

# Progressively Lowered Stress Threshold Model: Understanding Behavioral Symptoms of Dementia

The number of persons with Alzheimer's disease, the most common form of dementia, is currently 4.5 million, and as baby boomers age, the incidence will more than double.<sup>1</sup> Although advances have been made toward understanding Alzheimer's disease, there currently is no cure. Behavioral symptoms, such as wandering, aggression, and vocalizations, occur in 90% of persons with dementia.<sup>2,3</sup> Behavioral symptoms diminish quality of life and functional status for persons with dementia, increase burden for their caregivers, and contribute significantly to long-term care costs.<sup>4,5</sup> Effective interventions are urgently needed. Unfortunately, a lack of understanding of the origin of the behavioral symptoms of dementia has impeded development of effective interventions to prevent them and intercede when they occur.

In this issue of the *Journal of the American Geriatrics Society*, Smith et al.<sup>6</sup> review advances in geriatric nursing theory, practice, and research based on the progressively lowered stress threshold (PLST) model. The PLST model seeks to understand and explain causes of behavioral symptoms in persons with dementia and to guide interventions. The model posits that persons with dementia have a lowered stress threshold related to disordered person-environment interaction and thus are less able to cope and manage stress as their disease progresses. Behavioral symptoms in persons with dementia, such as agitation, night wakening, and combativeness, emerge when internal (e.g., pain, fatigue) or external (e.g., noise, change in routine) environmental demands exceed their stress threshold. The model also conjectures a circadian pattern for the stress threshold, with the highest stress threshold in the morning and the lowest in the evening.

The PLST model is one of several models of causes of behavioral symptoms in persons with dementia. One study<sup>7</sup> grouped these models into four categories that are not mutually exclusive. The direct effect of a dementia-biological model postulates that behavioral symptoms result directly from neuronal pathophysiology and that severe brain deterioration results in behavioral disinhibition. The unmet needs model hypothesizes that behavioral symptoms result from unresolved needs that persons with dementia are unable to verbally convey. A third category, the behavioral model, puts forth the notion that antecedents and consequences control behavioral symptoms and that many behavioral symptoms are learned through caregiver reinforcement. The PLST model best fits into the environmental vulnerability model category. This category suggests that a mismatch between the person's needs and abilities and

the environment results in behavioral symptoms. Interventions derived from environmental vulnerability models seek to modify the environment to match each individual's needs for rest or stimulation and their capabilities.

About the time that Hall and Buckwalter<sup>8</sup> developed the PLST model, federal legislation caused a paradigm shift in nursing home care, and the use of physical restraints to control behavioral symptoms rapidly decreased.<sup>9</sup> The need for effective alternative interventions for management of behavioral symptoms was (and remains) urgent. Their notion that behavioral symptoms were the result of person-environment interactions that triggered stress was novel and innovative. The PLST model led to the development of theory-based nursing interventions for behavioral symptoms. Its major premises still hold true today, 20 years later.

The PLST model delineates principles of care that caregivers can use to modify the environment to reduce environmental stressors and prevent behavioral symptoms. These principles have been widely applied and their efficacy and effectiveness tested in a variety of settings. Research findings support the idea that interventions based on the PLST model improve outcomes for caregivers and may reduce behavioral symptoms in persons with dementia.

As evidenced by its research and practice applications in several settings over the last 20 years, the PLST model has many strengths. Some of these are an emphasis on person-environment interaction and the stress response as root causes of behavioral symptoms, the use of the model to individualize interventions based on the needs and the environment of the person with dementia and his or her caregiver, and recognition of the contribution of fatigue and impaired sleep as important triggers of stress and behavioral symptoms.

The model postulates that fatigue is one of the stressors for persons with dementia and that stress is reduced with daytime rest periods. An implicit assumption is that stress is reduced after sufficient sleep at night. Persons with dementia exhibit impaired sleep, including increased sleep fragmentation, reductions in Stages 3 and 4 nonrapid eye movement sleep and rapid eye movement sleep, reduced length of sleep, and sleep-wake rhythm disorganization.<sup>10,11</sup> Although there has been little research on the effect of impaired sleep on outcomes in persons with dementia, recent empirical findings in persons without cognitive impairment indicate that depression, impaired learning and memory, pain, decreased quality of life, and other adverse outcomes are associated with or result from impaired sleep.<sup>12</sup> These findings indirectly support the as-

sumption that insufficient sleep may trigger behavioral symptoms. Future tests of the model should focus on the relationships between sleep, biological markers of stress such as cortisol, and behavioral symptoms in persons with dementia. The effect of daytime naps or rest periods on behavioral symptoms also requires further testing.

A limitation of the model is the lack of specificity on the six principles of care for reducing environmental stressors. Several are generic nursing care practice principles that are unlikely to guide formal and informal caregivers on how to avoid environmental stressors or select specific interventions to reduce them. Another limitation is the lack of clarity regarding the major propositions of the model. To our knowledge, the authors of the PLST model do not clearly state the predicted relationships between the major model concepts in any of their publications. Further elucidation of these relationships would provide direction for future studies validating the model.

Additional testing of the PLST model will strengthen and further refine it. We recommend that investigators examine the effect of interventions derived from the model on behavioral symptoms. The PLST model has been applied in numerous settings, and findings strongly support a positive influence on caregiver outcomes, including decreasing their depression, burden, and uncertainty. Although improved caregiver outcomes indirectly support the major proposition of the model that interventions derived from it will decrease behavioral symptoms, the direct evidence is sparse. It is unclear whether such studies have not yet been done or whether the lack of findings on the major theoretical propositions of the model represents publication bias for negative findings.

Research examining cortisol rhythms and other biological indicators of the stress response and their relationship to behavioral symptoms and stages of dementia is also needed. The PLST model proposes that stress is lowest in the morning and gradually increases during the day. A recent study showed normal salivary cortisol rhythms in persons with mild to moderate dementia but a tendency for salivary cortisol levels to be higher in persons with moderate dementia in the afternoon.<sup>13</sup> Finally, it will be important in future research for investigators to examine genetic risk factors of behavioral symptoms and for the authors to incorporate these findings into the PLST model.

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