Pilot Feasibility Study Examining Pupillary Response During Driving Simulation as a Measure of Cognitive Load in Breast Cancer Survivors

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OBJECTIVES: To test the feasibility of adding driving simulation tasks to measure visuospatial ability and processing speed to an existing neurocognitive battery for breast cancer survivors (BCSs).

SAMPLE & SETTING: 38 BCSs and 17 healthy controls from a cross-sectional pilot study conducted at the University of Kansas Medical Center.

METHODS & VARIABLES: Exploratory substudy measuring pupillary response, visuospatial ability, and processing speed during two 10-minute driving simulations (with or without n-back testing) in a sample of BCSs with self-reported cognitive complaints and healthy controls.

RESULTS: Feasibility of measurement of pupillary response during driving simulation was demonstrated. No between-group differences were noted for pupillary response during driving simulation. BCSs had greater visuospatial ability and processing speed performance difficulties than healthy controls during driving simulation without n-back testing and slower n-back response time.

IMPLICATIONS FOR NURSING: Preliminary evidence showed a possible link between cancer/treatment on visuospatial ability and processing speed in BCSs.

KEYWORDS breast cancer; cognitive dysfunction; pupillary response; driving simulation

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Breast cancer survivors (BCSs) frequently experience changes in cognitive function attributed to the disease and treatment. Proposed mechanisms for these cognitive changes include damage to neuroprogenitor cells, increased production and release of peripheral and central proinflammatory cytokines, malfunction of DNA repair mechanisms, and oxidative stress (Asher & Myers, 2015; Janelsins et al., 2014). BCSs have reported difficulty across a number of cognitive domains, such as short-term memory, attention and concentration, processing speed, and executive function, including the ability to multitask (task switching) (Ahles et al., 2012; Asher & Myers, 2015; Wefel et al., 2011). However, other studies have failed to note objective cognitive changes or dysfunction after treatment. BCSs' performance on standard neurocognitive tests frequently do not correlate with their self-report of cognitive changes. Some qualitative research results have included participants' concerns related to operating a vehicle, difficulty driving to familiar locations, and accident near-misses (Myers, 2012; Player et al., 2014). Standard neurocognitive testing may not be sensitive to the level of cognitive effort expended by BCSs to achieve performance that is within normal limits (Hermelink et al., 2010).

Kahneman's (1973) theory of attention and effort defines cognitive effort (also referred to as cognitive workload) as the mental effort or amount of attention and resources allocated to perform a task. Cancer survivors frequently report having to work harder to accomplish cognitive tasks they used to perform without difficulty prior to their diagnosis and treatment.