**Does Increasing Sleep Duration for Women Improve their Well Being in Chennai, India?**

**Simran Palak**

**190303760**

**EC 481 Economics Paper and Seminar**

**Professor Juan Morales**

**December 18th, 2023**

**Table of Content**

Abstract…………….………….………….………….………….………….………….………….………….………….………………3

Introduction………….………….………….………….………….………….………….………….………….………….………….3

Literature Review…….………….………….………….………….………….………….………….…….………….………….…5

Conceptual Framework …………………….….………….………….………….………….………….………….………..……6

Data………………….….………….………….………….………….………….………….………….………….………….…………..8

Experimental Design.………….…………………………….……………………………….………………………………………9

Empirical Framework………………………….…………………………………………….…………………………………..…13

Empirical Results………………………….…………………………………………….……………………………………………14

Conclusion………………………….…………………………………………….…………………………………………….……….19

References………………………….…………………………………………….………………………………………….…………20

**Abstract:**

This research addresses the significant issues of sleep deprivation in India, the second most affected country globally, and its often-overlooked economic implications. Furthermore, sleep deprivation is connected to various health conditions and optimizing sleep habits can potentially lead to financial savings on medical expenses. Women particular in India, face a higher risk in Insomnia due to hormonal and caregiving responsibilities. This paper delves into the impact of increased sleep duration on the well-being of women in Chennai, India, building on prior research exploring the economic consequences of sleep. A randomized controlled trial on 452 participants tested different sleep treatments, including interventions to improve their sleep quality and financial incentives. The paper further concludes that men benefited more than women in terms of happiness levels. This unexpected finding promotes a deeper exploration of how increasing leisure time and reducing labor supply may adversely affect women.

**Introduction:**

According to Times of India, India is the second most sleep deprived country in the world. What we fail to acknowledge is that this effects our economy as well (Sharma, 2023). Sleep deprivation is a common factor among many health conditions. As of Dr. Joy Desai, a Neurologist, argues that “sleep cycle communicates closely with your immune system”, knowing this, many residents can financially save from spending on medical expenses by fixing their sleeping habits (Sharma, 2023). Out of the sleep deprivation population in India, according to University of Michigan, women are more prone to Insomnia than men (Conroy, 2023). This has to do with the fact of their hormones and responsibilities that come from being the primary caregiver for children (Conroy, 2023). Later in life, women may also become caregivers for their parents or their partners parents which might double their responsibilities (Conroy, 2023). In addition, some women may also be working outside while taking care of their home. These are the major factors that overall effect a women’s sleep in India. Sleep plays a vital role in influencing one’s productivity, overall wellness, and cognitive performance.

This research examines the question*, Does Increasing Sleep Duration for Women Improve their Well Being in Chennai, India?* As we delve on the question of this article, it is significant to recognize the previous scholars who laid the foundation of this research. The article, “The Economic Consequence of Increasing Sleep Among the Urban Poor” by Pedro Bessone, Gautam Rao, Frank schilback, Heather Schofield, and Mattie Toma examine the economic impact if sleep duration is increased among a randomized controlled trial with 452 adults in Chennai.

In the article they employed the 452 participants for a one-month data entry job with flexible hours, allowing them to “precisely measure productivity and labor supply, as well as physical and psychological well-being, cognition, and time, risk, and social preferences” (Bessone et al., 2021). The participants are given two-night sleep treatments, one is to improve their home-sleep environments, second is providing them information and verbal encouragement to increase their night sleep, and the third is providing financial incentive to increase their night sleep. The treatments were randomly assigned in a cross-design fashion, and alongside them, there was a randomized nap treatment that provided participants with the option of taking a half-hour afternoon nap daily at their workplace.

Overall, the study discovered that increasing sleep duration did not have a significant effect. In contrast to night sleep, providing nap treatments in the workplace increased majority of the participants psychological well-being , productivity, and attention at work.

This paper aims to analyze the difference between men and women through the two-night treatments. I use linear regressions and specify between the genders to understand how each gender is impacted. I discovered that men were positively more impacted than women in terms of happiness level although I assumed that women would be since they have a higher risk of insomnia in India. These regressions gave me a deeper understandingthat increasing leisure time and decreasing labour supply can negatively affect women more than men even if they’re receiving the same level of income. This could be due to many factors outside of the experiment that could result to these emotions.

**Literature Review:**

Quality sleep plays a pivotal role in influencing an individual's performance in daily tasks. This significance is particularly pronounced in professions such as nursing, where professionals often work demanding 12-hour shifts or even longer (Han et al., 2021). A quasi-experimental study conducted by a team of researchers including Kihye Han, Heejeong Hwang, Eunyoung Lim, Mirang Jung, Jihye Lee, Yeon-Hee Kim, Smi Choi-Kown, and Hyang Baek aimed to explore the impact of implementing scheduled 30-minute naps for nurses during their extended shifts (Han et al., 2021). The study revealed compelling results, indicating that nurses who adhered to the scheduled naps reported noticeable improvements in fatigue levels on the first night, and a subsequent enhancement in the quality of nursing care on the second night. In contrast, those who did not adhere to the nap schedule showed no significant improvements. These findings underscore the potential benefits of strategic napping practices for healthcare professionals working extended hours, offering insights into how sleep interventions can positively influence both immediate well-being and the overall quality of patient care.

Like this study, researcher Rebecca Berger, Alison Miller, Ronald Seifer, Stephanie Cares, and Monique Lebrougeois delve into the significance of sleep for young children, exploring its profound effects on cognitive skills and mood .” (Berger et al., 2012). Their investigation yielded compelling insights, revealing that when sleep is curtailed, children exhibited heightened sensitivity. This sensitivity manifested as decreased clarity in response to “neutral pictures,” increased negativity toward 'neutral and negative pictures,' and diminished positivity toward “positive pictures.” (Berger et al., 2012). The significance of these findings is underscored by their alignment with the human capital and economic development theory. Both studies intricately examine the intricate ways in which sleep patterns can influence day-to-day functioning, ultimately contributing to an enhancement in cognitive skills.

Delving into the economic consequences of enhancing sleep patterns among residents in Chennai India, Pedro Bessone, Gautam Rao, Frank Schilbach, Heather Schofield, and Mattie Toma conducted a comprehensive investigation. Their research, which serves as the focal point of my own inquiry, illuminates intriguing insights. The study reveals that the incorporation of brief afternoon naps in the workplace not only enhances overall productivity, psychological well-being, and cognition but also results in a reduction in labor supply (Bessone et al., 2021).

**Conceptual Framework:** *Human Capital Theory*

Human Capital theory is an economic framework that studies the investment individuals make in their skills of health to improve productivity. In this case, Human Capital Theory recognizes health as an important component of an individual’s capital. Good health contributes to increased productivity and, by extension, higher earnings. It’s also a framework that is influential in shaping policies related to education, job training, and healthcare. This lens also allows for an exploration of how individuals of different genders invest differently in their day to day to improve their performance and productivity. Gender gap in terms of the Human Capital Theory helps understand the investment patterns and resource allocation disparities between men and women, shedding light on how these factors influence individual development, workplace contribution and overall professional outcome.

*Labour Productivity*

Labour productivity is connected to an individual’s human capital. Investing in health and skills has the potential to amplify labor productivity. Given the focus on the research paper, “The Economic consequences of Increasing Sleep Among the Urban Poor”, labour supply emerges as a key outcome. They discovered that once the sleep duration was increase, the labour supply was affected. The relationship between the labour supply and leisure involves an individuals’ choice regarding the allocation of their time between work-related activities and recreational pursuits.

*Economic Growth and Development*

In terms of economic growth and development, productivity and alert workforce can

boost economic growth. This can result to a better environment for the employees as well with

greater job satisfaction. Economic growth is linked to many different outcomes. Increase in

productivity can lead to multiple growth factors in the society. Since this research is focused in

Chennai and if there are a significant effect of sleep duration and the outcome, this can result in a

change in the employers’ cultures and lead to a higher development in the long run especially in an urban poor area.

**Data:**

I use publicly Harvard Data provided from the paper, “The economic consequences of increasing sleep among the urban poor” by Pedro Bessone, Gautam Rao, Frank Schilbach, Heather Schofield, and Mattie Toma. This is a time panel data that is collected on individuals’ observation for 30 days from October 23rd, 2017, to November 28th, 2017. There are multiple variables that were observed from recording everyone, but the main variable of interest are earnings, happiness level, night sleep, time in bed, sleep efficiency and nap sleep. These variables will be used to estimate the effects of each treatment and to distinguish between men and women.

1. **Measuring Sleep**

The first measure of sleep in Chennai comes from a randomized controlled trial with 452 adults that are employed for a full-time data entry job for one month. All the participants wore Actigraphs continuously throughout the study to measure sleep objectively. The Actigraphs measures the quality of an individual’s sleep. It records body movements, and any other disruptions to sleep that can drive down sleep efficiency during the night.

1. **Barriers to Sleep**

The researchers leading this study conducted a survey emphasizing the significance of "mental and physical distress (e.g., worries, stress, pain, or hunger), as well as environmental factors." Their findings revealed that more than half of the study participants experience sleep disruptions due to factors such as heat, noise, and/or light.

**Experimental Design:**

To precisely measure the earnings and happiness level, the participants were employed in full-time entry jobs that were closely controlled. To precisely measure Night sleep, Time in bed, Sleep efficiency and nap sleep, actigraphs were used. The 452 participants worked for 28 days in an office in Chennai, from October 23rd, 2017, to November 28th, 2017. They spent most of their workday doing paid data entry work. The office was equipped with computer workstations dedicated to data entry, a designated break room, booths designed for surveys and experimental tasks, and separate nap stations situated on another floor. The first 8 days of before the treatment is the baseline period. This baseline period reports patterns of sleep in Chennai that gives the researchers a depth understanding of external factors that could disrupt their sleep.

1. **Interventions to Increase Sleep**

Participants were randomly allocated to one of two-night sleep treatment groups (encouragement or incentives) or to an equally distributed control group.

1. **Night Sleep Treatment**
2. Devices + Encouragement: This treatment involved a bundled intervention to increase night sleep. Participants received (a) information on the advantages of sleep, particularly general health benefits, along with tips for better sleep hygiene (such as maintaining a consistent bedtime, refraining from caffeine after 4 p.m., and avoiding screens before bedtime – they were tested at the end to see if they listened to the information), (b) motivation to extend their sleep duration coupled with daily feedback on their sleep patterns, as measured by actigraphy, and (c) access to loaned devices aimed at improving their sleep environment. The provided devices encompassed eye shades, earplugs, a cot, mattress, sheets, pillows, and a fan.
3. Devices + Incentives: This group got the same help with sleep, like using devices and encouragement, as the group with devices and encouragement. But, in addition, they were given money to sleep more. Every day, participants received Rs. 1 for each minute they slept more, up to two extra hours compared to their usual sleep. This could amount to Rs. 120 (approximately $1.70). They wouldn't lose any money if they slept less than usual. To control for any income effects, participants in the other groups were matched with participants in this group and got the same money, no matter how they slept.
4. Control: This group did not get any of the treatments mentioned earlier. To address worries that lending items might lead to people feeling the need to reciprocate or could directly impact how they reported their well-being, we gave some control participants fake household items unrelated to sleep. These items were worth about the same as the sleep devices and included things like small kitchen gadgets, a chair, decorative figurines, and a flashlight. These items were also given back at the end of the study.

Recognizing the challenge of enhancing sleep in real-world settings, we adopted a comprehensive approach in crafting our treatments, aiming to improve sleep through various means. Participants had the flexibility to respond to encouragement and incentives by either extending the time spent in bed or taking measures to enhance their sleep efficiency. The provided tips for better sleep, such as avoiding evening caffeine, turning off the television, or keeping away from the cellphone at night, could feasibly contribute to improved sleep efficiency. Lastly, the loaned devices had the potential to enhance both sleep efficiency and time in bed, whether by making it easier to fall asleep, reducing awakenings, or enhancing the overall enjoyment of time spent in bed.

1. **Nap Treatment**

Starting on the 9th day of the study, a randomly selected group of individuals had the chance to take a brief afternoon nap daily, scheduled between 1:30 and 2 p.m. Located in a quiet and gender-separated part of the study office, the 25 private nap spaces were furnished with a bed, blanket, pillow, table fan, earplugs, and eye shades. Those who opted not to nap were encouraged to sit quietly or rest in their nap area; working during this time was not an available option. The participants who did not take a nap were randomly assigned each day with an equal chance to either a workday, where they could continue working during the nap period, or a break day, during which we mandated a half-hour break from data entry at the same time. On break days, participants could freely engage in any leisure activity, including relaxing in a comfortable office break room. By comparing those who took a nap with those who had a break, we can isolate the impact of a nap relative to a break of the same duration. Alternatively, by comparing those who took a nap with those who continued working, we can estimate the overall effect of naps on work output, considering the time lost during the nap.

1. **Eligibility Criteria and Selection**

Individuals who expressed interest underwent a two-step screening process, which included completing a concise unpaid survey and undergoing a home visit to determine whether they met the eligibility criteria for the study: (i) being 25 to 55 years old; (ii) fluency in the local language, in this case Tamil, and the ability to read and write numbers; (iii) having worked fewer than five days per week and earnings an average of Rs. 700 ($10 USD) or less per day worked in the previous month; (iv) living in a dwelling able to accommodate the sleep devices used in night sleep treatment; (v) the intention to be in Chennai for the following five weeks; and (vi) no children in the household younger than 3 years to mitigate disruption.

**Empirical Framework:**

The empirical analyses calculate the effects of treatments on outcomes assessed at the participant-day level, using modifications in the following equations:

 (1)

Where is the relevant outcome for participant *i* on their *t*th day in the study on calendar date *d.* in this case is night sleep, time in bed, sleep efficiency, nap sleep, happiness level and earnings. is a vector of indicator variables capturing the treatment(s) that participant *i* was assigned to. is the vector of coefficients, capturing the effect of each treatment on the outcome of interest.

Following the research already done, we control for the average baseline value of the outcome variables in all specifications and drop the baseline days from the regression (Bessone et al., 2021). We also drop days on which participants were absent, since attendance was balanced across groups. has information about the participants' age (sorted into groups) and gender, a dummy variable for whether a given no-nap participant *i* was assigned to work through the nap period or instead to take an enforced break on day *t.* This helps us figure out how naps affect people differently than just working or taking a break. Finally, we include day-in-study and calendar date fixed effects, captures by and , respectively. All standard errors are clustered at the participant level (Bessone et al., 2021).

**Empirical Results:**

Before beginning, we separate the female and male to understand how many participants we have regarding their gender.

Table I. Total Number of Female and Male Participants

|  |  |  |  |
| --- | --- | --- | --- |
| **What is the respondents gender?** | **Freq.** | **Percent** | **Cum.** |
| **Female** | 298 | 65.93 | 65.93 |
| **Male** | 154 | 34.07 | 100.00 |
| **Total** | 452 | 100.00 |  |

My simple approach is to examine a single overall index variable which has multiple outcomes. The index variable is distinguished through men and women to examine the effects of each treatment.

A table with numbers and text

Description automatically generated

**Table II** presents regression coefficients for different sleeping patterns for women. Noteworthy the variable "Nap Only" has a notable negative coefficient for Night Sleep (-0.17\*), suggesting a decrease in night sleep associated with taking naps. Additionally, the variable "Devices + Incentives and nap" exhibits substantial positive coefficients for Night Sleep (0.55\*\*\*), Time in Bed (0.70\*\*\*), and Sleep Efficiency (6.94), indicating a positive impact on sleep when both incentives and naps are considered.

A table with numbers and symbols

Description automatically generated

**Table III** reflects the treatments effects on sleep for men, Comparing the data between men and women, it appears that the treatment effects on sleep for men generally align with the overall trends observed in Table II, where positive coefficients indicate improvements in sleep outcomes. However, specific differences can be noted. For instance, the coefficient for Night Sleep under "Devices + Incentives only" is larger for men (0.34\*) compared to the overall model (0.54\*\*\* in Table II). Additionally, the impact of "Nap Only" on Sleep Efficiency is less negative for men (-3.6) than the model in Table II (-8.68). These gender-specific variations suggest that the effectiveness of treatments on sleep outcomes may differ between men and women.

In summary, the impact of treatments on sleep outcomes appears to vary between men and women. For certain treatments, women exhibit a higher positive impact on night sleep, while in other cases, men show a higher positive impact.

**Table IV** presents the regression results for the relationship between happiness level and earnings among women throughout the five different treatments. The participants after a treatment were asked to record how they felt. On a scale of 1 to 5, five being the greatest, participants would give a ranking. This helped us have a stronger understanding of how sleep treatments can affect their mood. Earnings is a measurement of their cognitive skills. It gives us a reflection of how the different sleep treatments effective their productivity at work.

A screenshot of a document

Description automatically generated

The coefficients indicate the impact of different interventions on both happiness level and earnings. Noteworthy findings include the negative coefficient for "Devices + Encouragement" on happiness level (-0.03), suggesting a slight decrease in happiness, while the positive coefficient on earnings (0.40) implies an increase in earnings. "Devices + Incentives Only" shows a similar pattern with a negative impact on happiness level (-0.06) and a positive impact on earnings (10.00). The coefficient for "Nap Only" indicates a negative effect on both happiness level (-0.03) and earnings (-5.20). On the other hand, "Devices + Encouragement and Nap" has a positive impact on happiness level (0.07) but a negative impact on earnings (-3.65). "Devices + Incentives and Nap" shows a minimal positive effect on happiness level (0.01) and a negative effect on earnings (-2.40).

**Table V** displays regression results examining the relationship between happiness level and earnings among men based on different sleep treatments.

A paper with numbers and symbols

Description automatically generated with medium confidence

Notable findings include the positive coefficients for "Devices + Encouragement" (0.02) and "Devices + Incentives only" (0.06) on happiness level, indicating a potential increase in happiness. However, these interventions demonstrate negative impacts on earnings, with "Devices + Encouragement" at -36.87\* and "Devices + Incentives only" at -30.55. "Nap Only" shows positive effects on both happiness level (0.06) and earnings (6.67), while "Devices + Encouragement and Nap" and "Devices + Incentives and Nap" exhibit positive impacts on happiness level (0.08 and 0.09, respectively) and negative impacts on earnings (-20.87 and -9.25, respectively).

**Conclusion:**

In the overall analysis, it appears that both men and women exhibit similar responses to various sleep treatments. However, delving specifically into the realm of earnings provides a comprehensive examination of the significance of their cognitive skills. Notably, both genders demonstrate an overall negative correlation between earnings and sleep treatments, without statistical significance. On the other hand, variations emerge in their happiness levels. Men exhibit a positive relationship between sleep treatments and happiness levels, contrasting with women's experiences. The primary objective of this study is to scrutinize the impact of sleep treatments on women, aligning with the earlier discussion on sleep insomnia in the introduction. Interestingly, naps prove to enhance cognitive skills in both men and women in the workplace, with men experiencing a more positive impact. The underlying assumption, explored in this paper, was that women might yield higher earnings return by investing more in leisure time. Additionally, by considering the lens of human capital theory, we can interpret these findings as an important source of cognitive abilities in economic productivity. The negative correlation implies that disruptions in sleep treatments may adversely affect the human capital investment represented by cognitive skills, consequently influencing earnings.

**References:**

Berger, R. H., Miller, A. L., Seifer, R., Cares, S. R., & LeBourgeois, M. K. (2012). Acute sleep

restriction effects on emotion responses in 30- to 36-month-old children. *Journal of sleep research*, *21*(3), 235–246. https://doi.org/10.1111/j.1365-2869.2011.00962.x

Bessone, P., Rao, G., Schilbach, F., Schofield, H., & Toma, M. (2021, April 8). *The Economic Consequences of Increasing Sleep Among the Urban Poor Get access Arrow*. Academic.oup.com. https://academic.oup.com/qje/article-abstract/136/3/1887/6217436?redirectedFrom=fulltext&login=false#267006894

Conroy, D. (2023, August 1). *How to get a good night’s sleep: Sleep disorders centers: Michigan medicine*. Sleep Disorders Centers. https://medicine.umich.edu/dept/sleep/news/archive/202307/how-get-good-nights-sleep

Han, K., Hwang, H., Lim, E., Jung, M., Lee, J., Lim, E., Lee, S., Kim, Y. H., Choi-Kwon, S., &

Baek, H. (2021). Scheduled Naps Improve Drowsiness and Quality of Nursing Care among 12-Hour Shift Nurses. *International journal of environmental research and public health*, *18*(3), 891. https://doi.org/10.3390/ijerph18030891

Sharma, K. (2023, March 17). *India is the second most sleep deprived country: What we can do to fix our sleep habits - times of India*. The Times of India. <https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/india-is-the-second-most-sleep-deprived-country-what-we-can-do-to-fix-our-sleep-habits/articleshow/98728738.cms?from=md>