

Sleep Apnoea: Impact on safety and psychosocial functions

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Abstract

Sleep apnoea is a common condition within the community. The consequences of untreated sleep apnoea are far-reaching and they include cardiovascular and cerebrovascular morbidity and mortality, neurocognitive impairment, increased risk of motor vehicle accidents, occupational injuries, lower quality of life (QOL), and mood disorders. It is an important public safety issue in light of its prevalence in certain subgroups. Untreated sleep apnoea has substantial safety and psychosocial impairments, which translate to major health care costs. Continuous positive airway pressure (CPAP) treatment for sleep apnoea has been shown to have a positive impact on subjective quality of life and depression, and is cost effective.

Keywords: obstructive sleep apnoea, safety, psychosocial function, quality of life, continuous positive airway pressure

Introduction

Sleep apnoea is characterised by the recurrent reduction in airflow or cessation of breathing during periods of sleep, with resultant arousals from the sleep state. It is prevalent in 4% of men and 2% of women in middle age¹. Obstructive sleep apnoea (OSA) is often used interchangeably with the term obstructive sleep apnoea-hypopnoea (OSAH), and is considered the obstructive sleep apnoea syndrome (OSAS) when it is when combined with excessive daytime sleepiness. In the Indian population the prevalence of OSAS in males aged between 35-65 years is 7.5%², whilst Sharma et al established the prevalence of OSA and OSAS at 13.7% and 3.6% respectively in men, and 4.96% and 2.03% respectively in women³. This remarkably similar prevalence was derived after accounting for selection

biases in terms of gender and socioeconomic class, despite differences in cephalometric variables and obesity rates³. Sleep apnoea is underdiagnosed and undertreated in the community⁴.

Repeated interruptions to breathing, whether it be from a physical block as in obstructive sleep apnoea, or an absence of respiratory effort in cases of central sleep apnoea, has cognitive and physiological consequences. Reported neurocognitive impairments include deficits in vigilance, concentration, alertness, short and long term memory, global intellectual dysfunction and executive functions⁵. Published literature appears to show a limited consensus regarding the type and severity of dysfunction from sleep apnoea.

Whilst some studies have shown those with OSA who subsequently received CPAP intervention fared better in tests of vigilance and alertness compared to those without treatment⁶, others such as Gast et al have found few CPAP-related improvements⁷. These inconsistent findings maybe possibly be explained by the partial nature of sleep deprivation in sleep apnoea, the development of executive coping strategies, a lack of standardized tests

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specifically targeted at CPAP treatment outcomes, or a longer period of time needed for neurocognitive changes to be rectified.

Sleep apnoea, motor vehicle accidents and occupational injury

Driving a motor vehicle is an intricate task comprised of many skills, each of which can be adversely influenced by many conditions including sleep apnoea, alcohol (implicated in 32% of all USA traffic fatalities⁸), excessive speed (a cofactor in 31% of all fatal crashes⁹), road circumstances, and driver experience. While crash statistics and their predisposing factors are heterogeneous and possibly inferential in nature, the abundance of epidemiological and investigational data recently reviewed by George has consistently supported findings that untreated sleep apnoea increases the risk for motor vehicle accidents from between two- and tenfold compared to control groups¹⁰, presumably from the same neurocognitive deficits mentioned earlier. The subpopulations of commercial drivers have a higher prevalence of sleep apnoea, obesity, sleepiness, and rate of motor vehicle accidents¹¹.

Although Indian road traffic statistics are less comprehensive, the total number of lives lost from traffic accidents is just as compelling – an estimated 110,000 road-accident related deaths, 2.5 million hospitalisations, and an economic loss of 3% of GDP for the year 2005¹². More precise measures of the risk of car accidents associated with sleep apnoea is complicated by a potential bias towards retrospective underreporting of sleepiness and fatigue in collision circumstances, inability to remove other influencing factors such as individual work schedules, medications, road familiarity and driver skill.

Treatment with CPAP in drivers with sleep apnoea has been shown to decrease motor vehicle accident rates to rates seen in the general driving population¹³. On the base-case analysis of newly diagnosed OSAH sufferers in the US carried out by Ayas et al., treatment of sleep apnoea with CPAP reduced the rate of collisions by a factor of seven compared to no CPAP¹⁴.

Similarly, as a consequence of greater inattention and reduced vigilance the risk of being involved in an occupational accident is at least twice in male heavy snorers with a 50% increase in men with OSAS, and at least three times as high for females with heavy snoring and OSAS¹⁵. Prospective studies have also demonstrated

similar odds ratios towards occupational injuries in sleepy snoring males¹⁶, as well as risk of work disability in both genders with an OSAS diagnosis¹⁷.

Although the benefits in relation to occupational injury have not been studied as extensively as motor vehicle accidents, similar statistical gains might be deduced given that the same cognitive returns will be made in these sleep apnoea candidates.

Sleep apnoea, quality of life and depression

The important associations between poor sleep, quality of life (QOL), attention-to-task, and mood disorders have been explored from the psychiatric, neurological, epidemiological and respiratory-sleep perspectives. Severe sleep apnoea sufferers have a reduced QOL compared to normal individuals as measured by the generic Medical Outcomes Study Short-Form (36-item) Health Survey (SF-36)¹⁸.

These general quality of life questionnaires are often negatively influenced by the symptoms of excessive daytime sleepiness, altered perception of functional and emotional well-being¹⁹. Disease-specific assessment tools as such as the Functional Outcomes of Sleep Questionnaire (FOSQ) have been shown to improve with sleep apnoea treatment, suggesting construct validity of this measure. FOSQ contains 30 items divided into five scales – activity level, vigilance, intimacy and sexual relationships, general productivity, and social outcome²⁰.

Within the FOSQ's five scales are indirect measures of an individual's perceived neurocognitive ability (in particular the concepts of vigilance and attention to task), the negative impact of which has already been previously delineated in consideration to motor vehicle collisions and occupational risk. These functional impairments have also been found to be in line with measures of sleep propensity as measured by the Epworth sleepiness scale¹⁸.

Disordered sleep can be seen to modulate depression and vice versa. Sleep disruption is a common symptom in those with depression, reflected by their inclusion as a DSM-IV diagnostic criterion. Conversely many patients with OSA also have depressive symptoms²¹⁻²³ and some studies have placed the prevalence at up to 48%¹⁸, but the accepted general prevalence of depression in this population remains unclear²⁴.

In a cross-sectional telephone survey of 18,980

individuals performed by Ohayon, 0.8% of people had both a breathing-related sleep disorder and a major depressive disorder²⁵. The identification of a breathing-related sleep disorder also indicated a 20% chance of having major depression as a co-condition and vice versa, and awareness of this association is recommended²⁵. A similar longitudinal dose-response association between sleep-related breathing disorder and depression supports a causal link between these conditions²⁶. QOL also correlates with the Zung self-rated depression scale in sleep apnoea patients¹⁸. A significantly higher prevalence of anxiety disorders, posttraumatic stress disorder, psychosis, and dementia were also found in sleep apnoea patients²⁷.

Treating sleep apnoea with CPAP has been seen in measures of subjective sleepiness with the ESS^{24,28}, general QOL measures (such as the SF-36) and in disease-specific measures of QOL (FOSQ)²⁸. Improvements in attention to task and neurocognitive tests following CPAP treatment are less forthcoming, made more difficult by the lack of differentiation on the basis of sleep apnoea severity in these studies, as well as a lack of an accepted assessment protocol to gauge improvements²⁴. Despite this, the economic and social burden of mood disorders and the ensuing quality of life would imply that this relationship warrants further inquiry.

The economic cost

Although sleep apnoea has a considerable impact on safety and psychosocial functioning, using economic terms to measure this impact has several benefits. The sum-total of healthcare and non-healthcare expenditure incurred by a condition in one individual can be extrapolated to the wider community. This allows for comparisons between different social groups and amongst different countries, and permits an appraisal of treatments through the demonstration of cost-effectiveness.

The economic impact of untreated sleep apnoea begins many years prior to the time of diagnosis and treatment^{29,30,31}. Kapur et al demonstrated that sleep apnoea sufferers accumulated on average twice as much in healthcare expenses over the year before their treatment²⁹. These costs appeared to remain true after consideration was taken for the cohort's chronic disease status as measured by the chronic disease score. In addition the severity of sleep-disordered breathing (as measured by the apnoea-hypopnoea index) was directly related to the healthcare costs used by those groups²⁹. A similar two-fold increase in healthcare consumption was

demonstrated in terms of hospital stay and physician claims two years prior³⁰, and ten years prior to diagnosis³¹ in further studies.

Hillman et al went one step further and comprehensively evaluated the direct costs of sleep disorders (those incurred through the health system including co-morbidities from appropriate attributable fractions), indirect costs (motor vehicle accidents, work-related injuries and lost productivity), and nonfinancial costs derived from depreciated quality of life and premature death³². The estimated total economic cost of sleep disorders in an Australian population of 20.1 million (in the year 2004) was \$7.5US billion, and the equivalent cost for a population the size of the USA was around \$109US billion³².

Direct costs contribute less than 2% of the total cost of sleep disorders, whilst indirect and financial expenses account for a disproportionately larger share of the total cost³². This reflects a lack of revenue allocated to prevention, diagnosis and treatment of sleep apnoea. It also demonstrates the often underestimated ripple effect that sleep disorders can have on the psychosocial and economic fronts.

The high cost of sleep apnoea is matched by a higher cost-effectiveness when considering standard treatment with CPAP. Using models to represent the natural history of OSAS, Mar et al compared the cost of nasal continuous positive airway pressure (nCPAP) treatment versus the alternative of allowing OSAS to take its untreated course³³. It was shown that nCPAP has a cost-effectiveness in line with commonly funded healthcare initiatives such as antihypertensive drug therapy, the benefits largely derived from improved daytime alertness and quality of life³³. For those with OSAS who remain adherent to their CPAP treatment after two years, there appears to be an absolute reduction in direct costs from physician consultation costs and hospital stays³⁴.

Central to the model of cost-effectiveness is an acceptable degree of compliance to treatment. Whilst technical reasons for non-compliance are pervasive, Suri et al has outlined some socio-cultural considerations applicable to the Indian patient. Initial refusal of therapy is higher, and significantly fewer patients were able to source their CPAP devices from insurance / healthcare funds³⁵. In addition, regular CPAP use in India was impeded by more hostile weather conditions, frequent travel, inconsistent power supply, and issues relating to privacy³⁵.

Adherence to CPAP treatment is economically advantageous when taking into consideration the gains in quality of life, costs of therapy, and outcomes from motor vehicle accidents¹⁴. The conversion of these physical sequelae of sleep apnoea into economic terms will hopefully allow developed and developing communities alike to account for future workforce planning and resource allocation.

Summary

Sleep apnoea is a common condition with far-reaching implications for social and psychosocial functioning. Through sleep deprivation and neurocognitive deficits, sleep apnoea can be a contributor to motor vehicle accidents and occupational injuries. Disrupted sleep, quality of life and depression are all intimately associated. Treatment with CPAP has demonstrated benefits in reducing motor vehicle accidents and occupational injury, subjective quality of life scales and subjective depression scales. The human consequences of untreated sleep apnoea can be consistently translated into economic terms that may be useful on social planning platforms. The economic impact of untreated sleep apnoea is present well before diagnosis and initiation of treatment, and its social impact is underappreciated as evidenced by the disproportionately large indirect cost component. Adherence to CPAP therapy for sleep apnoea is cost effective and economically advantageous.

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