Cancer, Cognitive Impairment, and Work-Related Outcomes: An Integrative Review

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Problem Identification: Cancer survivors often report concerns regarding their memory, attention, and ability to process information and make decisions. These problems, which have also been demonstrated on objective neuropsychological assessments, may have a significant impact on work-related outcomes.

Literature Search: A literature review was conducted using the following electronic databases: Ovid (MEDLINE®), PubMed, CINAHL®, and Web of Science. Search terms included *cancer*, *survivors*, *cognitive*, *work*, and *work ability*. Empirical research published in English from January 2002 to August 2015 that focused on cognitive impairment in adult cancer survivors was included in the review.

Data Evaluation: Articles were evaluated by two independent researchers.

Synthesis: Twenty-six studies met the inclusion criteria. Ten were qualitative, 15 were quantitative, and 1 had a mixed-methods design. Quantitative articles were synthesized using the integrative methodology strategies proposed by Whittemore and Knafl. Synthesis of qualitative articles was conducted using the criteria established by the Swedish Agency for Health Technology Assessment and Assessment of Social Services.

Conclusions: To date, research in this context has been limited by cognitive assessments focusing primarily on patient self-assessments of attention, concentration, and memory. Additional research is needed to examine the impact of cognitive performance and to expand work-related outcomes measures to include perceived work ability, productivity, and actual performance.

Implications for Nursing: Lack of information regarding cognitive impairment inhibits survivors' ability to prepare, understand, and accept impending cognitive changes and how they may affect work ability. Oncology nurses can assist cancer survivors by preparing and educating them on how to better manage impairment associated with cancer and its treatment.

More than 40% of the 14.5 million cancer survivors in the United States alone are of working age (American Cancer Society, 2014). However, many of these individuals experience unrelieved symptoms and side effects from cancer and cancer treatments, including cognitive impairment (Jansen, Miaskowski, Dodd, Dowling, & Kramer, 2005a, 2005b). Concerns regarding cognitive function, including problems with attention, memory, processing information, and making decisions, have been reported by cancer survivors (Munir, Burrows, Yarker, Kalawsky, & Bains, 2010; Myers, 2012). These cognitive impairments have been demonstrated on neuropsychological assessments (Anderson-Hanley, Sherman, Riggs, Agocha, & Compas, 2003; Falleti, Sanfilippo, Maruff, Weih, & Phillips, 2005; Jansen et al., 2005a; Stewart, Bielajew, Collins, Parkinson, & Tomiak, 2006) and functional magnetic resonance imaging (Cimprich et al., 2010; Ferguson, McDonald, Saykin, & Ahles, 2007; McDonald,

Saykin, & Ahles, 2008; Saykin & Wishart, 2006). A growing body of research, including the authors' own studies, has shown that a substantial number of cancer survivors continue to have objectively measured cognitive deficits that may persist years after treatment (Ahles et al., 2002; Bender et al., 2008; Jenkins et al., 2006; Koppelmans et al., 2012; Von Ah et al., 2009; Von Ah & Tallman, 2015; Wefel, Lenzi, Theriault, Davis, & Meyers, 2004). Cognitive changes have been identified by cancer survivors as one of their most problematic post-treatment symptoms (Boykoff, Moieni, & Subramanian, 2009). In addition, research by the current team and others suggests that, although these changes are often first noted during chemotherapy treatment, they became most worrisome after treatment has ended, when the cancer survivor is trying to reengage with normal life activities and return to work (Myers, 2012; Tiedtke, de Rijk, Dierckx de Casterlé, Christiaens, & Donceel, 2010; Von Ah, Habermann, Carpenter, & Schneider, 2013).

Returning to work and perceived work ability after the diagnosis and treatment of cancer have been identified as important to having meaning and purpose in life for patients with cancer (Feuerstein et al., 2010; Maytal & Peteet, 2009). The ability to work also has financial implications and can affect quality of life (Fenn et al., 2014; Meneses, Azeuro, Hassey, McNees, & Pisu, 2012). Theoretical models suggest a link between symptoms, such as cognitive impairment, and work-related outcomes in cancer survivors (Feuerstein et al., 2010; Steiner, Cavender, Main, & Bradley, 2004; Wells et al., 2013). However, the impact of cognitive impairment on work outcomes is not well understood. The purpose of this integrative review was to explore the empirical literature to gain insight into the experience of cognitive impairment in adult cancer survivors and to ascertain the impact of cognitive impairment on work-related outcomes. Findings from this review will increase understanding of the impact of cognitive impairment on work-related outcomes in cancer survivors, which, in turn, can guide the development of patient-specific interventions to address real-life implications of cognitive impairment after cancer.

Methods

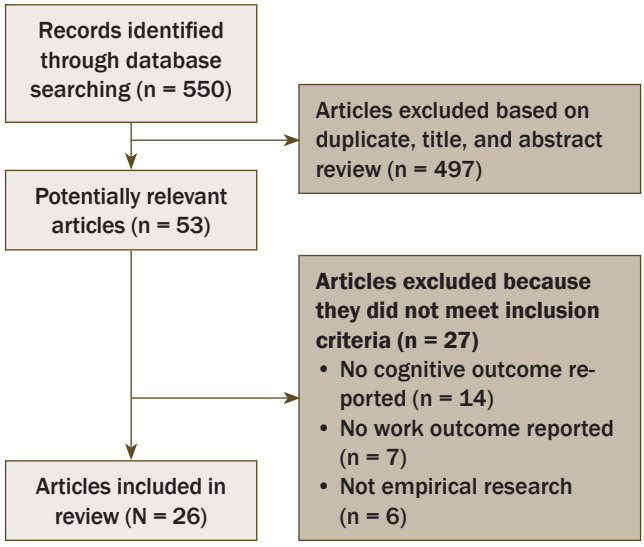
To obtain publications about cancer, cognitive impairment, and work-related outcomes, four electronic databases were searched: Ovid (MEDLINE®), PubMed, CINAHL®, and Web of Science. Key search terms included the following: *cancer*, *survivors*, *cognitive*, *work*, and *work ability*. The terms were used as key words and Medical Subject Headings (MeSH) to obtain the maximum number of publications. In addition, reference lists were searched for publications. Inclusion criteria were manuscripts reporting empirical research studies, both qualitative and quantitative that were published in English from January 2002 to August 2015 with a focus on cognitive impairment in survivors of adult cancer (see Figure 1).

For this review, cognitive impairment was defined as a decline in function in one or more of the following cognitive domains: attention and concentration, executive function, information processing speed, language, visual–spatial skill, psychomotor ability, learning, and memory (Jansen et al., 2005b; Lezak, Howieson, & Loring, 2004). Cognitive performance was assessed by the individual through subjective self-reporting and/or by objective neuropsychological assessments conducted by a trained professional. Qualitative and quantitative studies were reviewed to gain a more complete understanding of the survivors' experiences.

For inclusion, quantitative studies were required to have measured cognitive functioning and a work-related outcome (e.g., return to work, productivity). Quantitative studies that focused on psychological or mental health or general health that did not have a separate assessment of cognitive functioning were not included. In addition, studies that included occupationally active survivors but did not have an identified work-related outcome were also excluded because the intent of this review was to examine the impact of cognitive impairment on work-related outcomes in this population. Adult survivors of childhood cancers

FIGURE 1. Search Strategy

Note. **Search terms included *cancer*, *survivors*, *cognitive*, *work*, and *work ability*. Databases searched were Ovid (MEDLINE®), PubMed, CINAHL®, and Web of Sciences. Articles were limited to those published in English from 2002–2015 on adults aged 19 years or older with cancer.**



were excluded because cancer treatment during childhood, although it may affect cognitive development, was not the focus of this review.

The synthesis of quantitative articles was conducted using the integrative methodology strategies proposed by Whittemore and Knafl (2005). Qualitative articles were reviewed using the assessment and synthesis criteria established by the Swedish Agency for Health Technology Assessment and Assessment of Social Services (2014). Both strategies offer a structured format for article review in which at least two researchers conduct an independent review then review jointly until consensus is reached. Levels of evidence, strengths, and limitations of each article were included in the evaluation. Level of evidence was assigned based on criteria developed by Melynk and Fineout-Overholt (2010).

Synthesis

A total of 26 studies met the inclusion criteria. Table 1 presents the quantitative and mixed-methods studies that examined cognitive impairment as a predictor of work-related outcomes in patients with cancer. Fifteen quantitative studies and one mixed-methods study met the inclusion criteria. The majority (9 of 15) of the studies used a cross-sectional design to examine the relationships between cognitive impairment and work-related outcomes. Eight of the study samples consisted of survivors with mixed diagnoses, six included only breast cancer survivors (BCS), and two focused on survivors of brain cancer. Six studies were longitudinal, and one had a retrospective design. Sample sizes ranged from 18–1,348 cancer survivors.

Table 2 presents the qualitative studies examining the experience of cognitive impairment and work-related outcomes in cancer survivors. Ten qualitative studies explored the experience of cognitive impairment and its perceived impact on work outcomes in cancer survivors. All of the qualitative studies used cross-sectional designs but varied in the method of interviewing, which included individual face-to-face interviews, telephone interviews, or focus groups, with five studies using multiple methods (e.g., individual interviews and focus groups). Most of the studies focused on cognitive impairment in long-term survivors (as many as 15 years post-treatment), with only one focusing on cognitive concerns during treatment. Four of the studies included survivors of different types of cancer, and six study samples were comprised of only BCS. Sample sizes ranged from 12–74.

Cognitive Assessments

Assessments of cognitive impairment were predominately limited to self-report measures in the quantitative studies. Four studies used a modified Cognitive Symptom Checklist including the subscales of working memory, executive function, and attention (Calvio, Peugeot, Bruns, Todd, & Feuerstein, 2010; Collins, Gehrke, & Feuerstein, 2013; Feuerstein, Hansen, Calvio, Johnson, & Ronquillo, 2007; Hansen, Feuerstein, Calvio, & Olsen, 2008). Three studies used the Cognitive Failures Questionnaire, which assesses perception of attention, memory, and motor function (de Boer et al., 2008; Munir et al., 2011; Spelten et al., 2003). One study used the Cognitive Stability Index, which measures four cognitive domains: attention, memory, response speed, and processing speed (Hedayati et al., 2013). The remaining studies used single-item rating scales and asked participants to rate their ability to concentrate (Bradley, Neumark, Luo, & Schenk, 2007; Gudbergsson, Fosså, Borgeraas, & Dahl, 2006; Pryce, Munir, & Haslam, 2007; Schmalenberger, Gessert, Giebenhain, & Starr, 2012) or mental ability (Taskila & Lindbohm, 2007; Torp, Nielsen, Gudbergsson, & Dahl, 2012).

Three studies included objective neuropsychological tests to measure cognitive performance. Calvio et al. (2010) were the only team of researchers that used a self-report assessment (three subscales of the Cognitive Symptom Checklist) and an objective computerized neuropsychological battery to measure memory, executive functioning, and attention. Two other studies used neuropsychological tests that included components of executive function, visual–spatial skill, motor skill, speed of processing, and verbal memory tests (Nieuwenhuijsen, de Boer, Spelten, Sprangers, & Verbeek, 2009; Wefel et al., 2004).

Six of 16 quantitative studies were cross-sectional comparative studies of cancer survivors versus groups of adults without cancer (Bradley et al., 2007; Calvio et al., 2010; Feuerstein et al., 2007; Gudbergsson et al., 2006; Hansen et al., 2008; Taskila, Martikainen, Hietanen, & Lindbohm, 2007).The majority of these studies found that cancer survivors had greater cognitive concerns than non–cancer survivors. Six of the studies followed cancer survivors over time, from three weeks to 18 months (Bradley et al., 2007; de Boer et al., 2008; Hedayati et al., 2013; Munir et al., 2011; Schmalenberger et al., 2012; Spelten et al., 2003; Wefel et al., 2004). All of the studies noted cognitive impairment, which, for a subset of BCS, did not resolve over time.

Men and women in these studies experienced cognitive impairment. However, Bradley et al. (2007) found that cognitive impairment (i.e., concentration, analysis, keeping up with others, and learning new things) occurred in as many as 39% of female BCS, compared to 5%–16% of men with prostate cancer. Similarly, among survivors of different types of cancer diagnoses (the majority were breast and gynecologic

TABLE 1. Quantitative and Mixed-Methods Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors

Study	Design	Sample	Cognitive Measurement	Work-Related Outcomes	Findings
Bradley et al., 2007	Longitudinal; time points: 6, 12, and 18 months post-diagnosis	790 survivors (496 BCS and 294 PCS); 300 non-cancer comparisons; mean age: BCS = 51 years, PCS = 56 years	Investigator-initiated; four self-rated questions	Hours worked per week	• Greatest difference between cancer survivors and the controls regarding employment and hours worked was within the first six months postdiagnosis ($p = 0.05$); no differences were seen at 12 or 18 months postdiagnosis. • 20%–39% of BCS reported work-related cognitive limitations (e.g., concentration, analysis, keeping up with others, learning new things). • 5%–16% of PCS reported cognitive limitations (e.g., concentration, analysis, keeping up with others, learning new things).
Calvio et al., 2010	Cross-sectional; mean time point: three years post-treatment	122 BCS; 113 in the non-cancer group; aged 18–65 years	Cognitive Symptom Checklist–modified	Work Limitations Questionnaire	• Survivors had significantly more anxiety-related symptoms, depressive symptoms, fatigue, pain, job stress, and patient-reported work-related memory difficulties, attention, and executive functioning than controls. • Survivors performed better on attention than controls. • Self-reported cognitive limitations in survivors predicted work output. • Self-reported cognitive limitations and performance-based cognitive function tests were not congruent. • Fatigue and job stress were related to work output in both groups.
Collins et al., 2013	Cross-sectional	137 brain cancer survivors and 96 non-cancer comparisons aged 20–70 years	Cognitive Symptom Checklist–modified	Cognitive work tasks reported as problematic	• 21 of 24 reported that work tasks involving working memory were most problematic. • In 4 of 23, executive function work tasks were most problematic. • 1 of 12 reported that work tasks related to attention were most problematic.
de Boer et al., 2008	Longitudinal; time points: 6, 12, and 18 months after first day of sick leave	195 survivors of breast, gynecologic, genitourinary, gastrointestinal, or hematologic cancer aged 18–58 years	Cognitive Failures Questionnaire	Work Ability Index; return to work	• Work ability improved over time for all cancer survivors (24%–64% returned). • Self-assessed work ability predicted return to work at 18 months. • Current work ability, mental work ability, physical work ability, quality of life, fatigue, physical complaints, cognitive functioning, age, physical work load, work stress, gender, diagnosis, and treatment at 6 months were related to return to work at 18 months. • In a subgroup analysis that excluded those who returned to work early (at six months), mental work ability and cognitive dysfunction were predictive of return to work.
Feuerstein et al., 2007	Cross-sectional; time point: less than 1 year to 37 years post-diagnosis	95 brain cancer survivors and 131 non-cancer comparisons aged 20–70 years	Cognitive Symptom Checklist–modified	Work Limitations Questionnaire	• Cancer survivors had higher levels of work limitations and time off work than the non-cancer group. • Depressive symptoms, fatigue, cognitive limitations, sleep, and negative problem-solving orientation were each independently associated with work limitations in the cancer and non-cancer groups.

(Continued on the next page)

BCS—breast cancer survivors; PCS—prostate cancer survivors

TABLE 1. Quantitative and Mixed-Methods Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors *(Continued)*

Study	Design	Sample	Cognitive Measurement	Work-Related Outcomes	Findings
Gudbergsson et al., 2006	Cross-sectional; time point: two to six years postdiagnosis	430 survivors of breast, prostate, or testicular cancer; 596 non-cancer comparisons	One self-rated question	Hours worked per week, self-rated physical and mental work capacity	• Cancer survivors did not differ in work hours or full-time jobs compared to controls. • Cancer survivors reported poorer physical and mental work capacity.
Hansen et al., 2008	Cross-sectional; mean time point: less than 1 year to 27 years postdiagnosis	100 BCS with a mean age of 49.5 years and 103 non-cancer comparisons with a mean age of 39.8 years	Cognitive Symptom Checklist–modified	Work Limitations Questionnaire	• Survivors reported greater work limitations, as well as more fatigue, depressive symptoms, anxiety, and cognitive limitations than non-cancer comparisons. • Symptom burden accounted for 31% of the variability of work limitations (fatigue alone accounted for 22%). • Fatigue was more strongly related to work limitations in the survivor group, whereas depressive symptoms were more strongly related to limitations at work for the non-cancer group.
Hedayati et al., 2013	Longitudinal; time points: testing at baseline and as many as 18 months post-chemotherapy	44 BCS aged 40–64 years	Cognitive Stability Index	Return to work: medical certificate	• Cognitive function scores did not change significantly over time, but memory and response speed declined. • Return to work was not significantly related to memory, attention, response speed, or processing speed. • At baseline, 2 of 15 women reported cognitive impairment as their reason for taking sick leave, and 1 of 14 reported cognitive impairment as the reason for sick leave at follow-up. • Two of four women still on sick leave at 18 months reported cognitive impairment as a reason.
Munir et al., 2011	Longitudinal; time points: prior to and four months after chemotherapy; mixed-methods design: individual, face-to-face, or over-the-phone interviews (n = 31); questionnaire (n = 15)	31 BCS aged 34–62 years	Cognitive Failures Questionnaire	Return to work	• 26 of 31 were working prior to diagnosis, 17 were working at the end of treatment, and the remaining were on extended leave. • 28 of 31 reported symptoms of fatigue, low mood, and cognitive problems. • Cognitive concerns included problems with memory, concentration, and attention. • 12 of 17 who were working reported frequent problems remembering tasks at work. • 5 of 13 who had not yet returned to work expressed concerns about their confidence in their ability to work or carry out tasks as a result of cognitive changes.

(Continued on the next page)

BCS—breast cancer survivors; PCS—prostate cancer survivors

TABLE 1. Quantitative and Mixed-Methods Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors *(Continued)*

Study	Design	Sample	Cognitive Measurement	Work-Related Outcomes	Findings
Nieuwenhuijsen et al., 2009	Cross-sectional; questionnaire at 12 months after first day of sick leave	45 survivors of breast, gastrointestinal, gynecologic, genitourinary, or hematologic cancer	Neuropsychological assessment	Work Ability Index; work status questions	• 33% of patients showed neuropsychological impairment. • The mean work ability score for cancer survivors with neuropsychological impairment was 4.9, compared to a mean score of 6 among those without impairment. • Impaired neuropsychological functioning was related to lower vocational functioning but was not statistically significant.
Pryce et al., 2007	Cross-sectional; time point not specified	328 survivors of breast, colorectal, genitourinary, or head and neck cancer; lymphoma; or melanoma aged 18–68 years	Loss of concentration	Working during treatment, return to work, work site adjustments	• 30% continued to work during treatment; 42% returned to work following treatment. • Working during treatment was associated with work flexibility, disclosure of diagnosis to colleagues, paid time off for appointments, and fatigue. • Return to work was correlated with managing fatigue, stress, physical changes, advice from physician about work, and meeting with employer. • 36% reported loss of concentration during treatment; 33% reported it after. • 94% reported fatigue, which was associated with working during and after treatment.
Schmalenberger et al., 2012	Cross-sectional	97 musician BCS aged 31–78 years	Survey	Job performance	• More than half of the participants reported that their symptoms (cognition, concentration, or thinking) were moderate and affected their ability to make music. • 53% reported having problems with thinking and concentration, with 76% reporting moderate to extreme intensity. • When asked about the duration of problems with thinking and concentration, 78% reported more than 12 months or ongoing, and 84% reported persistent problems. • 34% of the women reported that problems with thinking and concentration had no or slight impact on their work ability, whereas 53% reported a moderate impact and 12% reported a severe to disabling impact.
Spelten et al., 2003	Longitudinal; time points: 6, 12, and 18 months after first day of sick leave	235 survivors of gastrointestinal, breast, gynecologic, or genitourinary cancer aged 19–58 years	Cognitive Failures Questionnaire	Time to return to work and rate of return to work	• 64% returned to work by 18 months. • Fatigue, diagnosis, treatment type, age, gender, depression, physical complaints, and workload were negatively related to return to work. • Fatigue was a predictor of return to work independent of diagnosis and treatment but not of other cancer-related symptoms. • Cognitive concerns did not significantly change over time and did not independently predict return to work.
Taskila et al., 2007	Cross-sectional; time point not specified	591 survivors of lymphoma or breast, testicular, or prostate cancer; 757 non-cancer comparisons; aged 25–57 years	Mental ability	Work Ability Index	• No difference in work ability between the two groups. • Impaired mental ability was reported by 23% of men and 18% of women. • Cancer survivors with at least two comorbid medical diseases had increased risk for impaired mental work ability.

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BCS—breast cancer survivors; PCS—prostate cancer survivors

TABLE 1. Quantitative and Mixed-Methods Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors *(Continued)*

Study	Design	Sample	Cognitive Measurement	Work-Related Outcomes	Findings
Torp et al., 2012	Retrospective cohort study; questionnaire	653 survivors of breast, gynecologic, prostate, or testicular cancer aged 25–60 years	Worksite adjustment questions; Work Ability Index	Work Ability Index; work site adjustment	• 26% of employed survivors made worksite adjustments. The most common adjustment was in the number of hours worked. • 23% of employed survivors reported a reduction in mental work ability. • 6% reported not coping well with mental work demands. • More women than men reported reduced mental work ability. • Total work ability score was 8.6 (SD = 1.8) for female and male survivors.
Wefel et al., 2004	Longitudinal; time points: baseline and three weeks and one year after chemotherapy	18 BCS aged 34–63 years	Neurophysical test	Work ability: Functional Assessment of Cancer Therapy–Breast module	• Cancer survivors who reported cognitive decline at three weeks postchemotherapy (n = 7) reported that they were not at all able to work (14%), were able to work somewhat (43%), or were very much able to work (43%). • Cancer survivors without cognitive decline (n = 8) said they were able to work quite a bit (14%) or able to work very much (86%). • At one year postchemotherapy, the cognitive decline group (n= 6) reported that they were able to work somewhat (17%) or very much (83%). • Those with no cognitive impact did not experience difficulty with return to work.

BCS—breast cancer survivors; PCS—prostate cancer survivors

for women and prostate and testicular for men), Torp et al. (2012) found that more women reported reduced work ability because of cognitive impairment. In contrast, in a study of survivors with diagnoses of lymphoma, breast, testicular, and prostate cancers, 23% of men reported impaired mental ability, compared to 18% of women (Taskila et al., 2007).

Assessment of Work-Related Outcomes

Half of the studies (8 of 16) assessed work-related outcomes using self-report measures. Four studies used only a portion of the Work Ability Index, which assesses work, work ability, and health (de Boer et al., 2008; Nieuwenhuijsen et al., 2009; Taskila et al., 2007; Torp et al., 2012). Of those studies using the Work Ability Index, three examined work ability among cancer survivors alone (de Boer et al., 2008; Nieuwenhuijsen et al., 2009; Torp et al., 2012); one study compared the work ability of cancer survivors with that of adults without cancer (Taskila et al., 2007). Three studies used the Work Limitations Questionnaire to examine the extent to which health interfered with job performance and productivity and compared cancer survivors to adults without cancer (Calvio et al., 2010; Feuerstein et al., 2007; Hansen et al., 2008). One longitudinal study used an item from the Functional Assessment of Cancer Therapy–Breast model that asks participants to rate the extent to which they are able to work, with 0 indicating not at all and 5 indicating very much, at three weeks and one year postchemotherapy (Wefel et al., 2004).

Six studies assessed return to work, using various definitions, such as time taken to return to work and rate of return to work (Munir et al., 2011; Pryce et al., 2007; Spelten et al., 2003), hours worked per week (Bradley et al., 2007; Gudbergsson et al., 2006; Pryce et al., 2007; Torp et al., 2012), medical certificate of release to work (Hedayati et al., 2013), and need for worksite adjustment (Pryce et al., 2007; Torp et al., 2012). Other researchers assessed work-related outcomes through indices of perceived job performance, such as the ability to perform tasks required by the job (Collins et al., 2013; Munir et al., 2011; Schmalenberger et al., 2012) and mental capacity for work (Gudbergsson et al., 2006).

Impact of Cognitive Impairment on Work-Related Outcomes

The effects of cancer- and cancer treatment–related cognitive impairment were identified by cancer survivors as a primary problem affecting work ability, return to work, and job performance. Cognitive concerns varied slightly across the quantitative studies reviewed; however, tasks involving memory, concentration, attention, and executive

TABLE 2. Qualitative Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors

Study	Design	Sample	Findings
Boycoff et al., 2009	Ethnographic content analysis; time point: one year post–adjuvant therapy; focus groups (n = 20); individual, face-to-face interviews (n = 74)	74 breast cancer survivors aged 30–89 years	• 54% of the survivors were employed full- or part-time one year post–adjuvant treatment; no specific information existed regarding how many changed their work status. • 70% of the survivors identified cognitive impairment as their most frequent problem. • Survivors reported concerns regarding concentration, memory, and processing speed. • Survivors reported that cognitive impairment resulted in decreased efficiency and speed at work. • Some survivors noted that cognitive concerns may have affected opportunity for advancement and ability to find employment; one survivor took early retirement as a result of her perceived impairment.
Fitch et al., 2008	Exploratory; time point: in treatment; individual, face-to-face interviews	32 cancer survivors (breast, colorectal, hematologic, gynecologic, lung, pancreatic) aged 20–72 years	• 8 of 19 survivors who worked returned to work during treatment, and 9 of 17 were on leave from their positions during treatment. • Primary cognitive impairments reported were memory, concentration, and comprehension. • Survivors reported distinct changes in work ability after treatment (e.g., "It [is] much harder to absorb it all.").
Kennedy et al., 2007	Thematic analysis; time point: 11 months to 10 years post-treatment; individual, face-to-face interviews (n = 19); two focus groups (n = 4, n = 6)	29 cancer survivors (breast, non-Hodgkin lymphoma, gynecologic, head and neck) aged 38–64 years	• 27 of 29 returned to work, 11 of 27 reduced hours, and 2 of 29 quit or took early retirement. • Effects of cancer and cancer treatment were identified as a main theme affecting return to work and work ability. • Cognitive impairments identified included the ability to concentrate and memory problems (forgetting everything). • One-third of the survivors identified inability to concentrate as disrupting work ability. • Survivors who had difficulty concentrating reported reduced work productivity and feelings of letting their company down.
Knott et al., 2014	Thematic analysis; focus group (n = 11), interview (n = 6)	17 cancer survivors (breast, colorectal, ovarian, non-Hodgkin lymphoma, other)	• Cancer survivors identified fatigue and, to a lesser extent, "chemobrain" to be significant problems impeding return to work.
Main et al., 2005	Thematic analysis; time point: two to three years postdiagnosis; individual, face-to-face interviews	28 cancer survivors (gastrointestinal, brain, leukemia, lymphoma, lung, thyroid, breast, genitourinary, skin, head and neck) aged 21–66 years	• 27 of 28 returned to work, 8 of 27 reduced hours, and 2 quit. • Effects of cancer and treatment were identified as a key factor in return to work and work experience. • Brain tumor survivors reported significant deficits in short-term memory. • Survivors identified concerns with concentration (staying on task) and memory (remembering details) as affecting work productivity.
Munir et al., 2010	Template analysis; time point: 1–10 years postchemotherapy; two focus groups, semistructured questions	13 breast cancer survivors aged 36–60 years	• 7 of 13 had no changes to work status, 2 of 13 reduced their hours, and 4 of 13 retired or quit working. • All survivors reported cognitive decline since chemotherapy. • Cognitive concerns reported included problems with short-term memory, verbal ability, speed of processing information, and executive functioning (multitasking, making decisions, and dividing attention). • All survivors reported that their cognitive impairments negatively affected their confidence in their ability to return to work. • All survivors reported that cognitive changes had a negative effect on their work performance, with problems lasting up to one year post–return to work.

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TABLE 2. Qualitative Studies Examining Cognitive Impairment and Work-Related Outcomes in Cancer Survivors *(Continued)*

Study	Design	Sample	Findings
Myers, 2012	Descriptive; time point: 6–12 months post-chemotherapy	18 breast cancer survivors aged 25–65 years old	• 13 of 18 worked full- or part-time; 2 of 18 lost their job and reported that cognitive changes contributed to loss of employment. • Survivors primarily reported concerns with short-term memory, word finding, and inability to focus and concentrate.
Nilsson et al., 2011	Content analysis; time point: 3–13 months post–surgical treatment; focus group interviews	23 breast cancer survivors aged 37–62 years	• 14 of 22 returned to full-time work, 4 of 22 reduced hours to part-time, 1 was part-time at diagnosis and remained part-time, 3 of 22 took partial leave, and 1 of 22 was terminated. • Several survivors expressed concern regarding lack of information about side effects, including cognitive impairment. • Lack of information regarding cognitive impairment was perceived to have had a negative impact on their work or work capacity.
Tamminga et al., 2012	Thematic analysis; time points: initial diagnosis and post–return to work; semistructured, individual, face-to-face interviews	12 breast cancer survivors aged 31–51 years	• Survivors stated that slow recovery (concentration) was a barrier to returning to work. • Survivors stated that difficulty focusing attention and remembering facts restricted their work activity. • Cognitive-related side effects, such as difficulty with attention functions, retrieval of memory, pace of thought, higher-level cognitive function, and application of knowledge, diminished over time and were only a hindrance during initial return to work.
Von Ah et al., 2013	Content analysis; time point: 1–15 years post-treatment; telephone interviews	22 breast cancer survivors aged 40–74 years	• 14 of 22 worked outside the home at the time of the study, 4 of 22 left employment after diagnosis and treatment, and 2 of these 4 left employment because of cognitive concerns. • Survivors reported cognitive decline in short-and long-term memory, speed of processing, attention and concentration, language, and executive functioning. • Survivors reported that, although they perceived that they were adequately functioning at work, they had to work harder to perform tasks and found that developing compensatory strategies for perceived shortcomings was essential (e.g., making lists). • A few survivors believed that others (e.g., coworkers, supervisors) were checking up on their work performance after they returned to work.

functioning (problem solving) (Collins et al., 2013; Feuerstein et al., 2007; Munir et al., 2011; Schmalenberger et al., 2012) were perceived as the most problematic in relation to work-related outcomes.

A thorough review of the qualitative studies produced similar concerns related to cognitive impairment. Deficits in memory described as forgetting everything and the inability to remember were the most commonly reported cognitive symptoms. Problems with memory, primarily short-term memory, were reported in 8 of the 10 studies (Fitch, Armstrong, & Tsang, 2008; Kennedy, Haslam, Munir, & Pryce, 2007; Main, Nowels, Cavendar, Etschmaier, & Steiner, 2005; Munir et al., 2010; Myers, 2012; Tamminga, de Boer, Verbeek, & Frings-Dresen, 2012; Von Ah et al., 2013). Difficulty with concentration, described as not staying on task, inability to focus, or difficulty with attention functions, were noted in seven of the studies (Boykoff et al., 2009; Fitch et al., 2008; Kennedy et al., 2007; Main et al., 2005; Myers, 2012; Tamminga et al., 2012; Von Ah et al., 2013). Changes in the ability and speed of processing information, also described as difficulty with pace of thought, were identified as cognitive problems in four of the studies (Boykoff et al., 2009; Munir et al., 2010; Tamminga et al., 2012; Von Ah et al., 2013). Verbal ability, language skills, or word finding were identified as cognitive concerns in three of the studies (Munir et al., 2010; Myers, 2012; Von Ah et al., 2013). Executive function, or higher-level function that included difficulty planning or executing multiple tasks, application of knowledge, and decision making, was described as being a barrier for cancer survivors in three studies (Munir et al., 2010; Tamminga et al., 2012; Von Ah et al., 2013).

In studies that compared cancer survivors with people who had not had cancer, cancer survivors had significantly greater cognitive concerns related to memory and concentration, and decreased ability to keep up with others, learn new things, and make decisions (Bradley et al., 2007; Calvio et al., 2010; Feuerstein et al., 2007; Gudbergsson et al., 2006; Hansen et al., 2008; Taskila et al., 2007). Of note, cognitive impairment did not resolve over time and it negatively affected work-related outcomes, including work ability, return to work, and work performance.

Work Ability

Objective cognitive performance and perceived cognitive function were found to influence perceived work ability. Specifically, Nieuwenhuijsen et al. (2009) found that cancer survivors with impairment on tests of executive function and verbal memory had lower mean work ability scores (score of 4.9 on a scale of 1–10, with lower scores indicating poor work ability) than cancer survivors without impairment (score of 6). Although not statistically significant, these impairments were also linked to lower perceived vocational functioning (Nieuwenhuijsen et al., 2009). Similarly, in a study of 653 cancer survivors aged 25–60 years, 23% reported that their cancer had impaired their cognition and work ability, and 6% reported poor coping with mental work demands (Torp et al., 2012). In 591 cancer survivors, Taskila et al. (2007) found that those with other medical comorbidities (at least two) or those who had chemotherapy as part of their treatment had increased risk for cognitive impairment affecting work ability. However, these survivors did not significantly differ in perceptions of overall work ability compared to 757 adults without cancer.

Return to Work

Return to work is an important outcome to assess. Results have been equivocal in regard to whether cancer- and cancer treatment–related cognitive impairment is a major influencing factor. The proportion of cancer survivors who returned to work after treatment ranged from 42%–64% among the quantitative studies (Munir et al., 2011; Pryce et al., 2007; Spelten et al., 2003). This percentage was greater in the qualitative studies reviewed, in which 47%–96% of cancer survivors had returned to work (Boykoff et al., 2009; Fitch et al., 2008; Kennedy et al., 2007; Nilsson, Olsson, Wennman-Larsen, Petersson, & Alexanderson, 2011). The greater proportion of patients returning to work in the qualitative studies was probably influenced by the focus of some of these studies on targeting or seeking out survivors who had experience with returning to work (Kennedy et al., 2007).

Although the majority returned to work, as many as 41% of survivors had reduced the number of work hours from pretreatment levels because of cognitive concerns. In 195 cancer survivors, de Boer et al. (2008) found that cognitive impairment was an important factor related to return to work 18 months after diagnosis. In addition, in a subgroup analysis that excluded those who returned to work early (i.e., by six months after diagnosis), the impact of cognitive impairment on work ability was predictive of return to work, suggesting that cognitive factors may be important for return to work over time (de Boer et al., 2008). In another study, BCS (n = 12) reported slow recovery in ability to concentrate as a barrier to returning to work (Tamminga et al., 2012). Conversely, in a heterogeneous sample of 235 cancer survivors, Spelten et al. (2003) found that cognitive concerns did not affect the rate of return to work. Overall, results across studies were mixed regarding the impact of cognitive impairment on return to work, which may be a result of the use of self-report rather than performance-based measurement. In addition, the various definitions of return to work made synthesizing results difficult.

In some studies, survivors returned to work, but not always to the same position or the same number of hours. Bradley et al. (2007) found that the employment and number of hours worked differed between cancer survivors and adults without cancer within the first six months of diagnosis, but this was not evident at 12–18 months postdiagnosis. Similarly, Gudbergsson et al. (2006) did not find a difference in the full-time status and number of hours worked between cancer survivors and the referents without cancer. However, in both studies, cancer survivors did report poorer cognition and work capacity than those who were not cancer survivors. The literature identifies many factors that affect work hours in this context. Flexibility to make adjustments in schedules and in the number of hours worked was important for cancer survivors to return to work. Pryce et al. (2007) noted that work during treatment was associated with work flexibility, disclosure of diagnosis, and paid time off for appointments and fatigue. Torp et al. (2012) found that more than a quarter of survivors made work adjustments (hours worked), with psychological demands, decision latitude (the freedom to make decisions and exercise control over work), and social support correlating with total work ability. Return to work was also correlated with managing fatigue, stress, physical changes, and physician/employer advice (Pryce et al., 2007). Taken together, these findings suggest that decisions to return to work and the number of hours worked per week are complex and most likely influenced by multiple factors, including cognitive concerns.

A number of studies identified cognitive concerns as an important factor for delaying return to work or leaving employment altogether. BCS who were still on sick leave at 18 months reported cognitive impairment as the reason for their inability to return to work (Hedayati et al., 2013). In one study, as many as 31% of cancer survivors with cognitive concerns stopped working or retired from work after the diagnosis and treatment of cancer (Munir et al., 2010). In another qualitative study, two of the four BCS who left their job reported that cognitive concerns were the primary reason for leaving their employment (Von Ah et al., 2013). Other studies found that cancer survivors were unable to retain their positions. In one study, 18 (11%) cancer survivors indicated that they had experienced job loss (Myers, 2012). In another study, 23 (5%) reported that they had been terminated from employment as a direct result of cognitive concerns (Nilsson et al., 2011). Cancer survivors also have reported retiring early because of the cognitive changes they experienced (Boykoff et al., 2009; Von Ah et al., 2013).

Impact on Job Performance

Cognitive impairment was perceived by the cancer survivors as affecting their job performance and productivity. Schmalenberger et al. (2012) studied the job performance of 97 BCS who were musicians and found that the majority reported cognitive problems (i.e., in thinking and concentration) that had a moderate impact on job performance (i.e., making music). Similarly, problems related to concentration, staying on task, slow recovery (Kennedy et al., 2007; Main et al., 2005; Tamminga et al., 2012), remembering details (Fitch et al., 2008; Main et al., 2005; Tamminga et al., 2012), finding it harder to absorb it all (Fitch et al., 2008), and focusing attention (Tamminga et al., 2012) were identified as affecting work productivity.

One-third of cancer survivors in one study identified inability to concentrate as disrupting work ability, which, ultimately, resulted in decreased work productivity and feelings of letting their company down (Kennedy et al., 2007). In another study, cancer survivors reported that, because of the cognitive problems, they were overwhelmed and found their work environment to be unbearable (Munir et al., 2010). On returning to work, some survivors believed that coworkers or supervisors were checking up on their work (Von Ah et al., 2013). Most cancer survivors reported that they had to work harder to perform tasks and developed compensatory methods to maintain their work productivity (Von Ah et al., 2013). In addition, cancer survivors reported that cognitive concerns resulted in reduced efficiency and speed at work and may have also affected their opportunities for advancement or the ability to find employment (Boykoff et al., 2009).

Duration and Impact of Cognitive Changes on Work-Related Outcomes

The duration of cognitive changes and their impact on return to work varied among the studies. Only a handful of studies examined cognitive concerns over time (Bradley et al., 2007; Munir et al., 2010; Tamminga et al., 2012; Wefel et al., 2004). Tamminga et al. (2012) found that difficulty with cognitive changes diminished over time and was only a barrier during initial return to work. Other studies found that cognitive changes had a negative effect on work performance lasting as long as one year post-treatment (Munir et al., 2010; Wefel et al., 2004). Bradley et al. (2007) reported ongoing symptoms as many as 18 months post-treatment. In addition, Hansen et al. (2008) noted cognitive concerns as many as 27 years post-treatment, suggesting that cognitive impairment can be a persistent symptom after cancer and cancer treatment.

Lack of Information Regarding Cognitive Changes After Cancer

Survivors reported that the general effects of treatment on work-related outcomes were not adequately addressed or discussed with them by the healthcare team (Boykoff et al., 2009; Fitch et al., 2008; Kennedy et al., 2007). The lack of information regarding cognitive impairment had a negative impact on the work and work capacity of cancer survivors (Nilsson et al., 2011). Cancer survivors indicated that more information was needed on how to manage cognitive impairment in the home and workplace (Munir et al., 2010).

Summary of the Evidence

Levels of evidence for the studies included in this review ranged from level 1 randomized, controlled trials (highest) to level VII expert opinion (lowest) (Melynk & Fineout-Overholt, 2010). The majority of quantitative articles in this study were categorized as level IV (well-designed cohort studies), with the qualitative articles assigned a level VI rating. The lower levels of evidence noted in these studies underscore the need for more rigorous study designs in additional research.

Discussion

The purpose of this integrative review was to examine the experience of cognitive impairment after cancer and its impact on work-related outcomes among cancer survivors. The authors reviewed the findings of 26 (quantitative and qualitative) studies. Despite variations in study design, type of cancer survivors

evaluated, assessment measures of cognitive and work-related outcomes, and operational definitions of work-related outcomes, the majority of the studies reviewed found cognitive impairment to be a common troubling symptom that persisted long after treatment and had a deleterious effect on work-related outcomes. Taken together, the evidence suggests that cognitive impairment is an important factor relative to work ability, return to work, and work performance.

The most common cognitive concerns reported in the quantitative studies and confirmed by the qualitative studies related to memory, concentration, attention, keeping up with others, processing of thoughts, inability to learn new things, and difficulty with decision making. Most of the survivors indicated that the cognitive impairment persisted long after the treatment phase. A growing body of research, including the authors' own studies, has shown that a substantial number of BCS continue to have cognitive deficits for as many as 20 years post-treatment (Ahles et al., 2002; Jenkins et al., 2006; Koppelmans et al., 2012; Von Ah et al., 2009; Wefel et al., 2004) and that BCS perceive cognitive impairment as disruptive and bothersome (Bender, Ergÿn, Rosenzweig, Cohen, & Sereika, 2005; Boykoff et al., 2009). Similar findings were reported in a meta-analysis that included 21 qualitative articles in which survivors reported cognitive impairment such as their mind "blanking out" and being "not as sharp as it was prior to treatment" (Bennion & Molassiotis, 2013). The survivors noted that these symptoms were ongoing and prevented them from returning to their previous functional state or "precancer selves" (Bennion & Molassiotis, 2013).

Among the studies, the authors noted a wide variation regarding the measure of work ability. Some of the researchers developed their own questions or used only a portion of the questions on the Work Ability Index. Therefore, the impact of cognitive impairment on work ability may not have been fully captured because of this lack of consistency or partial use of the measurement instruments. Similarly, the impact of cognitive impairment on return to work was unclear, which may be because of the various definitions used, as well as the complexity of other factors influencing return to work. Many studies focused on return to work, which was broadly defined and did not address specific job-related performance challenges associated with cognitive impairment.

Perceived job performance was negatively affected as a result of cognitive impairment in studies that focused on this outcome. Survivors identified difficulty with concentration, memory, processing speed, and verbal skills as affecting job performance and productivity on returning to work. Survivors expressed a lack of confidence in their ability to perform job-related tasks they had previously mastered as a result of these cognitive impairments. However, additional research is needed to objectively measure cognitive performance, as well as expand work-related outcomes to include productivity and actual job performance.

Knowledge Translation

- The most common cognitive impairment symptoms for cancer survivors relate to memory, concentration, attention, keeping up with others, processing thoughts, inability to learn new things, and difficulty with decision making.
- Research has demonstrated that cognitive impairment is a bothersome symptom following cancer treatment.
- Evidence suggests that cognitive impairment affects work ability, job performance, and productivity for cancer survivors returning to work after cancer treatment.

Although the goals of this integrative review focused primarily on cognitive impairment, the authors recognize the influence that other symptoms and medical comorbidities may have in cognitive impairment and work-related outcomes. Job stress, anxiety or depression, fatigue, and other symptoms can contribute to overall and work-related cognitive impairment (Ottati & Feuerstein, 2013). In addition, the type of cancer and cancer treatment regimen, as well as comorbidities, may also contribute to cognitive impairment (Munir, Yarker, & McDermott, 2009).

Similar findings regarding the importance of cognitive impairment on work-related outcomes have been reported in the literature. Steiner et al. (2004) conducted a comprehensive review to identify factors regarding return to work in cancer survivors. In this review of nine quantitative studies, 16%–30% of survivors who returned to work reported disability related to physical limitations (physical effort, heavy lifting, and shopping) and cognitive limitations (concentration and keeping up with work pace) (Steiner et al., 2004).

Strengths and Limitations

To the authors' knowledge, this is the first integrative review to include empirical research from quantitative and qualitative studies to examine the experience of cognitive impairment on the work-related outcomes of cancer survivors. The combination of subjective measures and perceptions of cognitive impairment confirms that cancer survivors experience significant day-to-day challenges that affect their ability to perform work-related tasks at the same level as prior to diagnosis and treatment. In addition, the findings from this review demonstrate that changes in cognition and work ability are not specific to one

type of cancer or cancer survivor, but rather span the breadth of cancer diagnoses.

This review should be taken within the context of its limitations. Although some samples varied regarding the type of cancers represented, most were BCS. Therefore, additional studies are needed in other populations of cancer survivors. In addition, only three studies examined actual cognitive performance through neuropsychological assessments, with the rest measuring self-reports of cognitive impairment. Finally, no consistency existed in the definitions of or instruments used to examine the work-related outcomes of work ability, return to work, and job performance.

Implications for Practice

This integrative review documents the significant impact of cognitive impairment on work ability and job performance of cancer survivors. Understanding the impact of cognitive impairment is important because this problem is disruptive, is potentially debilitating, and has implications for quality of life; it also has ramifications for the livelihood of cancer survivors and their families. This integrative review adds to the existing body of evidence and describes the substantial negative impact cognitive impairment can have on work ability, potential income, and quality of life.

Conclusion

Cognitive impairment, if left untreated, has far-reaching effects for cancer survivors, their families, and employers. Therefore, nurses must include an assessment for cognitive impairment in their routine assessment. The National Comprehensive Cancer Network (NCCN) published recommendations for assessing and treating cognitive impairment (Denlinger et al., 2014). Thorough screening and assessment of cognitive impairment by oncology nurses are essential for the development of individualized care plans that can allay symptoms and improve the quality of life of cancer survivors. The NCCN guidelines (Denlinger et al., 2014) offer primary (psychosocial and educational programs) and secondary (organizational strategies, such as memory aids, planners, and reminder notes; routine exercise; and stress and relaxation approaches) management strategies to address cognitive impairment, but few studies have been conducted to support these guidelines. Also, to the authors' knowledge, none of these interventions to address cognitive impairment has fully examined the implications of treatment effects on work-related outcomes.

Additional research is necessary to establish evidence-based treatments to improve cognitive function and, in turn, work ability and job performance. Additional research would benefit by using a mixed-methods approach to fully understand not only the impact of cognitive impairment on work-related outcomes, but also the specific challenges related to job performance. In addition, more interventional research studies are needed to facilitate the development of person-centered strategies to mitigate the effects of cognitive changes and to improve work ability for cancer survivors and their employers.

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