Application for Funding to the College Academy for Research, Scholarship, and Creative Activity (CARSCA)
For Review in the Social Sciences Division

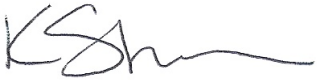
Project Title:
Development and Preliminary Validation of a Light Exposure Scale in Older Adults

Applicants:
Natalie Dautovich, Ph.D., Assistant Professor, Department of Psychology

Kelly Stanek, Ph.D., Assistant Professor, Department of Psychology

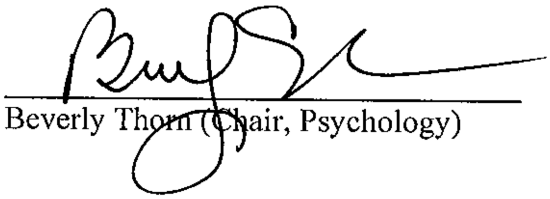
Abstract:
Given the aging of the population and that 20% of older adults experience a mental health condition, there is a need to develop innovative strategies to aid in the diagnosis and treatment of mental disorders in older adults. Exposure to light is a major factor implicated in both mental and physical conditions such as depression, obesity, and sleep functioning. Despite the potent effects that light has on our behavior, there is a lack of tools for measuring light exposure. The proposed study aims to develop and test a self-report Light Exposure Scale (LES). A self-report measure of light is needed as it: 1) is more economical and less invasive; and 2) can provide information that complements objective measures. The development of the LES measure will occur in four stages: 1) content of the scale will be generated; 2) instrument feasibility will be assessed; 3) psychometric assessment and refinement of the scale will occur; and 4) validity of the scale will be examined. The LES will be administered daily for two weeks to 75 older (60+) adults who will concurrently wear an objective instrument to measure light in order to provide validation of the LES. Publications generated from the study will support future grant applications. Collected data will also demonstrate the feasibility of a longitudinal daily diary design in Tuscaloosa County. Finally, the resulting LES will be used in future studies assessing medical, mental health, and behavioral correlates of light exposure and treatment in older adults.

Signatures:



Natalie Dautovich

Kelly Stanek



Beverly Thorn (Chair, Psychology)

Background: Mental health problems affect approximately 20% of older adults.[1] With the "Baby Boomer" generation beginning to turn 65 in 2011, the number of older adults in the United States is expected to increase dramatically.[2] Given this "greying of the population", there is an increasing need to provide mental health services for older adults. Unfortunately, the majority of older adults do not receive needed services.[3] Furthermore, an estimated 85% of older adults have at least one chronic illness.[4] The comorbidity of physical illnesses complicates the diagnosis and treatment of mental disorders. Therefore, there is a **need to develop innovative strategies to aid in the diagnosis and treatment of mental disorders in older adults.**

Exposure to light is a major factor implicated in both mental and physical conditions. Insufficient or poor timing of light exposure is associated with the etiology of many disorders such as increased risk for depression,[5] obesity,[6] sleep disorders,[7] and poorer quality of life outcomes[8]. Interestingly, light therapy has shown potential to realign biological rhythms with light therapy showing potential as a treatment intervention for obesity,[9] depression,[10] and insomnia[11]. However, there is a need to better understand the role of light exposure specifically in older adults, as perception of light changes with age and degenerative processes can diminish the amount and spectral composition of light input.[12] Also, regularity of outdoor activities change with age, which could affect the timing of light exposure.[13] Therefore, physiological and behavioral differences affecting light exposure warrant the development of an instrument that is specifically developed and suitable for assessing light exposure in older adults.

Despite the major role of light in the prevention and treatment of mental disorders, there is a dearth of tools to assess light in both research and clinical settings. Objective measures of light exist (e.g., Actigraphy and Pendant Monitors), but the cost of these instruments is prohibitive for large-scale research or for use by a practitioner. Furthermore, these instruments

can be invasive, as they should be worn over clothing, for a 24-hour period, across several days. A self-report (or subjective) measure of light is needed as it is more economical and less invasive and may provide information about the individual's perception that cannot be captured by objective measures.[14] **The aim of the proposed study is to develop, evaluate, and disseminate a measure for assessing light exposure in older adults (the Light Exposure Scale [LES]).**

Study Design: The development and validation of the LES measure will occur in four stages. *First*, content of the scale will be generated based on theory. Items will be developed to tap several constructs relevant to light exposure in older adults, including intensity and timing of light which are differentially associated with sleep and mood outcomes.[15] Content related to the study of light, light scales used in other fields (e.g., radiation exposure in cancer research), and self-report diaries used for other constructs (e.g., sleep diaries)[16] will be reviewed and an over-inclusive set of items will be generated for the prototype scale. *Second*, feasibility of the scale will be evaluated in 10 community-dwelling older adults. *Third*, the LES will be administered to the remainder of the validation sample, with concurrent objective measurement of light exposure using the HOBO Pendant® Temperature/Light Data Logger. At the start of the 14-day protocol, participants will also be asked to complete self-report measures of depressive symptomatology (S-GDS)[17], health related quality of life (SF-12)[18], and a medical history questionnaire. Following data collection, internal psychometric properties of the prototype scale (e.g., internal consistency, one-week test-retest reliability, factor structure, item response theory) will be assessed. The scale will be revised and rescored accordingly. *Fourth*, preliminary validity analyses will be conducted. Specifically, concurrent criterion validity will be examined by examining associations between scores on the objective light measure and scores on the LES. Convergent and discriminant construct validity will be assessed by examining associations

between scores on the LES, SF-12, and S-GDS. Exploratory analyses will examine correlations between LES scores in older adults and demographic, clinical, and medical characteristics.

Use of Funds: CARSCA funds will be used to reimburse participants, pay for mileage, and purchase instruments to objectively measure light (see attached 'Budget').

Future Funding: Both investigators are currently working with grant specialist Dr. David Bauer to develop NIH grant applications, including a proposal that involves the assessment of light as one of the constructs of interest. A validated LES is a necessary component of this application. Publications generated from the study will support the application in this sense, as well as providing local feasibility data for a longitudinal diary design.

Enhancement: Dr. Dautovich has expertise in behavioral sleep medicine, circadian rhythms, and geropsychology. This study will expand her background to include light – a key construct in the field of sleep and circadian rhythms. Dr. Stanek has expertise in the areas of obesity, health psychology, and psychological assessment, including psychometric applications. This study will expand her research to include examination of circadian rhythms, obesity, and related health outcomes. Undergraduate and graduate students will be meaningfully involved in all stages of the study, providing a learning opportunity in the application of psychometric theory that is currently unmatched in their standard curriculum. Finally, the development of a validated inexpensive approach to measuring light could have a widespread impact on the field, enhancing the reputation of the College of Arts and Sciences.

Metric: The success of this project will be measured in three ways: 1) the development of a measure with sufficient reliability and validity; 2) at least two publications in renowned and relevant scientific journals (e.g., in *Psychological Assessment*) and presentations at national conferences to disseminate the LES; and 3) the use of the LES in NIH grant applications.

Budget

Item	Cost	Justification
Participant Compensation *(75 Older Adults x $20)*	$1500.00	Older adults often require financial incentive to participate in research studies, as they are recruited from the community. As a result, they will be reimbursed $20 for their participation.
Mileage reimbursement for transporting older adult participants *([$0.55 x 5 miles] x 75 Older Adults)*	$206.25	Due to mobility barriers for some older adults researchers may need to provide transportation or deliver study materials to the home of older adults.
HOBO Pendant® Temperature/Light Data Logger (64K - UA-002-64) *($55.00 x 10)*	$550.00	The HOBO Pendant® will be used to provide an objective measure of light exposure. The HOBO Pendant® is worn on a string around the participant's neck and records light exposure in lux at predetermined intervals (e.g., every 30 seconds) for up to a two-week period. **The HOBO Pendant® will be available for future use by undergraduate and graduate students in the labs of both Drs. Dautovich and Stanek.**
HOBO Pendant® Temperature/Light Data Logger BASE-U-4 Optic USB Base Station *($115.00 x 1)*	$115.00	The Base Station is necessary to download data from the HOBO Pendant®.
HOBO Pendant® Temperature/Light Data Logger Software *($99.00 x 1)*	$99.00	The Software is necessary to analyze the HOBO Pendant® data.
Total Cost	**$2470.25**	

Proposed Timeline

Month	Task
Month 1	Literature review
Month 2	Development of LES prototype; submit IRB protocol
Month 3	IRB protocol is ideally approved
Month 4	Begin recruitment process; first 10 participants begin study
Month 5	First 10 participants complete study; data entry; examination of feasibility
Month 6	Participants 11 through 30 complete study; data entry
Month 7	Participants 31 through 50 complete study; data entry
Month 8	Participants 51 through 70 complete study; data entry
Month 9	Participants 71 through 75 complete study; data entry; analyses of internal psychometric properties; revision of scale; validation analyses
Month 10	Begin preparation of manuscript and conference abstract based on data
Month 11	Complete preparation of manuscript and conference abstract; submit manuscript and conference abstract
Month 12	Submit NIH grant proposal using LES

References

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17. Sheikh, J. I. & Yesavage, J. A. *Recent evidence and development of a shorter version. Clinical Gerontology : A Guide to Assessment and Intervention Geriatric Depression Scale (GDS)*. (The Haworth Press: New York, 1986).
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PUBLICATIONS (RELEVANT)

Dautovich, N. D., Kay, D., Perlis, M. L., Dzierzewski, J. M., Rowe, M. A., & McCrae, C. S. (2012). Day-to-day variability in nap duration predicts medical morbidity in older adults. *Health Psychology, 31*(5), 671-676.

Dautovich, N. D., McNamara, J. P. H., Williams, J. M., Cross, N., & McCrae, C. S. (2010). Tackling sleeplessness: Psychological treatment options for insomnia. *Nature and Science of Sleep, 2*, 23-37.

Dautovich, N. D., McCrae, C. S., & Rowe, M. A. (2008). Subjective and objective napping and sleep in older adults: Are evening naps 'bad' for nighttime sleep? *Journal of the American Geriatrics Society, 56,* 1681-1686.

Dautovich, N. D. & Gum, A. M. (2011). CBT for late life depression and comorbid psychiatric conditions. In K. Sorocco & S. A. Lauderdale (Eds.), *Implementing CBT for older adults: Innovations across care settings.* New York, NY: Springer Publishing Company.

Dautovich, N. D., Dzierzewski, J. M., & Gum, A. M. *Older adults display concurrent but not delayed associations between life stressors and depressive symptoms: A microlongitudinal study.* Manuscript submitted for publication.

PUBLICATIONS (OTHER)

Dautovich, N. D. & McCrae, C. S. *Dysregulation of daily activities predicts poorer sleep outcomes in younger but not older adults.* Manuscript under review.

Dautovich, N. D. & McCrae, C. S. *Differences in level of routinization predict sleep in younger and older community-dwelling adults.* Manuscript in preparation.

Dautovich, N. D., Greenblum, C. M., Rowe, M. A., & McCrae, C. S. (in press). Sleep in other conditions: Sleep in the caregiver. In C. A. Kushida (Ed.), *Encyclopedia of Sleep.* Oxford: Elsevier.

Dzierzewski, J. M., Williams, J. M., Roditi, D., Marsiske, M., McCoy, K. J. M., McNamara, J. P. H., **Dautovich, N. D.**, Robinson, M. E., & McCrae, C. S. (2010). Daily variations in objective sleep and subjective pain in older adults with insomnia: Evidence of dynamic covariation. *Journal of the American Geriatrics Society, 58*(5), 925-930.

McCrae, C. M., Rowe, M., Tierney, C., **Dautovich, N. D.**, DeFinis, A., & McNamara, J. (2005). Sleep complaints, subjective and objective sleep patterns, health, psychological adjustment, and daytime functioning in community-dwelling older adults. *The Journal of Gerontology: Psychological Sciences, 60B,* 182-189.

PRIOR EXTERNAL FUNDING

- Awarded a Research Fellowship as part of the United States' NIH federally-funded grant "Intraindividual Variability in Sleep and Cognitive Performance in Older Adults" grant number: 1R21AGO24459-01A1 (McCrae, Ph.D., PI). The fellowship included tuition remission for the years 2005 - 2006 and a monthly stipend.
- Social Sciences and Humanities Research Council of Canada Research Fellowship - Research Funding for $20,000 per year, 2006-2008
- APA Science Directorate Dissertation Research Award ($1000) - 2008

SYNERGISTIC ACTIVITIES

Conference Presentations

Dautovich, N. D., & McCrae, C. S. (2012, November). Age group differences in the amount of dysregulation of behavioral rhythms required to predict sleep outcomes. Paper presented at the Gerontological Society of America's (GSA) 65th Annual Scientific Meeting, San Diego, C.A.

Dautovich, N. D., & Douglas, K. (2012, November). Clinical geropsychology with rural older adults: Challenges and innovations. Paper presented at the Gerontological Society of America's (GSA) 65th Annual Scientific Meeting, San Diego, C.A.

Dautovich, N. D. & McCrae, C. S. Instability of behavioral circadian rhythms predicts poor sleep outcomes in younger not older adults: A microlongitudinal daily process study. *Abstract submitted to the Meeting of the Associated Professional Sleep Societies (SLEEP), Boston, M.A.*

Teaching

- Graduate Seminar in Geropsychology Fall 2012
  Role: Instructor (New Course Preparation)
  Department of Psychology, University of Alabama

- Senior Undergraduate Seminar in Chronopsychology Spring 2012
  Role: Instructor
  Department of Psychology, University of Alabama

Other

- Fellow, National Institute of Mental Health, July 2012 – Present
  Summer Research Institute (Competitive Application Process)
  Cornell University, Weill Medical College
- Faculty Associate, September 2011 – Present
  Center for Mental Health and Aging, University of Alabama
  Tuscaloosa, Alabama
- 2011 - Ad hoc reviewer for the journal of Behavioral Sleep Medicine
- 2010 - Ad hoc reviewer for the Journal of Applied Gerontology
- 2009 - Ad hoc reviewer for Aging and Mental Health
- 2008 - Ad hoc reviewer for the Journal of the American Geriatrics Society

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PUBLICATIONS

Stanek, K.M. & Gunstad, J. (in press). Can bariatric surgery reduce risk of Alzheimer's Disease? *Progress in Neuropsychopharmacology and Biological Psychiatry.*

Stanek-Sellbom, K.M. & Gunstad, J. (2012). Cognitive function and decline in obesity. *Journal of Alzheimer's Disease, 30,* S89-95.

Gunstad, J., Mueller, A., **Stanek, K.,** & Spitznagel, M.B. Cognitive dysfunction in obesity: Implications for bariatric surgery patients. (2011). In J.M. Mitchell and M. de Zwaan (Eds.), *Psychosocial assessment and treatment of bariatric surgery patients (pp 99-114).* New York: Routledge.

Stanek, K.M., Grieve, S.M., Brickman, A.M., Korgaonkar, M.S., Paul, R., Cohen, R., Gunstad, J. (2011). Obesity is associated with reduced white matter integrity in otherwise healthy adults. *Obesity, 19*(3), 500-504.

Stanek, K.M., Gunstad, J., Spitznagel, M.B., Waechter, D., Hughes, J.W., Luyster, F., Josephson, R., Rosneck, J. (2011). Improvements in cognitive function following cardiac rehabilitation for older adults with cardiovascular disease. *International Journal of Neuroscience, 121*(2), 86-93.

Stanek, K., Smith, J., Gunstad, J. (2011). Structural and functional neuroimaging in obesity. In R.A. Cohen and L.H. Sweet (Eds.), *Brain imaging in behavioral medicine and clinical neuroscience* (pp 193-200). New York: Springer.

Kakos, L.S., Szabo, A.J., Gunstad, J., **Stanek, K.M.**, Waechter, D., Hughes, J., Luyster, F., Josephson, R., & Rosneck, J. (2010). Reduced executive functioning is associated with poorer outcome in cardiac rehabilitation. *Preventive Cardiology, 13*(3): 100-103.

Stanek, K.M., Gunstad, J., Paul, R.H., Poppas, A., Jefferson, A.L., Sweet, L.H., Hoth, K.F., Haley, A., Forman, D.E., Cohen, R.A. (2009). Longitudinal cognitive test performance in older adults with cardiovascular disease: Evidence for improvement in heart failure. *Journal of Cardiovascular Nursing, 24(3),* 192-197.

Gunstad, J., **Stanek, K.,** Szabo, A., Kakos, L. (2009). Blood pressure and cognitive function. In R. Cohen and J. Gunstad (Eds.), *Neuropsychology and cardiovascular disease (*pp 147-166). New York: Oxford University Press.

Stanek, K., Gunstad, J., Leahey, T., Glickman, E., Alexander, T., Spitznagel, M., Juvancic-Heltzel, J., Murray, L. (2008). Serum brain-derived neurotrophic factor is associated with reduced appetite in healthy older adults. *Journal of Nutrition Health and Aging*, 12(3), 183-185.

SYNERGISTIC ACTIVITIES

Conference Presentations

Sellbom, M., Gervais, R. O, **Stanek, K.M**. (2010, February). Utility of the Personality Assessment Inventory in detecting symptom validity test failure in neuropsychological evaluations. Poster presented at the annual meeting of the International Neuropsychological Society, Acapulco, Mexico.

Stanek, K.M., Sellbom, M., Gervais, R.O. (2010, February). Effects of intelligence, reading, and executive functioning on MMPI-2 validity scales in a disability evaluation context. Poster presented at the annual meeting of the International Neuropsychological Society, Acapulco, Mexico.

Teaching

Psychological Testing (Psychometrics) (PSYC 40231); *Undergraduate*, Spring 2009, Department of Psychology, Kent State University, Kent, OH

Health Psychology (PY 375); *Undergraduate*, Spring 2012, Department of Psychology, University of Alabama, Tuscaloosa, AL

Other

- Relevant editorial experience
  Ad hoc Reviewer: Assessment, Journal of Clinical Nursing (*topic areas include psychometrics, obesity, and health psychology)
  Editorial Board (2012 term): Journal of Alzheimer's Disease