SD) for males and females. Significant slopes are indicated. Lower sleep efficiency = 87.8%; higher sleep efficiency = 99.2%. Panel A: Sleep efficiency and sex as moderators of associations between racial discrimination and anxiety symptoms. Panel B: Sleep efficiency and sex as moderators of associations between racial discrimination and depression symptoms.

El-Sheikh, Zeringue, Saini, Fuller-Rowell & Yip, 2021

WHAT ABOUT ADOLESCENT SLEEP/WAKE REGULARITY? SLEEP REGULARITY INDEX (SRI)

SRI[1] is "the percentage probability of an individual being in the same sleep state (asleep vs awake) at any two timepoints 24 hrs apart, averaged," across study days

Coded minute by minute

100 = an individual who sleeps and wakes at exactly the same times each day

0 = an individual who sleeps and wakes at random

- SRI ranged from 32 – 96, mean = 76
- Asian adolescents had higher SRIs than Latinx and Black adolescents[2]
- SRI was associated with earlier bedtimes[2]
- SRI was associated with earlier waketimes[2]

Correlations Between Actigraphy-derived Sleep Indices

	SRI	TST	Bedtime	*M*	*SD*	*Median*
SRI	-			75.79	11.46	77.56
Total Sleep Time (minutes)	-0.03	-		393.49	108.4	417.31
Bedtime	-.50**	-.21**	-	12:19am		
Waketime	-.49**	0.06	.68**	7:36am		

1. Phillips et al, 2017, 2. Yip et al, invited resubmission

SLEEP REGULARITY IS POSITIVELY ASSOCIATED WITH GRADES

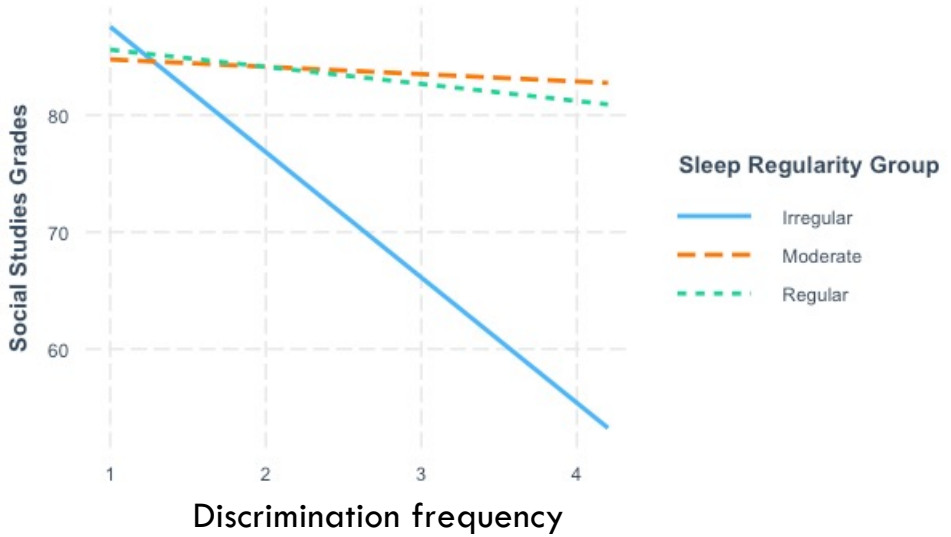
Partial Correlations Between SRI and Grades									
		SRI	Aggregated	Math	Science	English	*M*	*SD*	*Median*
1	SRI						75.79	11.46	77.56
4	Aggregated Grades	0.16*	-				83.53	9.53	85.19
5	Math Grade	0.15*	0.85**	-			82.15	11.00	83.25
6	Science Grade	0.15*	0.87**	0.67**	-		82.86	10.48	85
7	English Grade	0.15*	0.87**	0.60**	0.69**	-	84.77	9.44	86.5
8	Social Studies Grade	0.12	0.90**	0.67**	0.68**	0.77**	84.38	11.21	87.5

Note. * $p < 0.05$; ** $p < 0.01$

Adjusting for gender, age, ethnicity. All grades were provided by the Dept of Ed

PROTECTIVE FUNCTION OF SLEEP REGULARITY

- No direct association between discrimination-frequency and social studies grades
- However, adolescents reporting frequent discrimination and had irregular sleep schedules had lower social studies grades



SRI was categorized: **irregular sleepers** - bottom 20% (<67.40), **moderately regular sleepers** – middle 60%, **regular sleepers** - top 20% (>86.26), Yip et al, invited resubmission

DISCRIMINATION AND INTERNALIZING SYMPTOMS: SLEEP VARIABILITY AND GENDER

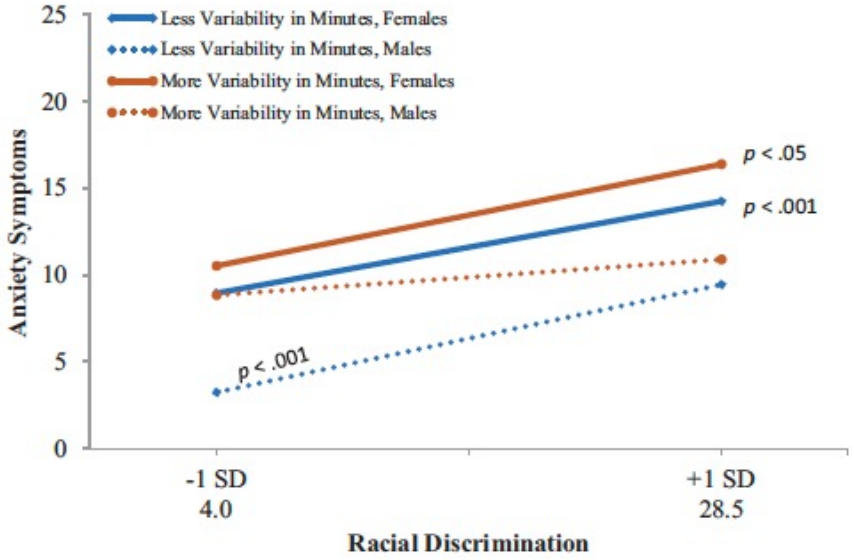


Figure 5. Variability in sleep minutes and adolescent sex as moderators of associations between racial discrimination and anxiety symptoms. Interactions depict associations between racial discrimination and anxiety at high and low levels of variability in sleep minutes (±1 *SD*) for males and females. Significant slopes are indicated. Less variable sleep = 0.08; more variable sleep = 0.24.

El-Sheikh, Zeringue, Saini, Fuller-Rowell & Yip, 2021

DISCRIMINATION AND EXTERNALIZING SYMPTOMS: SLEEP VARIABILITY

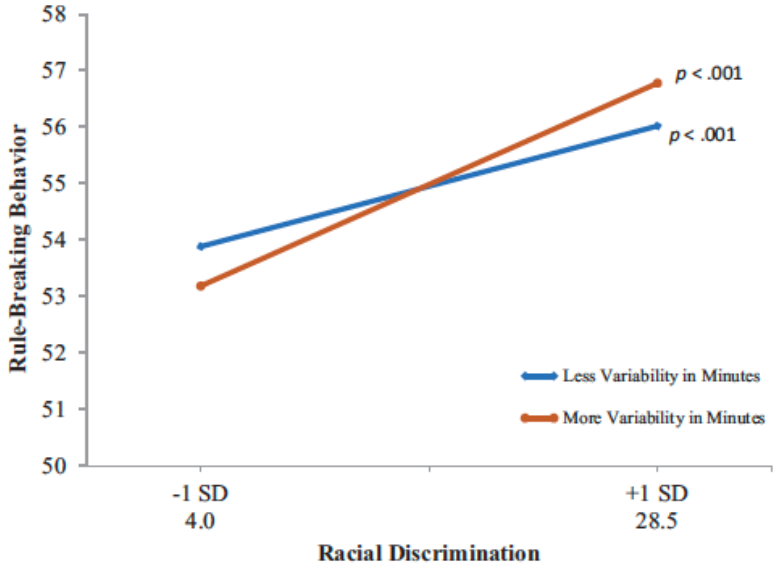
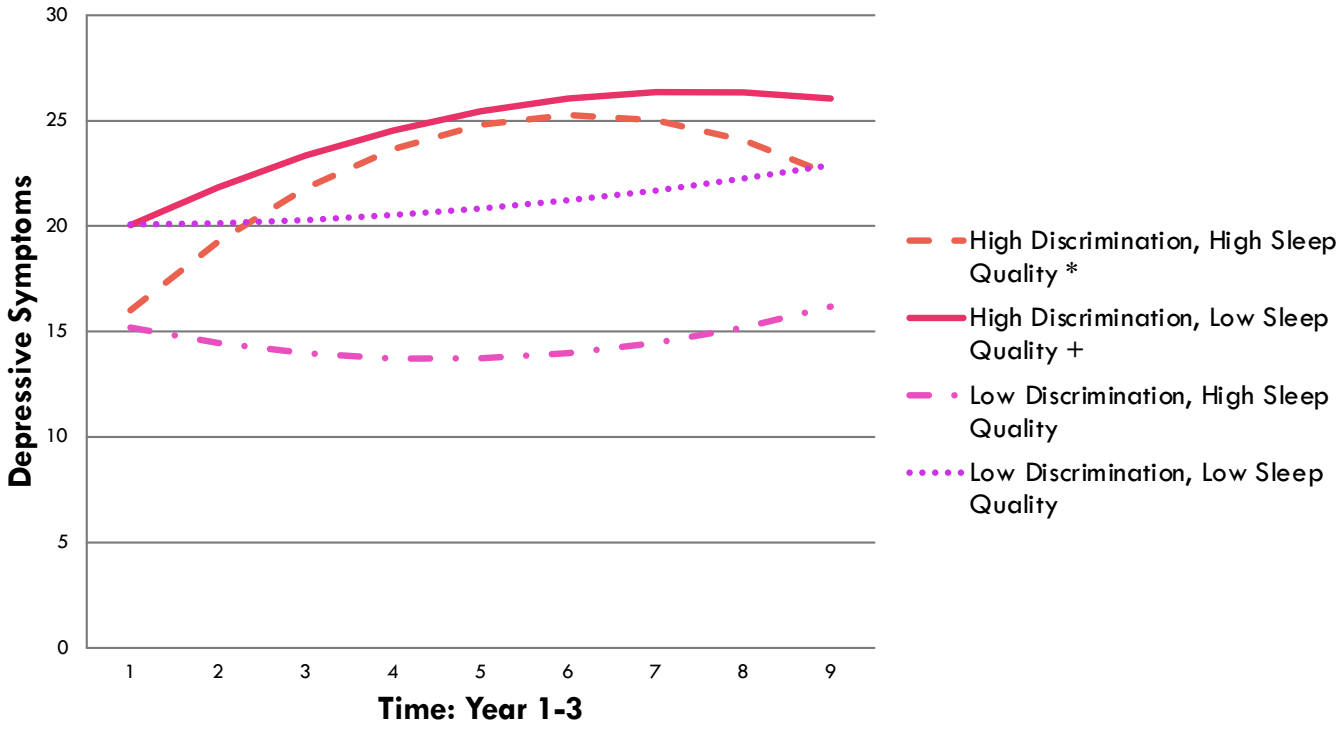


Figure 6. Variability in sleep minutes as moderator of associations between racial discrimination and rule-breaking behavior. Interactions depict associations between racial discrimination and rule-breaking at high and low levels of variability in sleep minutes (±1 *SD*) for males and females. Significant slopes are indicated. Less variable sleep = 0.08; more variable sleep = 0.24. Rule-breaking behavior is represented in *T* scores.

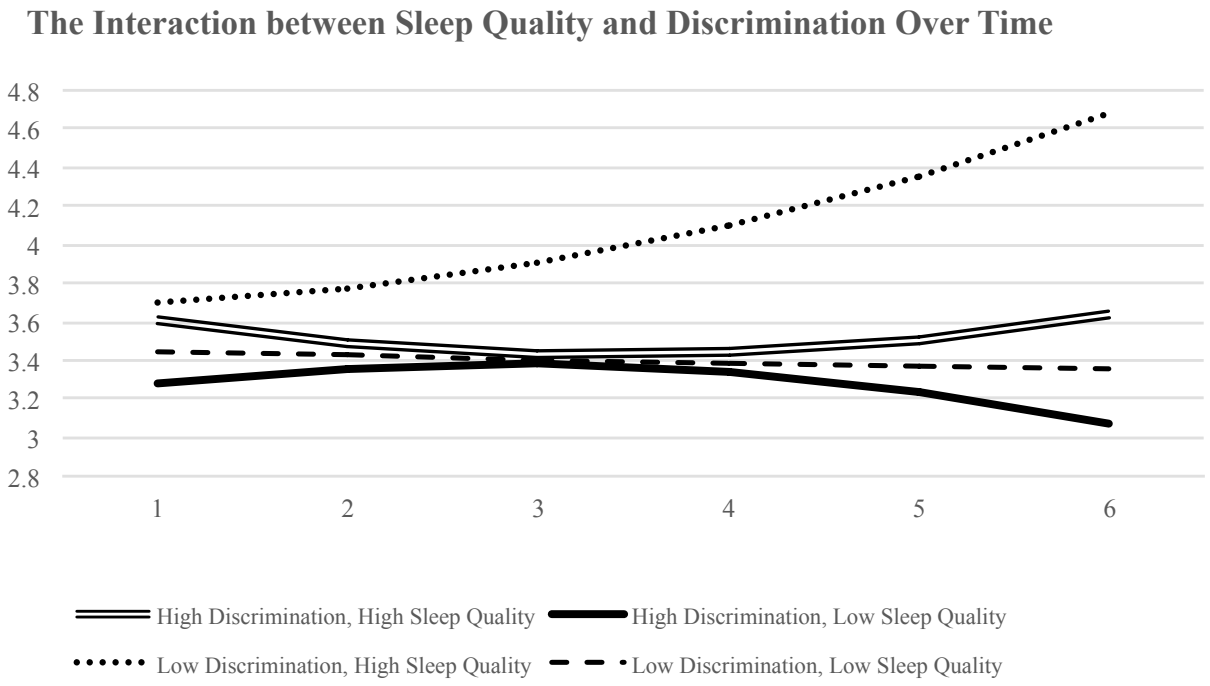
El-Sheikh, Zeringue, Saini, Fuller-Rowell & Yip, 2021

DISCRIMINATION AND SLEEP QUALITY ON DEPRESSIVE SYMPTOM TRAJECTORIES



Yip, 2015

DISCRIMINATION AND SLEEP QUALITY ON SCHOOL ENGAGEMENT TRAJECTORIES



Dunbar, Mirpuri & Yip, 2017

SUMMARY: PROTECTIVE FUNCTIONS OF SLEEP

- Sleep quality and sleep regularity are observed to buffer associations between discrimination and internalizing, externalizing, and academic outcomes

CONCLUSIONS AND DISCUSSION

- Disparities in sleep are evident among children and young adults across various indicators
- Sleep serves as a biosocial pathway through which the stress of racism, daily discrimination, and neighborhood conditions across multiple ecological levels impact health, functioning and academics at a daily level and over time
- Reciprocal developmental processes - sleep is impacted by, reduces probability of, and promotes coping with, discrimination stress
- Potential for sleep health/behavior promotion as a biobehavioral lever for interrupting/modifying pathways between racism and health?
- A particular focus on sleep quality and regularity

SLEEP AND HEALTH

"Sleep is the best meditation"

- Dalai Lama

- Sleep is restorative and healing
- Sleep is a modifiable health behavior
- Sleep is a complex and delicate system incorporating biological, social, contextual, environmental, societal, and cultural influences
- It is not the burden of young people to "sleep off" racism
- However, sleep health promotion may be a pathway towards health equity

THANK YOU!

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