

# History, Development, and Future of the Progressively Lowered Stress Threshold: A Conceptual Model for Dementia Care

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Behavioral symptoms associated with dementia are a major concern for the person who experiences them and for caregivers who supervise, support, and assist them. The knowledge and skill of formal and informal caregivers affects the quality of care they can provide and their ability to cope with the challenges of caregiving. Nurses are in an excellent position to provide training to empower caregivers with the knowledge and skills necessary to reduce and better manage behaviors. This article reviews advances in geriatric nursing theory, practice, and research based on the Progressively Lowered Stress Threshold (PLST) model that are designed to promote more adaptive and functional behavior in older adults with advancing dementia. For more than 17 years, the model has been used to train caregivers in homes, adult day programs, nursing homes, and acute care hospitals and has served as the theoretical basis for in-home and institutional studies. Care planning principles and key elements of interventions that flow from the model are set forth, and outcomes from numerous research projects using the PLST model are presented. *J Am Geriatr Soc* 52:1755–1760, 2004.

**Key words:** Progressively Lowered Stress Threshold model; dementia; caregivers

Issues relating to the care and treatment of older adults with dementia have been well documented in the nursing and geriatric literature. Loss of abilities associated with Alzheimer's disease and related disorders (ADRD) cause a variety of changes in personality, emotion, behavior, and function. These progressive and unpredictable disorders impose substantial emotional and financial costs on patients, caregivers, and society.<sup>1</sup>

Behaviors associated with dementia are a major concern for the person who experiences them and caregivers

who supervise, support, and assist those with dementia. These behaviors are often difficult for caregivers to understand and manage, and can cause stress, frustration, and burden.<sup>2</sup> Because most persons with dementia rely on their caregivers for support and assistance to execute activities of daily living (ADLs), the knowledge and skill of caregivers is important to quality of care and caregiver coping. Nurses are in an excellent position to provide training to empower caregivers with the knowledge and skills necessary to manage behaviors. This article reviews advances in geriatric nursing theory, practice, and research based on the Progressively Lowered Stress Threshold (PLST) model that are designed to promote more adaptive and functional behavior in older adults with dementia.<sup>3</sup> The model, which is most effective in the middle stages of the disease trajectory, has been used to train caregivers in homes, adult day programs, nursing homes (NHs), and hospitals and has served as the conceptual basis for in-home and institutional studies.

## DEVELOPMENT OF THE PLST MODEL

The year 1981 was a watershed in dementia care, with the publication of *A Guide to Alzheimer's Disease*, which explained the physiological basis for dementia symptoms, and *The 36-Hour Day*, which provided a vast array of suggestions for care.<sup>4,5</sup> These books, plus the developing network of Alzheimer's Association chapters, made dementia care a consumer issue. Grassroots activism catapulted dementia from the back wards of mental institutions into a major healthcare and research issue.<sup>6</sup> That same year, working with families and NH staff, one author (GRH) noted that formal and informal caregivers struggled to provide care that met the needs of the person with dementia without producing excess disability but that care was often a process of trial and error. Caregiver reports of patient responses to their environments suggested that behavioral (as opposed to cognitive) symptoms complicated care provision and that care recipients often failed to respond to traditional care measures, pharmacological management, and restorative approaches such as reality orientation, maximum sensory input, and re-education for lost skills. Behaviors were observed to be responses to overwhelming stress, and specific triggers for the stress responses were documented.

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Moreover, as the disease advanced, lower doses of the triggers produced stress responses, indicating a progressive lowering of the stress threshold.

In 1984, a program of care based on clinical observations was implemented in a small Alzheimer's unit in a NH.<sup>7</sup> The following year, the care program was developed into a conceptual model for care of adults with dementia called the PLST model. The model postulates that a person has a stress threshold that is more or less set in adulthood. Changes in biological mechanisms for coping can lower the stress threshold temporarily (such as with the development of cataracts that limit the ability to sense and perceive) or permanently (as with brain damage). This model was designed to teach care providers to organize observations, make care decisions, and plan care by modifying stress-inducing triggers and thus minimizing or preventing discomforting behaviors.<sup>3</sup> It was developed to help explain the interaction of cognitively impaired persons with their environment, thereby providing a method for rapid assessment of behaviors and a repertoire of environmental strategies catalogued to meet the specific needs at the time of the problem, and evaluate the success of interventions. The PLST model evolved from an understanding of behaviors of persons with dementia in the context of person-environment fit/interaction.<sup>8–10</sup> Because of cognitive impairments, persons with dementia exhibit behaviors that indicate disordered person-environment interaction, such as inability to recognize once-familiar objects, the purpose of the objects, and how to use them; inability to recognize family and friends; repetitive behaviors; catastrophic reactions; and situationally inappropriate behaviors.<sup>11</sup> The PLST model proposes that persons with dementia need environmental conditions modified as they experience progressive cognitive decline so that cues can be more easily processed and are thus less stressful.

The model was also built upon theories of acute confusion, client-centered therapy, anxiety, stress, and coping, as well as key elements of the Ecological Theory of Aging to explain and predict behaviors in dementia.<sup>12–16</sup> As noted, the model was developed in response to the observed behaviors of older adults with ADRD residing in nursing facilities. It expanded on descriptions of three clusters of behavioral symptoms: cognitive, affective, and conative or planning losses.<sup>17</sup> PLST was added as the fourth category of symptom. This category included an array of behaviors that emerged when environmental demands (external (e.g., noise) or internal (e.g., pain)) exceeded the person's ability to cope and adapt. Behaviors in the PLST cluster, such as agitation, night wakening, and combativeness, were hypothesized to be stress related.

According to the PLST model, persons with dementia are less able to manage stress as the disease progresses (Figure 1A).<sup>3</sup> For example, their stress threshold is reduced, resulting in anxious, more dysfunctional behaviors as stress accumulates throughout the day.

Three types of behavior are observed in ADRD, including baseline behavior, increasingly anxious behavior as the person approaches their stress threshold, and dysfunctional behavior. Increasing anxiety is often observed as loss of eye contact and attempts to avoid offending stressful stimuli (e.g., moving away from crowds of people). Clinical observations and temporal patterning assessments over a

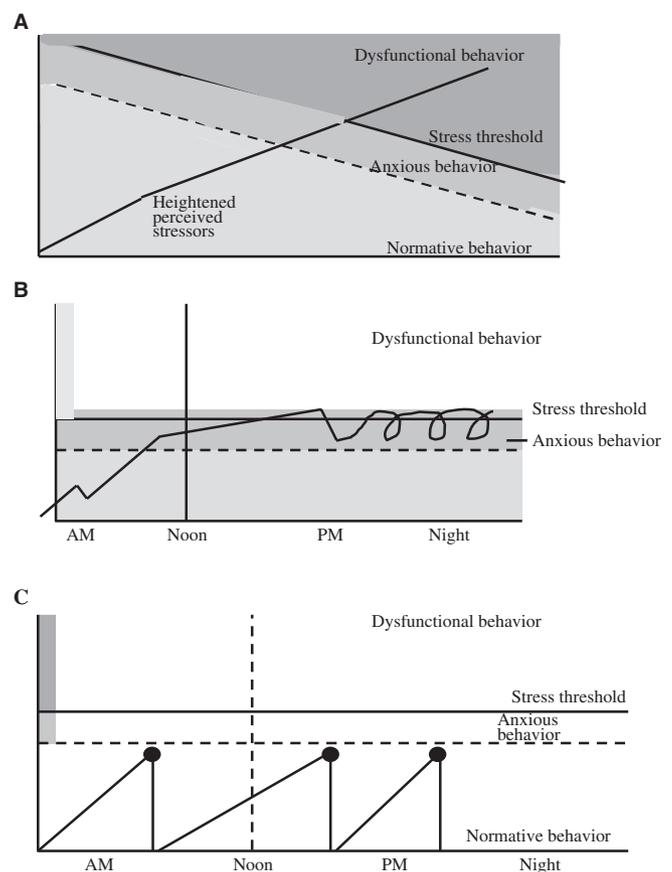


Fig. 1. A. Stress threshold in a patient with Alzheimer's disease and related disorders (ADRD). B. Effects of stress during a 24-hour day in a patient with ADRD. C. Planned activity levels for the person with ADRD.

24-hour period reveal that most persons with ADRD experience lower levels of stress in the early morning. Without intervention, stressors may accumulate throughout the day until, by afternoon, the stress threshold may be exceeded, resulting in problem behaviors. As depicted in Figure 1B, "If the stress threshold is repeatedly exceeded, the patient cycles between anxious and dysfunctional states."<sup>3</sup>

Stressors take many forms for persons with dementia, such as fatigue; changes in routine, caregiver, or environment; internal or external demands that exceed the person's ability to function; multiple and competing stimuli; physical stress (e.g., illness, medication reactions); and affective responses to perceptions of loss.<sup>3</sup> As with any model, it has been modified, based on research findings. In 1996, the sixth stressor group (affective responses to perceptions of loss) was added along with new interventions to reduce stressors. Caregivers can facilitate more adaptive behavior by regulating stressors for the person with dementia. Specifically, recognition and intervention when the person initially exhibits anxiety-related symptoms may reduce more intense and dysfunctional behaviors.

Behaviors may be used as a barometer to determine the patient's tolerance to stressful stimuli. As anxious behavior is exhibited, interventions include modifying activities and environmental stimuli to reduce internal and external stressors. The PLST model predicts that a reduction in stress experienced by the person with dementia will diminish

anxious behavior and prevent the onset of dysfunctional behavior (Figure 1C).<sup>3</sup> Therefore, interventions will be most effective when implemented before the patient's peak levels of agitation, but stimuli should not be reduced to the point of sensory deprivation, because persons with dementia may become agitated as a means of self-stimulation secondary to boredom.

Six principles of care are proposed to keep stress to a manageable level: (1) maximize safe function by supporting losses in a prosthetic manner; (2) provide unconditional positive regard; (3) use anxiety and avoidance to gauge activity and stimulation levels; (4) teach caregivers to observe and listen to patients; (5) modify environments to support losses and enhance safety; and (6) provide on-going education, support, care, and problem-solving.<sup>16,18</sup> Appendix 1 lists key elements of the PLST community-based intervention related to this sixth principle.

Specific recommendations for caregiving strategies and interventions for each of the principles of care have been developed and applied in a wide variety of settings, including NHs, special care units (SCUs), hospitals, adult daycare, and homes.<sup>7,18–23</sup> The PLST model has also been used as a framework for devising nonpharmacological interventions, such as massage and music, and is the basis for many book chapters and a component of other nursing care models.<sup>24–29</sup> A psychoeducational intervention to train community-based caregivers to care for family members with ADRD evolved from the model. This intervention was individualized for each caregiving dyad and focused on psychological support while providing instruction in behavioral techniques aimed at reducing stressors, compensating for executive dysfunction and communication deficits, providing unconditional positive regard, and allowing for a lowered stress threshold. Appendix 2 sets forth a sample Plan of Care based on the above principles of care that was individually adapted to the needs of each caregiving dyad and setting of care.

The PLST model has had a significant effect on the delivery of care for persons with dementia for more than 17 years. A strength of the model is its strong link between theory, clinical application, and research.

## RESEARCH USING THE PLST MODEL

### Institutional

Although the PLST model has been widely described and applied in nursing practice, systematic testing and refinement of the model continues. The first article describing application of PLST principles in a SCU evaluated the effect of nursing care interventions for 12 residents after 3 months.<sup>7</sup> Global changes included increased socialization, sleep, and nutritional intake. Agitation, wandering, repetitive questions, illusions, delusions, combative behaviors, and use of psychotropic medications decreased.

A quasi-experimental study compared outcomes in a SCU using the PLST model of care with those of traditional integrated units within the same nursing facility over a 12-month period.<sup>21,22</sup> Data were collected on 19 experimental and 34 control subjects. Because of attrition and missing data as a result of death and disability, complete data were obtained from 22 subjects for two data collection points before and two data collection points after initiation of the

SCU. Significantly fewer catastrophic reactions and other adverse behaviors occurred during the posttest period in the experimental (PLST) group than with controls, although no differences in cognitive or functional abilities were evident over time. Consistent with the PLST model, subjects in the experimental group exhibited more unscheduled activities and socially accessible behaviors such as spontaneous positive interactions with other residents, staff, and family members. This same study determined that staff who cared for ADRD patients on the unit using the PLST model were less stressed and burned out than staff on traditional units, using data from the Caregiver Stress Inventory and Maslach Burnout Inventory. Six items on the Caregiver Stress Inventory showed significantly less stress in the treatment group, particularly with regard to residents' verbal and physical behaviors.<sup>30</sup>

Building upon data from these early SCU studies and the knowledge that relocation to a NH does not mean an end to the stress experienced by family caregivers, some researchers developed and tested the family involvement in care protocol.<sup>31</sup> After placement, many family members do not know how to make the transition from direct care tasks to a more indirect, supportive role, resulting in staff-family role conflict. The family involvement in care protocol, designed to diminish these potential conflicts, which decreases family and staff stress and increases satisfaction with caregiving roles, was theoretically grounded in the PLST model. It is a step-by-step method for helping NH staff and family members work together by achieving a negotiated partnership that emphasizes cooperation and includes clearly outlined roles for the family caregiver in the institutional setting. Key elements of the protocol include family orientation to the facility and the partnership role, negotiation and formation of a partnership contract, education of family members for involvement in care, and follow-up evaluation and renegotiation of the partnership contract as needed. Descriptions of and outcomes from this multisite, longitudinal study are widely reported in the literature.<sup>31–34</sup>

### Community-Based Research

There are numerous reports on research conducted as a part of the National Caregiver's Training Project (NCTP), the name given to a large, multistate research project funded by the National Institute of Nursing Research under the title *PLST Model: Effectiveness for Rural ADRD Caregivers*.<sup>35</sup> One study detailed the overall project design, sample, and methods.<sup>18</sup> The NCTP was conducted over a 4-year period in Iowa, Illinois, Minnesota, Arizona, and Indiana and included a sample of 241 caregiver/care recipient dyads who were randomly assigned to experimental and comparison groups. Research assistants blinded to group assignment collected data at baseline and 3-, 6-, and 12-month intervals. Caregivers in the PLST intervention group received educational sessions using a standardized training protocol and an in-home follow-up session designed to apply and individualize care. The comparison group received other standardized approaches to caregiver training emphasizing support and referral for community services. Data were collected on caregivers and care recipients at each of the four intervals. Caregiver data included measures of social support, subjective affect, depression, burden, and

knowledge of Alzheimer's disease. Care recipient data included measures of behavioral symptoms, functional and cognitive deficits, weight loss, medication use, illnesses, and sociodemographic factors.

Another study tested the hypothesis that caregivers in the PLST group would experience less depression than those in the comparison group, as measured using the profile of mood states (POMS) and the Geriatric Depression Rating Scale (GDRS).<sup>36</sup> Data from the POMS partially supported the hypothesis, and the GDRS data fully supported the hypothesis and provided support for the value of using the PLST model with dementia caregivers, who are at great risk for becoming depressed.

Other support for the PLST-based caregiver intervention was derived from open-ended interviews administered in the home before the structured instruments.<sup>37</sup> Interviews were audiotaped and transcribed for computer-assisted contextual analysis. Six themes emerged from the qualitative data: (1) making meaning of the caregiving experience; (2) defining the scope and character of the caregiver role; (3) identifying specific caregiving strategies; (4) coping with change, unpredictability, and vulnerability; (5) evaluating past and future decisions and quality of care; and (6) seeking help and support. The PLST intervention was more effective than the comparison approach in reducing caregiver uncertainty and concern with evaluation of quality of care, in addressing issues related to caregiving strategies, and in managing unpredictability. It promoted "greater self-confidence in their role as a caregiver and in the adequacy of their performance of the tasks of caregiving."<sup>37</sup>

Some investigators<sup>38</sup> have also used interviews from the NCTP data set to describe the experience of caring for a family member with ADRD in the home. Using vanKaam's rigorous psychophenomenological method, 2,115 descriptive expressions were categorized into 38 structural elements and subsequently reduced to eight essential elements. These were then synthesized to form this definition of the caregiving experience: "Being immersed in caregiving; enduring stress and frustration; suffering through the losses; integrating ADRD into our lives and preserving integrity; gathering support; moving with continuous change; and finding meaning and joy."<sup>38</sup> Intrigued by the last positive element of the caregiving experience, these investigators further examined the process of how caregivers shape the exasperations of caring for a family member with ADRD into blessings, using Heidegger's hermeneutic phenomenological perspective.<sup>39</sup> The interpretive analysis focused specifically on the meaning of the caregiving process.

Additional caregiver outcomes from the NCTP study used data from the Philadelphia Geriatric Center Caregiving Appraisal Scales.<sup>40</sup> A hierarchical linear modeling approach was taken to analyze effects of the intervention on measures of mastery, burden, satisfaction, and effect over time. The PLST intervention had a positive effect on caregivers' experience of burden, effect, and satisfaction but had no effect on mastery.

Another study using NCTP data evaluated care recipient behaviors and caregiver responses to those behaviors using the memory and behavior problems checklist.<sup>41</sup> The 9-item ADL subscale was used to evaluate functional status. The intervention effect on frequency of behaviors varied according to type of caregiving relationship. Nonspouse

caregivers reported no change in frequency of behaviors over time, whereas spouse caregivers reported a statistically significant increase in behaviors, as did caregivers in the comparison group. No difference in care-recipient ADL function was observed between the groups. Caregiver reactions to behaviors decreased in the experimental group. Reactions to ADL function varied according to caregiver type, with spouse caregivers in the experimental group having no increase in reactions. Nonspouse caregivers in both groups had a statistically significant increase in negative reactions to ADL problems. Thus, the frequency of behaviors and caregivers' reactions to those behaviors appear to depend largely on the caregiver relationship.

### Dissertations/Related Studies Using the PLST Model

The PLST model has served as the framework for numerous graduate theses in the United States and abroad, including dissertations at the Universities of Iowa, Minnesota, Massachusetts, and Indiana and Göteborg University in Sweden.<sup>42,43</sup> It is used in research and practice in Taiwan, in the Scandinavian countries, and in Australia, where the model has been taught in NHs and continuing education programs throughout the country since the late 1980s.<sup>44</sup> Data from doctoral dissertations and postdoctoral studies using the PLST model have supported depression findings from the NCTP but have also examined additional caregiver outcomes, such as self-efficacy; immune response; religiosity and psychosocial adjustment; caregiver demands; perceived stress; resource and spousal adaptation to caregiving; the relationship between genotype and cognition, function, and behavior; parent care as a midlife developmental task; and friends and social support in dementia caregiving.<sup>44-48</sup> (Additional references are available upon request.) One investigator analyzed behavioral "critical incidents" and caregiving coping strategies using quantitative and qualitative data from NCTP behavioral logs.<sup>42</sup> Findings revealed that caregivers using the PLST intervention reported significantly fewer episodes of pacing and fidgeting, refusing care, repetitive behaviors, incontinence, sundown/late-day confusion, violent/aggressive behavior, night-time waking, wandering, and psychosis in their care recipients and had significantly stronger appraisals of the efficacy of their interventions. More recently, investigators (unpublished data) examined temporal patterning associated with agitation in residents with ADRD of six long-term care facilities. Data suggest that agitated behaviors are predictable based on application of the PLST model. Finally, a review of Web of Science records show the PLST model cited in numerous U.S. and international research, theory, and clinical journals. These citations have appeared in many interdisciplinary gerontology and dementia-specific journals, as well as those representing the disciplines of nursing, geriatric medicine, occupational therapy, and psychiatry. (Further references on use of the PLST model are available upon request.)

### Ongoing Studies and Future Research Using the PLST Model

Research has stimulated additional community-based studies using the PLST model. A 3-year Administration on Aging-funded randomized, controlled trial is currently evaluating the effect of the model in eight rural counties.<sup>49</sup>

Case managers are trained using the PLST model as a framework for interventions and family member training in the provision of care for persons with ADRD, as well as in role reconciliation and anticipatory guidance. Outcomes include functional status of the care recipient, potential for caregiver endurance, caregiver stressors, caregiver well-being and general health, and use of resources. This study will have important implications for community services and policy development.

Future interdisciplinary research is planned using the PLST model in assisted living settings, combining psycho-educational interventions with pharmacological treatment of agitated residents, and examining physiological outcomes and genetic risk factors in addition to the more traditional pencil and paper psychosocial outcomes examined to date.

## CONCLUSION

The PLST model has been used in home care, NHs, SCUs, adult day care, and hospital settings to guide the development of individualized interventions for persons with dementia. Extensive testing during the NCTP supports the use of the PLST model in decreasing depression, diminishing uncertainty and unpredictability associated with dementia caregiving, lessening caregiver appraisals of stress and burden while promoting levels of satisfaction, and reducing caregiver reactions to behavioral symptoms. Less research-based information is available about the PLST model's effect on behavioral symptoms experienced by the person with dementia. Recent findings are promising but suggest that additional study is needed to establish whether the PLST model consistently produces positive behavioral outcomes for persons with ADRD. More rigorous outcome studies are needed to test the model's effectiveness in reducing undesirable behaviors in other care environments such as assisted living facilities.

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### Appendix 1. Key Elements of the Progressively Lowered Stress Threshold (PLST) Community-Based Intervention

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- Provide ongoing education for the care recipient and caregiver about the disease process.
  - Assist the care recipient and caregiver with development of routines and strategies that enhance appropriate behavior patterns in care recipients based on concepts of the PLST model of dementia care.
  - Help the care recipient and caregiver to simplify day-to-day care tasks such as bathing, toileting, and dressing, based on the PLST model of dementia care.
  - Assist the caregiver with problem-solving strategies, based on the PLST model of dementia care, over the course of the illness as behavioral and functional abilities of the care recipient change.
  - Assist the caregiver in locating community resources and developing support networks.
  - Provide ongoing emotional support and counseling for the care recipient, the caregiver, and other members of the caregiving network.
  - Assume a case management role of advocacy, service coordination, and liaison with primary healthcare providers.
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### Appendix 2. Plan of Care Based on the Progressively Lowered Stress Threshold (PLST) Model

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#### Reduce environmental stressors (**modify environment**).\*

- Eliminate caffeine, misleading stimuli such as televisions, unending spaces, unnecessary noise (e.g., background radio), extra people, large groups.

#### Compensate for care recipient's inability to plan (**support losses in a prosthetic manner**).

- Provide calm, consistent routine.
- Eliminate changes of pace and environment.
- Keep choices to those the patient can tolerate.
- Do not ask the patient to "try harder."
- Do not encourage the patient to recover lost skills.

#### Provide unconditional acceptance and positive regard.

- Avoid trying to teach or drill on "right answers."
- Provide one-to-one communication.
- Use touch to reassure.
- Allow patient to use remaining social skills.
- Reminisce together about former pleasant experiences.
- Eliminate "you're wrongs" from the environment.
- Do not confront; distract instead.

#### Allow for lowered tolerance of stress and diminished energy reserve (**gauge activity and stimulation levels**).

- Provide rest periods twice daily.
- Alternate stimulating activities with rest.
- When the impaired person gets "upset," decrease stimuli and identify the activity associated with the upset behavior; explore possible physical reasons such as pain, hunger, and constipation (**observe and listen to patient**).
- Keep a record of possible causes of the upset behavior. Caregivers must take care of themselves (**provide education, support, care and problem solving**).
- Plan respite care regularly.
- Arrange for legal and financial advice.
- Arrange day care as needed.
- Arrange home care services as needed.
- Prepare visitors and home and day care help by teaching them key elements of the PLST approach.

Join a support group if it seems helpful.

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Related principle of care noted in bold in parentheses.

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