

## Sleep, Public Health and Wellness: The Elephant in the Room

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The rising cost of health care and the burden of chronic illness are perennial concerns. Remarkably, there exists a measure that around 30% of city dwellers can implement to reduce their risk of accidents, coronary artery disease, diabetes, cancer and all-cause mortality while improving their cognitive performance. Unlike costly supplements or diets, this measure incurs no financial expense and unlike exercise, requires no exertion. That measure is improving sleep duration and quality.

Sleep and health have a strong bidirectional relationship.<sup>1</sup> It has become increasingly evident that short sleep, whether by personal choice, work demands, or illness, is a concern in many urbanised societies.<sup>2</sup> In particular, Asia Pacific nations constitute 7 out of 10 of the latest sleepers globally.<sup>3</sup> East Asian children and young adults have higher rates of short sleep than many of their Western counterparts.<sup>4-6</sup>

The adverse effects of short sleep are multifaceted.<sup>7</sup> Neurobehavioral effects include failure of sustained attention,<sup>8</sup> reduced information processing capacity,<sup>9,10</sup> impaired memory consolidation,<sup>11</sup> emotional dysregulation,<sup>12,13</sup> and altered decision-making.<sup>14</sup> Short sleep is associated with increased all-cause mortality,<sup>15</sup> adverse cardiovascular outcomes<sup>16</sup> as well as negative effects on glucose metabolism and an increased propensity to gain weight.<sup>17</sup> Sleepiness increases the risk of transport, medical<sup>18</sup> and industrial accidents.<sup>19</sup> The economic cost of productivity loss and work-related events secondary to sleep loss runs into billions of dollars.<sup>20</sup>

Despite these facts, a comprehensive time use study found most people who sleep less choose to do so.<sup>21</sup> Working, socialising and commuting are the leading activities related to sleep curtailment.<sup>22</sup> Most people alter the timing and duration of sleep in exchange for other activities. Rural societies do not face the situation where the biological imperative to sleep opposes the social or cultural reasons to stay awake.<sup>23</sup> Many urban dwellers on the other hand, consider sleep to be a commodity that can be traded for other activities considered more pressing or of greater value.<sup>22,24,25</sup> The metaphorical story of the frog that could not be tricked into jumping into a boiling cauldron but nevertheless met its end by entering cold water that was gradually heated

is an apt parallel to prevailing attitudes towards voluntary sleep deprivation. Why is this the case and what can be done to remedy it?

### Why Attitudes to Sleep Are Misguided

Human beings typically exhibit overconfidence in their own abilities and almost everyone rates themselves as 'above average'.<sup>26</sup> This has been demonstrated in many walks of life—including investment bankers, doctors, engineers, managers and entrepreneurs alike. In the spirit of 'it won't happen to me!' Having experienced a night or two of significantly shortened sleep without noticeable consequences, many think it fine to continue to chronically curtail sleep in service of career advancement.<sup>27</sup> In truth, there are persons who need only to sleep for about 4 hours per night on a sustained basis, but they are rare.<sup>28,29</sup>

'Sleep-banking', where the tolerance of a night of sleep deprivation can be improved by extending sleep a few nights prior to deprivation, may be feasible.<sup>30</sup> However, conversely, after a few nights of more severe partial sleep deprivation, the average participant loses insight into the extent to which vigilance can degrade.<sup>31</sup> The real-world effects of cumulative sleep loss was recently demonstrated when medical residents on a 3-week night duty rotation evidenced poorer neurobehavioral performance on their fifth and sixth shifts relative to their first shift.<sup>32</sup>

Turning back to the broader public, a key reason for the lack of urgency in promoting sleep as a risk factor is the fact that negative outcomes of short sleep commonly highlighted, such as coronary artery disease and obesity, are often delayed and may be confounded by co-factors. One is reminded of the metaphor of the frog being slowly boiled.

### Why We Need to Get Things Right in East Asia

The problem of short sleep in the young is pressing in our part of the world. In a meta-analysis of over 17,000 university students aged 17 to 30 years from 27 universities in 24 countries, students from East Asia led the world in reporting short sleep and poor subjective health ratings.<sup>4</sup> This may be a consequence of deeply rooted East Asian collectivist

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values that remain despite the veneer of modernity.<sup>33</sup> Despite shifting mores, traditional values of hard work continue to inure Asians to long hours and short sleep.<sup>34,35</sup>

Preliminary data from my laboratory indicate that older adults don't differ much in sleep patterns reported elsewhere. In contrast, undergraduates and elite high school students sleep alarmingly less than their Western counterparts. They also exhibit greater social jet lag,<sup>36</sup> meaning that the difference between weekday sleep duration and weekend sleep duration is greater. As the young have many years ahead of them, the long-term consequence of entrenched lifestyle choices could have devastating effects in the future.

Apart from changing personal attitudes, there is a need to focus on environmental factors that can disrupt sleep. Environmental noise is poorly regulated in Asia. Elevated transport related noise interferes with sleep and increases the rate of cardiovascular morbidity.<sup>37</sup> Far less is known about construction noise and little research is conducted in Asia where this problem is more widespread. This gap should be addressed.

Another environmental factor that can be improved on is the use of lighting at night. Three decades ago, it would be unusual to have late night shopping in all but the largest Asian cities. Today, brightly lit malls litter the cityscape. Bright light at night can cause a phase shift, delaying sleep onset.<sup>38</sup> This can compound shortened the effect of reduced time of sleep.

### **Guidelines About Sleep Duration Need to be Customised and Refined**

Policymakers seeking to establish the norms for an appropriate duration of nocturnal sleep face the challenging task of reconciling findings from small-sample laboratory studies that evaluate behaviour through theoretically-motivated and controlled experiments, and epidemiological studies that evaluate rather coarse, long-term outcomes.<sup>7</sup>

Scientists who have the tools and knowledge to investigate sleep deprivation are expected to publish exciting papers. These don't necessarily translate into meaningful guidelines unless there is a concerted effort to also probe long-term consequences of short sleep against the benefits of sleep extension. Data from cross-sectional surveys need to be backed up by longitudinal studies that are capable of establishing causality.

Conflicting data require thoughtful resolution. For example, in spite of robust laboratory-based studies that suggest memory consolidation occurs when we sleep, 2 recent studies where middle school participants were sleep restricted to 4 to 5 hours per night were unable to find an effect of sleep loss on declarative or procedural memory.<sup>39,40</sup> It could well be that teens may be cognitively more resilient

than we imagined. The little sleep they do get may contain sleep architecture adaptations like increased spindle density or increased slow oscillations.<sup>11</sup> Dramatising effects that are small or inconsequential harms the overall credibility of the message that chronic short sleep is harmful.

Another difficulty encountered when seeking to establish guidelines arises from changes in sleep duration and architecture across the lifespan.<sup>41</sup> Laypersons need simple axioms to live by—keep blood pressure below 140/90, BMI below 23 kg/m<sup>2</sup> and HbA1c below 5.7% and so on. They get confused when it becomes necessary to process different numbers for different contexts, yet this is the reality when it comes to sleep.

Given these challenges, it would make sense to craft guidelines and end-points targeted to the needs of specific groups and across the lifespan. For example, vigilance may be a more critical endpoint for transport workers or security personnel, while avoiding deficits in memory and learning would be of great greater relevance to students. Developing such customised measures will take expertise, effort and expense but the benefits to public health could be commensurately significant.

### **Opportunities Abound**

Compared to even a decade ago, there is increased awareness of sleep disorders. More people are coming forward to seek help for medical conditions where sleep is affected. This is welcomed, but it remains for the broader public to be more aware of the role sleep plays in maintaining health and wellness. Similarly, considering the health trade-offs when pulling an all-nighter need to be communicated in ways that change behaviour. Sleep researchers would do well to contribute their expertise in formulating more customised advice regarding sleep need based on growing knowledge of the mechanisms underlying performance decline and their amelioration.

Policymakers would do well to consider the 'u-shaped' function governing work-rest balance. It would also pay dividends to admit measures that could affect productivity in the near term, but improve human wellbeing and lower the burden of chronic illness in the long run. It took decades before the health hazards of tobacco consumption were assessed to outweigh business interests and a similar story is evolving for sweetened soft drinks. It is just a matter of time before sleep assumes similar gravitas in the public mind but for that day to dawn, more need to acknowledge short sleep as the proverbial elephant in the room—something too big to be left unaddressed.

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