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Sleep Debt: A Growing Human Deviation with Complex Global Fallouts

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Abstract:

The insatiable quest for comfort, fame and financial security along the course of human history, have continued to dictate human actions on earth. Driven by a perfidious capitalism, the world of the 21st century possessed by, and agog in its frenzied speed towards technological and economic success (developmental equation), appear to be cumulatively antagonistic to all vestiges of nature and its endowments, hence the litany of unfolding deadly global health and environmental challenges. The much celebrated technological appurtenances of the present era, have rather paradoxically promoted man's anxiety, stress and fatigue, through an adaptive trending deprivation and disorganization of the natural circadian shutdown of restful sleep. On the other front, how can a proactive professional academic be on top of his stock in trade without studious and energy-sapping research, which would always demand sleep denials involving distortion in sleep time/quality and quantity regimen? Unfortunately, this anomaly has permeated all theatres of human endeavor, marginalizing productivity and exacerbating terrible systemic complications and fallouts. Quite phenomenal as it has risen to be, sleep debt has inexcusably been silently accommodated and enamored, hence metastising almost through all aspects of human engagements, due to its attractive face-value, largely masking its cumulative fatal consequences. Poised towards deepening public awareness with regards to this problem, this study, under the cloak of Health History, adopted the eclectic research approach towards unearthing, sieving and evaluating available information. Nevertheless, in order to fully understand the general implications of sleep debt, one has to first appreciate the nature and essence of healthy sleep, hence the quality and quantity. The importance of quantitative and qualitative analysis cannot be ruled out in this study. The paper submits that since sleep debt is a proven human derivative resort posing innumerable challenges to global productivity and development, drastic cautionary measures should guide attitudinal change in all human endeavors to interject and turndown this anomaly.

Keywords:

Sleep, Fatigue, Stress, Attitudinal Change, Sleep Hygiene

1. Introduction

The complexities of today's digital world have continued to strengthen the insatiable urge for 'more' by the human family. This unfortunately manifests in the act of trying to do too much, hence overstepping the naturally-enshrined limits ensuring quality life. The dogmatic catechism of global capitalism continues to spin the wheel of obsessive economic advancement and technological breakthroughs, conversely inflicting pains, distorting and destroying lives. The danger in sleep debt, is not mainly on the primary resultant effects on the particular debtor, but on the wholesome complicating secondary ripple effects meted unto the innocent person, society or environment by the same culprit as a resultant consequence. Along this pedestal, a drowsy driver could not only get himself killed, but equally send a whole lot to their early grave, amidst serious environmental damages. At the same time, this debt could be a major factor in the damaging of careers, social upheavals like the ruining of marriages, extensive drug addictions, several health challenges and people's life span. This growing problem has permeated every profession and human engagements, dating back to the 'early man', who being fast of the foot, hunted through speed, pursuit and stamina, only to succumb to rest and sleep sequel to fatigue, for rejuvenation. Whether sedentarily engaged, or mobility-driven, passively employed as regards teachers who teach in a class situation or auto-mechanics and surgeons who could be held down practically, the common denominator, remains the human factor; thought sequence, output and productivity vis a vis energy and time spent, not even under emphasizing that diminishing returns could be involved.

Suffice it to acknowledge that over a given time and activity, nature has endowed it that the human brain must 'shut down' and re-booth later, for maximum performance of both thoughts – sequencing and practical performance. It is estimated that, average night sleep during the early 1900 was nine hours per day and by 1975, it dropped to seven and a half hours, while in 2002, it continued to drop. Lately, a significant number of people hardly have five to six hours sleep per night [22]. One may not forget that a research study had earlier shown that many individuals have their sleep reduced from 8 hours to 4 hours per night for one reason or the other, in effect causing features that mimic advance ageing, early diabetes amongst other disease conditions [2]. Further researches correlated the fact that earth's population is now getting on the average, an hour less sleep per night than what are needed. While this may seem insignificant, a nightly six billion hour sleep debt, has become the focus of researchers in both the variety of sleep-related illnesses and their impacts on the quality of life [11].

Sleep disorders devoid of any medical condition, trauma or traceable to an undesired effects of medicaments could under certain circumstances introduce one into an orgy of dangerous sleep deprivation, which accruable dangers are often masked by motivational tangible successes and references. Excuses to the effects of sleep debt (SD) have largely helped in providing this malady the much needed hidden cover, making actual clinical diagnosis in most cases elusive, hence providing more enabling condition for greater havoc to the population and society. The Covid 19 pandemic has simply succeeded in placing global economy beyond textbook analysis, hence deeply aggravating an already unemployment rate/job losses stemming from the stables of the high-speed 21st century world of the robotics and Artificial Intelligence (AI). Inorder to remain relevant, humans are made to compete with machines in efficiency and productivity, thereby over burdening the human system through abnormal extra inputs. Today's sleep-depriving lifestyles have unfortunately

systematically widened the population, age and size within the global population of sleep debtor potentials including those already suffering from it. Indices from many families, indicate that many young people are rather spending excessive and unusual nocturnal periods dwelling on social networking, E-books, amongst others, since in some areas, service providers prefer granting cheaper browsing rates to customers at night, compared to daytime. Reactionary responses and behavior from such youths even within their primary family settings under the influence of sleep debt, are better imagined than experienced, more so where there is a norm of delegated functional duties and responsibilities.

The ambience of night travels, especially in the developed countries, where there are good travel facilities and basic security cannot be doubted. However, discouraging and exorcising such 'idea' and practice from the psyche of many people, citing the palpable dangers, in the developing countries, may not be possible. Just as the name connotes, night travel comes with a totally different retinue, opposite of the Day travel. Greater emphasis here, is on the travel by road, either as a driver, a passenger, security provider or business attendant/service provider to passengers *enroute*. Notoriously made worse by dilapidated roads, increasing substance abuse and the 'nefarious activities of sex hawkers, many articulated vehicles and luxury buses drivers in Nigeria skip daytime sleep regimen, preferring to risk it all at night in fatal challenge against natural fatigue. By the same token, one would notice the alterations and altercations in the sleep/rest rhythm of the residents of many land route terminus, such as the popular *Ojuelegba*, a sub urban ghetto location within Lagos' State, Nigeria: 'Stark awake and fully active all through the night to welcome and assist night travellers, the inhabitants are in the habit of sleeping from 8 in the morning to around 4 in the evening, when they wake to start preparation for the on-coming night. In its notoriety, according to Ephraim, *Ojuelegba*, *Ore*, *Obolloafor* and their types elsewhere in Nigeria, have overtime succeeded in breeding many generations of sleep debtors and its accompanying human complexities. One wonders how those born and bred within such locations could easily re-align their social priorities when exposed to the larger human society', queried Ephraim [9].

Moreover, some professionals, usually classified as 'essential duties' like Nurses, fire service personnel, security agents, doctors amongst others within which certain sleep restrictions are demanded, sometimes are exposed to a chronic sleep deprivation, which surmounting evidence has proved incapable of being resolved or paid back simply as it was acquired. When performance is crucial, wakefulness is forcedly extended and sustained, with later consequences. Unfortunately, in the midst of enormous time- and labour-saving gadgets, people are complaining of getting more tired and stressed up, an incriminating evidence and pointer to a world nakedly exposed to the fast lane, hence beckoning on anxiety and emotional disorders as reliable visitors.

Since the turn of the millennium, more so sequel to the successive global health fatalities and pandemics ambushing the human community, through the ambits of Health History, it is relatively easy to glean through the past to the present, with the gainful ability towards nipping potential medical challenges from the bud. Life's hustle and bustle aimed at 'beating the system', and remaining ahead in all things is simply at an extreme mode currently, hence the apparent stubborn deafness to almost all important life's instructive physiological cautions. Dulled and deliberately disregarded overtime, such 'Signs and Symptoms' could result to either acute life threatening challenges like Cerebrovascular Accident (CVA), heart attack, affective

disorders, among others. Complex retinues of socio-cum health challenges are speedily amassing as accumulated developmental drawbacks bedeviling the human family, sequel to what always goes for 'simple' disregard of natural order and sequence. Reversing sleep debt (SD) may not be much of a problem than diagnosing and recognizing the symptoms. Consequently, SD diagnosed would appear to have been largely solved. Early to bed, early to rise, guarantees a lifetime of strength and alertness, rather than cutting corners always without pre-arranged backup.

2. Understanding Sleep

Sleep maybe explained simply as a rhythmic state of reduced consciousness enabling humans and animals to relax and rest so as to sustain life in stable momentum. Quite aware that medical books are awash with lots of definitions and explanations on what sleep is all about, one may agree that it is 'a state of repose in man and animals, which the activity of the brain and the senses appears to be temporarily suspended, characterized by partial or complete unconsciousness, relaxed condition of the body and general diminution of vital functions [26]. Agreed that it is a period of 'rest, during which volition and consciousness are in partial or complete abeyance and bodily functions partially suspended; occurring in cycles of two distinct phases of approximately 60 – 90minutes, it remains a very important biological process occurring in a 24hours rhythm [27]. The intricacies of this biological process are embedded in these two phases tagged – 'orthodox or non-rapid eye, movement sleep (NREM) and paradoxical or rapid eye movement sleep (REM)' [27]. Though from 6 to 8 hours each day appears to be the general average, each person according to apparent needs, more so, the nature of one's employment or undertaking helps in deciding the needed duration of sleep. However, it's important to note that it's not how long one sleeps that bequeaths tranquil rest and health, but how well and good, hence the duration could be short, but the important deciding factor is whether the paradoxical or rapid eye movement (REM) phase was experienced. It simply REM that repairs the loss occasioned by activity during time of wakefulness, hence more sleep is needed in youth than in old age, when nature makes few permanent repairs and is content with temporary expedients. It has been found that there are 80 proteins in the human brain called 'sleep need index phosphorproteins' (SNIPPS), which become more and more phosphorylated during waking hours and are dephosphoylated during REM sleep [28]. People, especially who are really tired may not obtain proper rest, unless they are allowed to sleep and naturally wakeup by themselves.

Compared to the state of being awake, the pulse and breathing are slower while sleeping, the secreting organs of the body are less active, and the pupil of the eye is contracted considerably, added to a lower temperature, especially from two to five o'clock in the morning [26]. That some people chose to refer to sleep as the 'little brother of death' does not mean that one's unconsciousness during sleep should be equated with that of coma. Under coma, victims cannot be aroused, added to the total absence of both spontaneous eye movements and response to painful stimuli (Glascow Coma Scale, 1991). Conversely, a study by [11] shows that the human brain never decreases in activity whether awake or asleep, since throughout the 8 hours of adult sleep cycle, a normal person alternates between the non REM and the REM sleep.

Sleep is not only a normal biological function, but a *sine qua non* to human physical and emotional viability and stability; hence a research study by Buysse opines that without adequate sleep, a person's ability to perform even simple tasks declines dramatically [6]. Sleep greatly assists the human brain in the task of learning and

memory. This it does when through sleep, the brain commits new information to the memory through a process called Memory Consolidation. Buysse, [6] equally towards buttressing this, reported that people who had slept after learning a task, did better on tests later. Due to the deep part played by the brain during sleep, which has been classified as a biological function, many endogenous and exogenous factors always help in determining the nature, status and outcome of ones sleep. Overall health status which includes psychological stability and environmental calmness, amongst others cannot be overlooked. Many workers, especially those on 'shift duties' choose to live in the greener, quieter outskirts of cities. Needless to caution that choice of diet and clothes, including eating pattern one way or the other, affect sleep. However, the combination of shift work and workplace stress is known to compromise people's wellbeing, and is common precursors to compromised sleep quality [8].

It could be medically diagnosed as Insomnia, when one finds it difficult initiating or maintaining the state of sleep. Sometimes the body reacts to this lack of sleep through daytime drowsiness and dullness, which is completely hazardous to both the person and the society. [6] once more nailed it by concluding that there is a homeostatic relationship between wakefulness and sleep, this discourages normal people from becoming dangerously sleep deprived. All in all, personal idiosyncrasies as a result of the differing uniqueness of individuals could assist in determining one's sleep, sleep needs, and hence, sleep deprivation.

3. Conceptualizing Sleep Debt

Dueling historical and scientific annals including editorials have continued to occupy global research reservoirs on the debate centered on Sleep Debt (SD). Challenged as a mere human construct, or welcomed and addressed as a dangerous challenge, it has continued to engage the attention of some leading sleep researchers, psychiatrists, psychologists and interested individuals who have had palpable reasons to be. Sleep Debt (SD) is said to build up, when a person does not get the amount of healthful sleep needed for his well-being [16]. Naturally, the individual's body wants to pay this debt and encourages such by making him to feel tired, but infatuated with the sleep-deprived life-style of speed and convenience, one degenerates into chronic tiredness. Researchers today are faced with ever growing volumes of information they need to search, evaluate in order to update their work, hence tedious and extraneous work that often demand over stepping their regular boundaries. At the end of the tunnel, there's always a high cost to pay for being too busy.

Each year, the global cost on human lives and many accruing from the complications of tiredness and fatigue would always remain geometrically unimaginable. From terrible road accidents, unbalanced academic assessments, wrong medical diagnosis/surgical attention and Nursing management, incriminating drivers, teachers and health workers, Martin Moore-Ede reminds humanity that 'machines are protected by operational manuals, warning labels and training courses. Since humans arrive this world with no such protection, added to the shocking truth of knowing far less about humans than the operational sequence of these hard and soft wares, it may be time to heed the warning signals' [20].

Fatigue resulting from long hours and staff cuts is said to have contributed to some of the worst disasters of the 20th century. Among these are the nuclear disasters at Chernobyl, Ukraine; the explosion of the Challenger Space Shuttle; the oil spill caused when the tanker Exxon Valdex struck a reef in Prince William Sound, Alaska.

When overtime becomes excessive, worker efficiency decreases and the potential for human error rises [20,3]. Amassed evidence have not only consistently shown that tired minds are prone to costly and serious mistakes, but heaps of scientific pointers have identified a litany of learning/memory problems, motor-skill impairment and weakened immunity as part of a whole lot of health challenges inherent from sleep deprivation. On the social angle, apart from the tendency to relapse into a cycle of drug and alcohol abuse, including poor eating habits and even child abuse, studies show that the divorce rate in shift working families is 60 percent higher than for day workers in regular jobs (Moore-Ede,)

The danger in the 21st century world is that younger people are much more affected by a world spinning at a hypersonic technological speed, engaging and tasking more people while spreading unemployment, competition and economic inequity. Depression can only add to the widespread corruption of basic human values and success, hence the massive reliance on addictive elements and hard drugs. A recent study by [14] asserted that sleep deprivation is not only cyclical in nature, but also geographical; hence people who sleep less than six hours per day are likely to be tired, sad, stressed and angry, moody, susceptible to obesity, type II diabetes and infections.

Comprehending sleep debt better could be equated with one who deliberately resigns from his source of income, but kept on debiting his monetary savings on even more added expenses, hopelessly striding along devoid of any contingency plans. As the body experiences more nights without sleeping, the need for sleep intensifies and are compounded as time goes on, and waking hours are run on borrowed energy that will likely run out someday. Sleep debt takes a serious toll on the body, causing problems with concentration, dexterity and creativity (WHO, 2010), hence cumulative neurobehavioral deficits. Agreed that one's sleep needs may differ from that of another that subsequently makes it more difficult, quantitatively measuring sleep deprivation, hence [10] advises that sleep debt seems to be best determined in terms of tasks impaired.

Wrongs, misdeeds and mistakes done within the hospital environment traceable to sleep debt, remain lethal and psychologically more painful, because the idea of the medical arena is for live-saving. Ethically tailored and Hippocratically – bound to save lives, toying with anything that could predispose healthcare professionals from operating with sound disposition remains highly unacceptable. Several researches have implicated Doctors with 'tired heads' for wrong assessment, diagnosis and prescription, while Nurses who are fatigued due to extended shifts are prone to deadly medication administration errors, lack of proper patient attention and undeserved irritable responses against the sick. Undoubtedly, overtime always comes at the expense of sleep and fatigue. A study by [15] established that Nurses in Massachusetts who worked variable schedules (including mandated overtime shifts) were twice likely reported to have accident/error and two and-one-half times likely to notify supervisors of near-miss accidents.

Even with the diverse trending successes of evolving modernity, triggering the cultural upheavals changing the course of human life on earth, 'sleep debt is contributed to by the social phenomenon called 24/7- operating 24 hours a day, seven days a week, with a new wave of round-the-clock retailers and services profiting by mocking the clock (USA Today, Cited in jw.org). In recognizing sleep patterns as a crucial component in health determinant, [15] opined that a relationship exists between sleeping disorders and declining wellbeing, increased morbidity and

mortality, as well as reduced productivity and memory performance. Giving more credence to this position, Peterson *et al* [23] highlighted that investigations of improved sleep quality and quantity consistently shows improved performance, alertness and mood, with results appearing most beneficial to those who work shift or night time. The occupational dangers of being around a sleepy coworker were made bare when certain participants selected by an Australian researcher – Ann Williamson, were kept 17 to 19 hours without sleep. Performance tests later conducted on them proved the equivalent or worse than a blood alcohol concentration of 0.05% (percent) – subjects functioned as if at or beyond the legal limit in some countries of alcohol permitted in a driver's blood stream (www.jw.org). One can then imagine the annual cost of the numerous auto-related and job-site accidents, in productivity and family. Sleep debt has become a dangerous behavior reliance of man, with seemingly complex irreversible challenges.

Amongst the many scientific tests that have helped in providing more understanding to sleep debt (SD) include the Multiple Sleep Latency Test (MSLT), the Epworth Sleepiness Scale (ESS) [12]; an Amylase enzyme test indicating sleep deprivation through increased saliva activity of the enzyme (conducted by University of Washington in St. Louis, 2007), and a 2009 study by the same University, successfully isolating the enzymes Orexin and Amyloid beta as possessing illuminating relations with sleep debt and Alzheimer's disease (Washington University, 2007) see also Kang *et al* [25], wikipedia.org/wiiri/sleepdebt).

4. Effects of Sleep Debt

Regardless of the numerous identifiable factors that could lead to sleep deprivation, this study believes that at the heart of those, lays the all-important issue of attitudinal change and choice. However, the deleterious effects of SD are not only to human health, but to the society in general. As a health problem, its debilitating effects could complicate into many life-threatening conditions-physiological, Neuropsychological, endocrinal and mortality curves.

The impact of chronic sleep debt on the metabolic and endocrine body functions are really unimaginable [18]. Furthermore, a study published in the Lancet investigated the physiological effects of sleep debt by assessing the sympatho vagal balance (an indicator of the sympathetic nervous system activity), thyroptopic function, HPA axis activity, as well as the Carbohydrate metabolism of 11 young adult males whose sleep period for six nights was either restricted to four hours per night or extended to 12 hours in bed per night [17]. Results revealed that in the sleep debt condition, thyrotropin concentrations were decreased, while lowered glucose and insulin responses indicated a clear impairment of carbohydrate tolerance, a 30% decrease than in the well-rested sleep condition [17]. On the other hand, males who were sleep-restricted showed significantly elevated concentrations of evening cortisol (the 'stress' hormone) and elevated sympathetic nervous system activity in comparison to those who enjoyed a full sleep over a period of 6 nights [4,17]. While potentially increasing the severity of cardiovascular (neuro), physiological, immune, endocrine and age-related illnesses over a period of time, chronic sleep debt remains a growing human challenge [17].

Accumulated and continuous short-term sleep deficit has been shown to increase and intensify psychophysiological reactions in humans to emotional stimuli. Motonura *et al*, through their 2013 extensive study, assessed sleep deficit in young

Japanese men over a 5-day period, during which they slept only 4 hours per day. In humans, the Amygdala plays a strong functional role in the expression of negative emotions such as fear, and through its anatomical connections with the Medial Prefrontal Cortex (MPFC) has an important function in the subjective suppression of, the refraining and reappraisal of negative emotions.

Emergent study result showed that there was greater left amygdala activation to fearful faces but not happy faces, and overall subjective mood deterioration [21]. Thus, a full and uninterrupted 7 hour sleep is crucial for the proper functioning of the amygdala in modulating an individual's mood states, by reducing negative emotional intensities and increasing reactivity to positive emotional stimuli [21].

Sedentary lifestyle, inactivity, browsing and internet activities, excessive time spent on television as well as higher food consumption have been pin-pointed through Epidemiological research as key elements associated with sleep debt and/or deprivation and obesity sequel to an elevated body mass (BMI). Identified links include disruptions in the hormones – leptin and ghrelin that regulate appetite, higher food consumption and poor diets, and a decrease in overall calorie burning [4]. Added to this, Bayon and his group have equally listed other contributing factors to overweight and obesity as a result of shorter sleeping periods to include – work related behavior such as long working and community hours, irregular work timings such as during shift work. They concluded that in comparison to adults, children exhibit a more consistent association between sleep debt and obesity [5].

Dangerously hidden beyond public awareness and attention, SD whether chronic, deficit or of shorter duration, has been proved to play an active part in mortality whether weekdays or weekends; convincing scientific evidence show that in people aged 65 years and younger, a daily sleep duration of 5 hours or less (amounting to a sleep deficit of 2 hours per day) during weekends correlated with a 52% higher mortality rate compared to a control group who slept for 7 hours. Surprisingly, the harmful consequences of SD over weekends and weekdays was not seen in individuals aged 65 years and older [1]. Nonetheless, a consistent weekday sleep debt exhibited a detrimental association with mortality and morbidity, though this effect was negated when compensated with long sleep during weekends [1,13].

In different climes and by people with personal idiosyncrasies, reactions to exposure to sleep debt have recorded experiences like visual/auditory hallucinations, exaggerated peculiarities of ageing lines, wrinkles and shadowy looks, split personalities and *deja va* experience, among others.

5. Conclusion

'Sleep is never an easy or common business', hence to fall asleep and stay asleep may not be a simple experience. In life, experience has shown that indebtedness of any sort, relatively mortgages the debtor's basic psychological freedom, and may even require more than what was actually borrowed in paying back. From the stressful jobs, to the tensions/anxieties daily accompanying human life and the traffic jams, distant travels and shift duties, it's obvious that both mental and physical fatigue would at same point set in. The natural sequence of mandatorily having or reserving night period for sleep has been completely defeated by the urge to achieve much within a short period, hence pilfering with expected rest/sleep periods. Sleep debt remains a growing problem which elicits awareness/understanding in order to manage, contain and possible mitigate.

Against this backdrop, this study advocates for a total, attitudinal change on the part of the human family, regardless of one's job, task or professional engagement. Life is not only precious but personal. From on start, one should aim at resisting 'playing around' this urge, so as to prevent descent into a habitual reliance. This can be done through focusing on the emergent calamitous predispositions and damages. For individuals who are already neck deep in this, the healthy option is embarking on the several proactive sequential formulas of walking out of it devoid of drugs/alcohol dependency.

Good sleep hygiene remains a prerequisite for good health. Sleep hygiene is a systematic approach for developing life style and dieting habits that promote sound sleep. It is the goal of developing a pattern of behavior, which has positive effect on sleep before, during and after time spent in bed [7] Good sleep hygiene is the most important regimen of therapy in the exhausting fight against all forms of disruption to sleep (National Sleep Foundation, 2002*). The uphill task in this encounter is the reversal schedules involved, which must stem from mind preparation, before initiating increasing scheduled activities, all encapsulated in attitudinal change. Resort to hypno-sedatives (Pharmacologic therapies) or other chemical aids many offer a temporary help, since their proven efficiency appear to be on people suffering from either specific medical condition or short-term episodes of broken sleep.

Combating stress apart from involving a multi-faceted regimen, remains a direct attack to fatigue. Towards minimizing and controlling sessions of anger and worry (Sleep Killers), one should initiate periods of physical exercise to avoid sedentary life and inactivity. Guided exercises in streamlining metabolic activities, just as an ambient environmental condition (noise level, odour, temperature and light-level) in tune with individual comfort and relaxation remains mostly recommended. Creating a routinized sleeping and waking time in aiding the body's sequential alignment, bequeaths one with veritable psychosomal gains from sleep. Customized professional attention, including treatment regimens remain viable alternatives depending on the severity of the problem; and always appears better applied after detailed psychosocial assessment.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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