

Shift Work and Neurological Disease Lange JH

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Non-standard work shifts are common in many occupations and until recently were not addressed as a potential occupational hazard. Recent studies have shown workers undertaking non-standard work periods experience “negative health effects” [1]. These health effects can be categorized as either acute or chronic impacts from a neurological prospective. Acute effects, as examples, include sleep disturbances, postural performance, memory impairment, reduced response, behavioural changes, and dysfunction in thermoregulation. These acute responses can be extended to chronic conditions and also include, as examples, cardiac dysfunction, dementia, Alzheimer’s disease, overall increased mortality, increased cancer rates, and peripheral resistance disease [2-4]. Many of these issues have been suggested to be a result of disturbance in circadian rhythms, including changes in melatonin levels [4]. Historically, the literature frequently addressed work shifts regarding impact to cancer risks; however, neurological effects have been commonly noted [4]. Numerous cancers have been suggested to be related to shift work (e.g. breast, prostate, colorectal, non-Hodgkin lymphoma) [5-7].

The International Agency for Cancer Research (IARC) now categorizes shift work as a “probably” carcinogenic agent (Group 2A) [3]. This categorization by IARC has changed the view as to how employers and governmental agencies (e.g. the Occupational Safety and Health Administration–OSHA) examine impacts from shift work. However, the literature is not clear on this causation and types of related cancers [8]. There is also a discussion within the literature of how the health-worker effect impacts shift work which may be a major confounder [8].

It is believed that effectors resulting in oxidative stress may be one of the primary mechanisms of “inducing” disease events associated with shift work [9]. Certainly, this is a result, at least in part, from altering the circadian rhythm and associated regulators. Those that rotate work periods may be most affected as compared to those working a steady night shift [3]. There may also be a selective factor for those continuing to undertake shift work at least on the long-term basis. This selection (healthy-worker effect) may in part explain why studies are inconsistent in reporting various diseases related to those involved in shift work [8]. However, as workers age, stress of working varying shifts may become more magnified resulting in a greater hazard [9]. These stresses also appear to be an important factor resulting in the occurrence of metabolic disease states, which in turn can contribute to many other harmful medical conditions (e.g. Alzheimer’s disease, diabetes, psychiatric conditions) [10].

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Alternatively, it has been suggested that shift work may have a protective effect against Parkinson’s disease [11]. This alone does not provide support for oxidative stress being a causative factor for disease; although, any relationship may be strictly related to the specific infliction (e.g. sleep disturbance) [8,9].

A possible underlying factor for many suggested disease events associated with shift work appear to relate directly to impacts on metabolism and endocrine functions [1,3,8]. However, psychological factors in conjunction with physiological disruptions appear to have a relationship with disturbance of circadian rhythms [12,13]. Theorell and Akerstedt [14], suggested that those undertaking shift work enter a catabolic state which eventually leads to disruption of homeostasis. This can result in a contribution of many of the increases in disease states reported in epidemiological investigations (e.g. stroke, heart disease, migraines, cancer, Alzheimer’s disease) [9,15-17]. However, in some ways it may be more difficult to relate these changes to neurological concerns from shift work. Thus, change and variations in hemostasis may be an important contributor and confounder as reported/observed for disease rates in shift work studies.

Shift workers, as related to neurological functions, have been suggested to result in many detrimental effects including those associated with cognitive function, stress, seizures, sleep disorders, neuroendocrine impairment, headache and insomnia [18,19]. In some ways, these endpoints are more difficult to measure. However, impacts to sleep cycles may be indirectly causing, or at least be a contributor, to other more clearly defined medical

conditions, such as cancer. Recently, it has been shown that those undertaking shift work have an increase in inflammatory markers [20]. Although these markers are probably related to neurological dysfunction, they do have a clear relationship with other health issues such as cardiovascular disease. This suggested relationship becomes even more important with the finding of disruption of cytokines as a result of shift work [21]. The recent suggestion that pro-inflammatory cytokines may have some relationship with the occurrence of Alzheimer's disease and possibly other cognitive impairments [22] does not make it difficult to extend these molecular/physiological changes, along with observed epidemiological findings, that shift work may be an important factor in occurrence of many neurological disease states. The recent finding that stroke may be associated with shift work makes these plausible relationships of even greater concern, since this disease event is more highly definable [23]. However, the consistency among several studies finding a relationship of shift work and stroke certainly adds to the level of concern for this type of rotating work [16,24]. It is not difficult to expand these findings to other brain dysfunctions regarding neurological impairment.

Another impact from shift work is psychomotor-related performance and stress [4]. Parameters of this nature are difficult to measure; however, such related events have been well reported in populations commonly performing shift work (e.g.

transportation industry, healthcare workers). The general clinical characteristics associated with shift work has been recently termed Shift Work Disorder (SWD) [25]. This disorder may result in long-term consequences that are only recently being recognized [26]. With information on molecular mechanisms related to shift work emerging [10], plausibility of SWD having an organic underlying for this disease appears to exist. SWD may in some ways be a major disease categorization for the multitude of reported diseases (e.g. stroke, psychomotor, seizures, cancer, dementia, cardiac) as suggested in the epidemiological literature. This it itself may form a new category of occupational disease in relationship to varying work shifts. However, recognizing numerous disorders together and placing them in one new category, as related to shift work, will be difficult and likely experience resistance from those providing more traditional classifications.

As issues of shift work become better understood, a greater emphasis on preventative practices will be needed. It is likely governmental agencies (e.g. OSHA) will begin to examine health risks more closely related to this type of work activity. However, since some occupations requires employees to work over-night, addressing these issues will be difficult. It may be feasible in the future to match employees with their most suitable work period for an optimal work life-health balance.

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