

Sleep Norms

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Sleep deprivation has been linked to worse health, human capital accumulation, and productivity (Giuntella and Mazzonna, 2019; Gibson and Shrader, 2018; Jagnani, 2021). Since 2013, the CDC considers sleep deprivation a public health epidemic, and some scholars have referred to it as the most prevalent risky behavior (Roenneberg, 2013). Despite a majority of individuals reporting an ideal sleep duration of at least 7 hours (Ballard, 2019), approximately a third of the US adult population reports sleeping less than the recommended 7 hours of sleep (Liu et al., 2016). Prior work suggest that lack of self-control and biased beliefs may contribute to explaining the difference individuals' ideal sleep and their actual behavior (Avery, Giuntella and Jiao, 2022; Breig, Gibson and Shrader, 2020). However, the role of norms and beliefs in the sleep domain remains largely unexplored.

Norm nudges – supplying information about social norms to guide individuals towards desired behavior – has become an increasingly popular policy intervention. (Bicchieri, 2023). For example, extensive research by Cialdini and colleagues (e.g., Cialdini, Reno and Kallgren (1990); Reno, Cialdini and Kallgren (1993)) has demonstrated the efficacy of norms in motivating pro-environmental choices. Previous literature in psychology also suggests that norms can significantly influence health-relevant behaviors (Schwarzer, 2008). Drawing on these findings, our study investigates how beliefs about sleep norms

might similarly affect sleep-related behavior.

Norms are important in shaping behavior, and previous studies suggest that they are often misperceived (Bursztyn, González and Yanagizawa-Drott, 2020; Blanton, Köblitz and McCaul, 2008; Reid and Aiken, 2013). Thus, providing accurate information about norms may be important in helping individuals make decisions. In this study, we focus on two types of norms: descriptive and injunctive norms. Descriptive norms involve perceptions of actual behavior, while injunctive norms relate to socially approved or ideal behavior. For instance, in the case of sleep, injunctive norms refer to ideal sleep behavior (what people ought to do), and descriptive norms reflect the actual sleep patterns in the population (what people are actually doing). Signals about others' behavior in the sleep domain are especially noisy or non-existent because, outside of partners and close family members, people rarely observe when others actually fall asleep or wake up. Thus, we expect misperceptions of descriptive norms about sleep.

Our work relates to the recent studies analyzing sleep and bedtime choice. Monetary incentives have been successful in inducing people to sleep more (Giuntella, Saccardo and Sadoff, 2023; Bessone et al., 2021) suggesting that sleep duration is to some extent a choice. However, these decisions may not be optimal: Avery, Giuntella and Jiao (2022) identified time inconsistency as an important factor for sleep decisions and Breig, Gibson and Shrader (2020) highlight the role of excessively optimistic beliefs about future demands on an individual's time. In this study, we examine a different mechanism: people may have inaccurate beliefs about the injunctive and descriptive norms, but correcting those beliefs could change sleep intentions and be-

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havior. Our study also speaks to the literature on the role of motivated and biased beliefs in shaping behavior (Rabin, 2013). These psychological mechanisms have been found to explain perceptual biases in the health domain (Oliver et al., 2011). Finally, we contribute to the literature that asks whether potentially biased health perceptions can partially explain the prevalence of risky health behaviors (Arni et al., 2021; Harris, 2017). Sleep deprivation can be viewed as a risky behavior, and misperceptions about the descriptive and the injunctive norm may affect the social approval or disapproval of such behaviors.

I. Experimental Design and Implementation

We conducted an online experiment aimed at understanding how information provision about different norms affects participants’ intentions to improve their sleep and bedtime habits. Specifically, we investigated the impact of learning about the injunctive norm — the perceived ideal behavior regarding sleep — and the descriptive norm — the actual sleep behavior of others.

Our experiment contained three treatments: 1) Participants learned only the widely accepted ideal amount of sleep (the injunctive norm); 2) Participants discovered that others generally adhere to this ideal, indicating a small gap between what people believe is ideal (injunctive norm) and what they actually do (descriptive norm); and 3) Participants discovered that there is a significant discrepancy between the ideal and the actual sleep patterns of others, meaning a large gap exists between the injunctive and descriptive norms.

We used responses from a benchmark group of 200 Prolific participants to construct the norms. This group responded to two questions. The first question, “How many hours do you think you should sleep on a workday (evenings of Sunday - Thursday)?” elicits the injunctive norm — the participants’ perceived ideal sleep duration during the workweek. The second question, “In the past 7 days, how many hours of ac-

tual sleep did you get on average per night during the workweek (evenings of Sunday - Thursday)? This may be shorter than the time spent in bed.” captures the descriptive norm.

We conducted a median split based on the difference between the injunctive and descriptive norms for the benchmark group. The 100 responses with the smaller norm gap were allocated to the ‘small gap’ group, while the 100 with the larger gap were assigned to the ‘big gap’ group. In the ‘injunctive norm’ treatment arm, participants were randomly presented with information from either the first or the second set of 100 benchmark responses. Each treatment group received this information about norms through a combination of histograms and verbal descriptions, followed by comprehension checks.

The data was collected on Prolific, a platform widely used to conduct surveys and experiments online (Palan and Schitter, 2018), in Fall 2023 using Qualtrics. We recruited two batches of gender balanced Prolific participants, who were over 18 years old, based in the US, and fluent in English. The first batch, 200 people served as the benchmark group and completed a short 10-minute long survey about their demographics, sleep patterns, and beliefs. For our main survey, we recruited the second batch of 503 participants. These participants were offered a guaranteed \$5 completion fee and could earn as high as \$26 with bonus payments. Participants in this survey answered questions about their demographics, their sleep, their beliefs about the benchmark group, received treatment information if any, stated their intentions about their future sleep behavior, and made a consequential choice about acquiring information related to sleep improvement.

A. Data

The average age of the participants was 40.65 years. The gender distribution in our sample is nearly even, with 49.7% of participants being women and 50.3% men. In terms of racial composition, 82% of respondents are White, 13.5% are African-

American, and 9% identify as Hispanic. Educational background varies: less than 1% have less than a high school degree; 12% have a high school diploma or equivalent; 21% have some college education; 10.3% hold an associate or technical degree; 41.5% have a bachelor's degree; and 15% possess a graduate or professional degree. Employment-wise, 83% of the respondents are working, and 34% report having children. The survey on average took 24 minutes to complete. In our baseline analysis, we excluded participants who were in the fastest 5% of the sample and completed the survey in less than 9.5 minutes, leaving us with 485 observations.

II. Results

On average, participants reported sleeping 7.26 hours per night, with 36% sleeping less than 7 hours. Notably, a majority (60%) indicated that they went to bed by their preferred bedtime on less than 50% of the nights in the previous week. Regarding sleep satisfaction, 77% of the subjects expressed some level of regret about their sleep timing: 15% regretted their bedtime choices every time, another 15% more than half the time, and 20% at least half of the time. Furthermore, 81% reported sleeping less than their desired amount, with an average shortfall of 1 hour and 20 minutes. Additionally, 70% of the subjects believed they should sleep longer than they currently do. Among those who went to bed later than their preferred time, 71% did so because they were engaged in activities they enjoyed more than going to bed. Reasons for delayed bedtime varied: 35% were “occupied with necessary tasks”, 30% “spent time with others”, and 33% “were ready for bed but struggled to fall asleep.” Participants believed others sleep 7.49 hours on average. Thus subjects in our sample believed others sleep on average longer than they do which is in contrast with previous evidence of over-placement in sleep duration among young adults (Avery, Giuntella and Jiao, 2022). However, consistent with over-placement, 36.38% of the subjects reported they sleep less than 7 hours, while

48% believe others sleep less than 7 hours.

Table 1 shows these descriptive statistics and highlights that across the three treatments our randomization was successful, and the arms are broadly balanced. In the injunctive norm treatment, participants initially believed that others thoughts one should sleep 8.32 hours and were informed that, on average, others actually believed one should sleep about 7.8 hours. This amounts to a prior overestimation of roughly 30 minutes.

For participants assigned to the ‘small gap’ treatment, they initially believed that others sleep 7.57 hours on average and that others believe that one should sleep 8.59 hours. They are informed that they are basically correct about the actual sleep duration (7.61 hours) while they overestimated others’ beliefs about the injunctive norm (7.63 hours) by almost an hour.

For participants assigned to the ‘big gap’ treatment, they initially believed that others sleep 7.91 hours on average and that others believe that one should sleep 8.34 hours. They are informed that their beliefs about others’ views of what one ought to do is close to others’ actual beliefs (8.08 hours), but they overestimated the descriptive norm by about an hour and 45 minutes (6.28 hours).

The effects of our main intervention are reported in Table 2. We find little evidence of any effect of providing information on the injunctive norm alone. This is not surprising given the congruence between first and second-order beliefs about the injunctive norm (Table 1). We instead find some evidence that that when individuals learn that others’ sleeping behaviors are closely aligned with societal expectations (i.e. the injunctive norms), they are more inclined (a 14% increase with respect to the mean of the dependent variable) to report an intention to increase their sleep duration (column 1). Similarly, we find a 15% increase in the likelihood of individuals intending to go to bed earlier (column 2) when they were aware of others adhering to the injunctive norm regarding sleep times. We have two possible interpretations for this finding. This could indicate that individuals

Table 1—: Summary statistics and balance check

	Control (1)	N (2)	T: Injunctive norm		T: Small gap		T: Big gap	
			Δ (3)	$p(\Delta = 0)$ (4)	Δ (5)	$p(\Delta = 0)$ (6)	Δ (7)	$p(\Delta = 0)$ (8)
Panel A: Baseline sleep pattern								
Avg sleep per night last workweek (in hours)	7.07	485	0.30	0.12	0.30	0.11	0.16	0.28
Sleep quality last 7 days	6.62	485	-0.02	0.94	0.24	0.31	0.02	0.95
Snore	3.11	485	0.13	0.43	-0.17	0.34	0.09	0.60
N days not enough sleep last 7 days	2.70	485	0.23	0.39	0.16	0.55	-0.06	0.82
N days unintentionally falling asleep last 7 days	0.74	484	0.11	0.46	0.12	0.48	0.25	0.10
Ever fallen asleep unintentionally last 7 days	3.72	485	-0.03	0.86	0.01	0.97	-0.35	0.08
Constrained max possible sleep duration workday	8.36	485	-0.04	0.83	0.25	0.28	-0.13	0.52
Constrained preferred sleep duration workday	7.63	485	-0.06	0.69	0.05	0.77	-0.05	0.75
N days went to bed before preferred workweek	2.67	485	0.01	0.98	-0.31	0.17	0.06	0.79
Unconstrained preferred sleep duration workday	8.43	485	0.18	0.17	0.45	0.01	0.02	0.86
Panel B: Baseline beliefs								
Self: Hours should sleep on workday	7.97	485	0.13	0.15	0.11	0.34	0.04	0.69
Others' avg: hours sleep workday	7.49	485	0.21	0.56	0.08	0.83	0.42	0.24
Others' avg: hours should sleep workday	7.97	485	0.35	0.19	0.62	0.02	0.37	0.18
Panel C: Demographics and background vars.								
Age	39.69	483	3.83	0.02	0.81	0.61	0.19	0.91
Female	0.48	477	0.04	0.53	0.04	0.53	-0.00	0.96
Race: White	0.78	482	0.00	0.93	0.08	0.11	0.05	0.36
Race: Black	0.12	482	0.12	0.01	0.04	0.35	-0.05	0.15
Hispanic	0.09	483	-0.04	0.26	0.01	0.84	0.06	0.12
Educ: less than high school	0.02	484	-0.02	0.21	-0.02	0.22	-0.00	0.74
Educ: high school or GED	0.12	484	0.01	0.85	0.00	0.98	-0.04	0.32
Educ: some college	0.22	484	-0.02	0.63	-0.05	0.32	0.09	0.10
Educ: associates or technical degree	0.09	484	0.07	0.08	-0.01	0.79	0.01	0.74
Educ: BA	0.43	484	-0.07	0.26	0.03	0.68	-0.10	0.12
Educ: graduate or professional degree	0.12	484	0.03	0.43	0.05	0.26	0.04	0.35
Work for pay last 7 days	0.82	472	0.01	0.79	-0.04	0.38	0.02	0.68
Living with children	1.71	485	-0.06	0.26	-0.10	0.10	-0.02	0.69
Time preferences	6.95	485	-0.09	0.71	-0.28	0.25	-0.07	0.75
Risk preferences	4.79	485	-0.38	0.19	-0.46	0.13	0.59	0.06

Notes: For each variable, the columns display summary statistics and balance check: the mean value of the control group (col. 1), the number of observations (col. 2), and for each of the treatment groups the difference between the treatment and the control mean, and the probability that the difference is 0. Columns 3-4 show these statistics for the injunctive norm treatment, columns 5-6 refer to the treatment when the gap between the descriptive and injunctive norm is small, and columns 7-8 tabulate the results for the group that sees a big gap between the two norms.

are more likely to align their actual sleep behavior with their ideal when they learn that others do the same. It could also be the case that individuals learning about others' more attainable ideal about sleep duration motivates them to strive towards this new ideal.

We then asked individuals whether they would consider signing up for a newsletter on sleep hygiene. Interestingly, we find those who were shown a larger gap between the injunctive norm and the actual behavior of others were more likely to subscribe (+52%, see column 3). Perhaps this large gap between the norms reminds participants of the difficulties they may face in trying to adhere to the injunctive norm, thus motivating them to seek out helpful information.

III. Conclusion

Our study highlights how societal norms and individual beliefs shape sleep-related intentions with implications for designing interventions and educational programs to promote healthy sleep patterns. Our findings suggest that the effect of the injunctive norm on sleep intentions may be limited. However, individuals who perceive a convergence between others' sleep behavior and the injunctive norm are more likely to express a desire for longer sleep and an inclination to go to bed earlier. Intriguingly, a notable disparity between the injunctive norm and the actual behavior of others appears to increase individuals' interest in subscribing to a newsletter that provides insights into sleep hygiene. Perhaps this large gap between the two norms makes the dif-

Table 2—: Average Treatment Effects

	Intend sleeping longer (1)	Intend going to bed earlier (2)	Newsletter (3)
Injunctive norm	-0.004 (0.137)	0.002 (0.145)	0.050 (0.057)
Small gap (IN-DN)	0.279** (0.135)	0.288** (0.142)	0.038 (0.057)
Big gap (IN-DN)	0.081 (0.133)	0.067 (0.140)	0.094* (0.056)
Number of observations	469	469	469
R ²	0.164	0.169	0.133
Control mean (control group)	2.943	2.923	0.180

Notes: All columns control for age, race, ethnicity, gender and education. The dependent variables for columns 1 and 2 are on a 5-point Likert scale where 1 is "Definitely not" and 5 is "Definitely yes". The dependent variable in column 3 is an indicator equal to 1 if respondents express willingness to subscribe to a newsletter on sleep hygiene. The sample excludes those with the lowest 5% response duration. Standard errors are in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ficuity of adopting healthy sleep behavior more salient to participants, thus making them more likely to seek advice.

Our study has a few limitations. The small sample size does not allow us to investigate heterogeneity in treatment effects for socioeconomic characteristics and limits our ability to distinguish the relative importance of the treatments considered as well as the potential mechanisms underlying our main findings. Furthermore, our study is based on self-reported data on sleep duration, which are notably imprecise and tend to overestimate sleep (Lauderdale et al., 2008).

Future research should explore more thoroughly how information interventions that aim to change beliefs affect both descriptive and injunctive norms in sleep behavior. It is important to distinguish whether our findings are due to an understanding of the alignment between descriptive and social norms, or due to the realization that conforming to injunctive norms may be easier than previously thought. Conducting field studies with wearable devices may offer valuable insights into whether the observed effects on intentions translate to tangible changes in actual sleep behavior. Understanding and leveraging the role of norms and beliefs may be crucial in designing effective health interventions, campaigns, and public health strate-

gies that aim to promote healthy behavior within communities.

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