Published in final edited form as:

Gynecol Oncol. 2016 December ; 143(3): 578–583. doi:10.1016/j.ygyno.2016.09.013.

Cancer and Treatment-Related Symptoms are Associated with Mobility Disability in Women with Ovarian Cancer: A Cross-Sectional Study

Dr. Grace Campbell, PhD, MSW, RN^a, Dr. Teresa Hagan, PhD, RN^b, Dr. Stephanie Gilbertson-White, PhD, RN^c, Dr. Martin Houze, PhD^a, and Dr. Heidi Donovan, PhD, RN^a

Grace Campbell: gbc3@pitt.edu; Teresa Hagan: thagan@mgh.harvard.edu; Stephanie Gilbertson-White: stephanie-gilbertson-white@uiowa.edu; Martin Houze: houzemartin@gmail.com; Heidi Donovan: donovanh@pitt.edu

^aUniversity of Pittsburgh School of Nursing, 336 Victoria Building, 3500 Victoria Street, Pittsburgh, PA 15261

^bMassachusetts General Hospital and Harvard Medical School, Yawkey Center, 55 Fruit Street, Boston, MA 02114

^cUniversity of Iowa College of Nursing, 50 Newton Road, 444 College of Nursing Building, Iowa City, IA 52242

Abstract

Objective—To examine the prevalence of symptom-related mobility disability and identify specific symptoms and other factors associated with mobility disability among a national sample of ovarian cancer (OC) survivors.

Methods—Descriptive, correlational secondary analysis of a National Ovarian Cancer Coalition mailed survey of women with a history of OC (N = 713). We used the Symptom Representation Questionnaire (SRQ), the MD Anderson Symptom Inventory (MDASI) Interference Scale, and medical and demographic information to determine prevalence of symptom-related mobility disability. We constructed a multiple linear regression model to determine the relative contributions of specific symptoms and other factors to mobility disability.

Results—A majority of the sample (60.0%) reported symptom-related mobility disability. Independent predictors included: > one comorbidity ($\beta = 0.112$, $p = 0.001$), active OC ($\beta = 0.111$, $p = 0.037$), abdominal bloating ($\beta = 0.097$, $p = 0.006$), fatigue ($\beta = 0.314$, $p < 0.001$), lack of appetite ($\beta = 0.072$, $p = 0.045$), numbness/tingling ($\beta = 0.134$, $p < 0.001$), and pain ($\beta = 0.194$, $p < 0.001$). The model explained 41.5% of the variance in symptom-related mobility disability ($R^2 = 0.415$). Unexpectedly, age ($\beta = -0.028$, $p = .412$) and current chemotherapy ($\beta = 0.107$, $p = 0.118$) were not significant predictors.

Corresponding author: Grace Campbell, PhD, MSW, RN, University of Pittsburgh School of Nursing, Department of Acute/Tertiary Care, 336 Victoria Building, 3500 Victoria Street, Pittsburgh, PA 15261, Phone: 412-383-8754, Fax: 412-383-7227.

The authors have no financial conflicts of interest to disclose.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions—Symptom-related mobility disability is common among women with OC and is associated with medical comorbidities, abdominal bloating, fatigue, lack of appetite, numbness/tingling, and pain. Longitudinal research should clarify the relationship of these symptoms to mobility disability and determine whether effective symptom management minimizes disability.

Keywords

Ovarian cancer; Symptom assessment; Physical function; Mobility; Disability

Cancer and its treatments are associated with disability and poor physical function,(1) which in turn are key components of health-related quality of life among individuals with a history of cancer.(2,3) Because cancer incidence increases with age,(4) cancer-related disability is often attributed to aging-related issues such as frailty,(5) comorbidities,(6) and toxicities of current chemotherapy, such as anemia.(7) The assumption that cancer-related disability is confined largely to older, sicker individuals may lead clinicians to severely underestimate its prevalence, especially in younger patients or those with few comorbidities. In a study conducted in an outpatient oncology clinic examining the congruence between clinician-recorded patient problem lists recorded in the medical record and a patient survey about cancer- and treatment-related disability, clinicians noted only 6% of the disabilities reported by patients. Disabilities that were particularly prevalent in this study included difficulty walking, difficulty completing activities of daily living, and cognitive changes.(8)

The prevalence of mobility disability (defined for the purposes of this paper as self-reported difficulty with walking) among women with ovarian cancer (OC) has not been well documented, and the explicit contribution of symptoms to mobility disability in this population remains to be evaluated despite the importance of this knowledge for disability prevention and management. An analysis of data from the National Health Interview Survey found that women with OC were three times more likely than individuals with bladder, prostate, melanoma, and colorectal cancer to experience disability related to walking, standing, transferring, and dressing.(9) Access and ability to pay for health care, a greater number of chronic medical conditions, and higher self-reported psychological distress were associated with higher rates of disability. However, disease- and treatment-related symptoms, which represent potential modifiable intervention targets for treating and preventing disability, were not considered. Therefore, the purpose of this study is to examine the prevalence of symptom-related mobility disability and identify specific symptoms and other factors associated with mobility disability among a national sample of OC survivors.

Materials and Methods

Data Source

This descriptive correlational study is a secondary analysis of cross-sectional data from a parent study of symptom experiences among women with OC.(10) Participants in the parent study were women who responded to a mailed survey distributed by the National Ovarian Cancer Coalition (NOCC) (N = 713). Consistent with the National Cancer Institute's definition of cancer survivorship,(11) in which individuals are considered to be survivors from the time of diagnosis through the end of life, the survey was mailed to NOCC members

who had ever been diagnosed with cancer, regardless of their current disease or treatment status. The survey included reliable, valid self-report measures of symptom severity and symptom interference with daily activities, as well as an investigator-developed sociodemographic questionnaire. Subsequent to exempt approval from the University of Wisconsin IRB, the NOCC distributed the parent study's survey by mail to 3,000 randomly selected NOCC members. Informed consent was implied by return of the anonymous questionnaire. Respondents who had not returned the first survey within 10 days received one reminder postcard. A 35.3% response rate was achieved. We excluded 88 survey respondents who were missing either the outcome variable (Interference with Walking) or any predictor variable, yielding a final sample of 625 for this analysis.

Symptom-Related Mobility Disability

Symptom-related mobility disability was defined as the score on the Interference with Walking item from the M.D. Anderson Symptom Inventory (MDASI) Interference Scale. (12) This scale asks participants, "How much have symptoms interfered with the following items during the past week?" The 6 items (general activity, mood, work, relations with other people, walking, and enjoyment of life) were rated using an 11-point Likert-type scale ranging from 0 (symptoms "Did not interfere") to 10 (symptoms "Interfered completely"). Among women with OC the MDASI demonstrates high test-retest reliability (with intraclass correlation coefficients ranging from 0.88 – 0.96) and it correlates strongly with the Functional Assessment of Cancer Therapy-Ovarian (FACT-O) ($p < .001$), demonstrating criterion validity. (13)

Factors Potentially Associated with Mobility Disability

Symptom severity—Symptom severity has been suggested as an indicator of health-related quality of life. (14) In this study, symptom severity was assessed using the Symptom Representation Questionnaire (SRQ), (10) a self-report scale in which respondents rate the severity of 24 common cancer- and treatment-related symptoms (e.g. nausea, pain, fatigue, shortness of breath, cognitive and affective symptoms) using an 11-point Likert-type scale ranging from 0 ("I did not have the symptom") to 10 ("The symptom is as bad as I can imagine"). To better understand which symptoms are particularly associated with mobility disability, we used each symptom's severity score as a distinct predictor.

Sociodemographic and clinical characteristics—Age, socioeconomic (e.g. education, income) (15) and clinical characteristics (e.g. months since diagnosis, stage at diagnosis, months since chemotherapy, number of recurrences, presence of active cancer) (9) have been associated with diminished health-related quality of life and physical function and disability in a variety of populations. In this analysis, we used education as our indicator of socioeconomic status. Sociodemographic and clinical information was collected as part of the mailed survey, using an investigator-developed questionnaire.

Statistical Analysis

Descriptive statistics (means, standard deviations, proportions) were used to characterize the entire sample, while t-tests and chi square analyses were used to compare the demographic and clinical attributes of women with and without self-reported symptom-related mobility

disability. To determine whether predictors of mobility disability might differ for women with “clinically significant” mobility disability (defined for this analysis as Interference with Walking of 5) we also divided the sample into 3 comparably-sized groups based on severity of Interference with Walking (0, 1-4, 5) and examined demographic and clinical attributes of the three groups. After describing the sample, we constructed a multivariate hierarchical regression model by first computing bivariate nonparametric correlations (Spearman's *rho*) to identify symptoms, sociodemographic factors, and disease- and treatment-related factors that were correlated with the Interference with Walking score. Using the symptoms that were significantly ($p \leq .05$) bivariate correlated with symptom-related mobility disability (abdominal bloating, fatigue, lack of appetite, numbness/tingling, and pain), we constructed a model in which symptoms were entered using mobility disability as the outcome variable. We then constructed a second model in which sociodemographic and clinical factors that were theoretically hypothesized to be related to mobility disability (age, education, months since chemotherapy, number of recurrences, presence of active OC), and all symptoms that were significantly correlated with symptom-related mobility disability ($p \leq .05$) were entered into the regression model. In the second model, we entered sociodemographic and clinical variables in Block 1 and the symptoms that were significantly correlated with symptom-related mobility disability in Block 2, with the Interference with Walking score as the outcome variable. Level of significance was set at $p < .05$ (two tailed) for all analyses. SPSS (v. 21.0, IBM Corp., Armonck, NY) was used for all analyses.

Results

A full description of the sample is found in Table 1. The mean age of our final sample ($N = 625$) was 53.28 ($SD 11.04$). The sample was mostly white (95%), and well educated: 57% had at least some college, and another 27% had postgraduate education). Half of the sample (49.76%) had received chemotherapy more than 12 months prior to responding to the survey, while 7.36% had received chemotherapy between six and 12 months prior, and 20.8% had received chemotherapy between one and six months prior, and 22.08% were receiving chemotherapy at the time of questionnaire administration. Respondents experienced an average of 2.25 ($SD 2.45$) OC recurrences, and 36% endorsed having active OC at the time of the survey. The sample was relatively healthy, other than the OC diagnosis: a majority (55.7%) endorsed no comorbidities, 24.3% endorsed one comorbidity, and 20.0% endorsed more than one comorbidity.

A majority of the sample (60.0%; $n = 375$) endorsed at least some degree of symptom-related mobility disability within the week prior to answering the questionnaire (defined for this analysis as a score > 0 on the Interference with Walking item of the MDASI Interference Scale). Approximately one-third of the sample (30.2 %, $n = 189$) rated the symptom-related mobility disability as severe (defined for this analysis as a score 5 on the Interference with Walking item). The subsample endorsing any symptom-related mobility disability did not differ from those without it with respect to age or race. However, the group of women endorsing symptom-related mobility disability included fewer respondents with post-graduate education than women without mobility disability. Moreover, the group of women endorsing symptom-related mobility disability had fewer months since

chemotherapy, had experienced more recurrences, had a higher proportion with more than one comorbidity, and a higher proportion receiving chemotherapy at the time of survey response than did women not endorsing symptom-related mobility disability. The subsample of women with clinically significant mobility disability did not differ from women with mild mobility disability (1-4 out of 10) with respect to key demographic and clinical characteristics, except that the women with 5 mobility disability were more likely to have active OC, $X^2(2, n = 189) = 52.04, p < .001$ and were slightly more likely to have more than one comorbidity, $X^2(2, n = 189) = 19.58, p < .001$. Thus, we proceeded with modeling using the full sample rather than constructing separate regression models for those with and without clinically significant mobility disability.

In the unadjusted regression model, the five symptoms that were bivariately correlated with Interference with Walking together explained 40% of the variance in symptom-related mobility disability (adjusted $R^2 = 0.398; p < .001$). The adjusted regression model identified five symptoms and two covariates as significant independent predictors of symptom-related mobility disability severity: abdominal bloating ($\beta = 0.097, p = 0.006$), fatigue ($\beta = 0.314, p < 0.001$), lack of appetite ($\beta = 0.072, p = 0.045$), numbness and tingling ($\beta = 0.127, p < 0.001$), pain ($\beta = 0.181, p < 0.001$), presence of more than one comorbidity ($\beta = 0.112, p = 0.001$), and presence of active OC ($\beta = 0.111, p = 0.037$). This model explained 42% of the variance in severity of symptom-related mobility disability (adjusted $R^2 = 0.415; p < .001$). Specifically, sociodemographic and clinical covariates (Block 1) explained only 14.4% of the variance in symptom-related mobility disability ($R^2 = 0.144; F(11, 613) = 10.55, p < 0.001$), but adding symptoms to the model (Block 2) explained an additional 27.1% of the variance in symptom-related mobility disability ($R^2 = 0.27; F(5, 608) = 57.88, p < .001$). Regression results for the adjusted model can be found in Table 2.

Discussion

This study is one of the first to explore the prevalence of and factors associated with symptom-related mobility disability in a national sample of women with a history of OC. It represents an important step in establishing the influence of specific, potentially modifiable symptoms on physical function among women with OC. In our sample of 625 women, a majority (60.0%) of participants endorsed at least some mobility disability, and 30.2% endorsed moderate to severe mobility disability. By comparison, in a sample of middle-aged women (mean age 60.6 years, $SD 2.8$) with numerous comorbidities including diabetes, hypertension, and obesity, prevalence of any degree of self-reported mobility disability was slightly higher than ours. In that study, 65.2% endorsed presence of any amount of mobility disability, and 39.0% endorsed moderate to severe mobility disability.⁽¹⁶⁾ However, their sample comprised a higher proportion of racial and ethnic minorities and women of low socioeconomic status than did ours; these two groups tend to have higher rates of mobility disability than the general population.⁽¹⁷⁾ While prevalence of mobility disability is similar in the two samples, it is possible that in a more socioeconomically representative sample of OC survivors the prevalence of mobility disability would be even higher than present in our sample, given the symptom burden present in OC survivors. Indeed, we found that abdominal bloating, fatigue, lack of appetite, numbness and tingling, and pain, in addition to having more than one comorbidity and having active OC were significant independent

contributors to symptom-related mobility disability, explaining 41.5% of the variance in the outcome variable. The symptoms that were closely associated with symptom-related mobility disability (abdominal bloating, fatigue, lack of appetite, numbness and tingling, and pain) represent potential intervention targets when seeking to preserve mobility and physical function among OC survivors. These results support previous research in other cancer populations in which ratings of overall symptom severity were associated with diminished lower extremity function,(18) and fatigue and pain were associated with greater dependence in activities of daily living(19) among cancer survivors. Poor physical function, especially related to mobility, is also thought to contribute to the high rate of falls seen in cancer survivors.(20,21) Thus, improving mobility by ameliorating the symptoms most closely associated with disability could also address the growing problem of falls among cancer survivors, which may be related to fatigue, pain,(22) and chemotherapy-induced neuropathy (numbness and tingling).(23)

Interestingly, when other sociodemographic and clinical characteristics were controlled, the number of months since chemotherapy treatment was not a significant predictor of mobility disability in any stage of the model, even though in descriptive analyses the women endorsing mobility disability were fewer months from active treatment. Nearly 50% of our sample was 12 months or more beyond active chemotherapy treatment and only approximately one third (36%) of the sample had active OC at the time of the survey. Given the high prevalence of symptom-related mobility disability, the relatively low proportion of respondents with active OC, and the large amount of time since chemotherapy for half the sample findings from this study suggest that cancer and treatment-related symptoms and associated mobility disability persists beyond active treatment and throughout the survivorship trajectory. Longitudinal research is needed to determine the extent and trajectory of the persistent symptom-related mobility disability suggested by our cross-sectional results.

Unexpectedly, age was not associated with mobility disability in our sample. When modeling the influence of sociodemographic and clinical variables alone on mobility disability, age was a significant predictor, but when symptoms were added to the model, age was no longer related to mobility disability. Advanced age is generally associated with worsening physical function, including mobility, in many populations.(24,25) Our results suggest that among OC survivors, age is less important than disease- and treatment-related factors such as symptoms in determining mobility. These findings are consistent with multiple studies that have identified an inverse relationship between age and cancer symptom severity,(26,27) and positive relationships between cancer symptom severity and general physical function,(28,29) suggesting that symptoms, rather than age, are the primary driver of mobility disability in OC.

Limitations

Several limitations must be acknowledged. For example, because of the cross-sectional nature of our data, we cannot link the onset and progression of symptoms with the onset and progression of mobility disability. Longitudinal research is needed to confirm our findings. The ability to draw conclusions about the prevalence of and factors associated with mobility

disability among all women with OC is limited by the lack of racial, ethnic, and educational diversity in our sample. Furthermore, we used only education as our indicator of socioeconomic status. Our sample had a moderate amount (approximately 7%) of missing income data in the original data set. Missing income data of up to 30% are common in survey research, and excluding participants with missing income data could bias results(30) and decrease power. However, educational attainment is highly predictive of morbidity and mortality(31) and causally precedes other indicators of socioeconomic status such as income.(32) Thus, our use of education as our sole socioeconomic variable is likely not to have biased our results. Our sample is largely Caucasian (95.8%), and highly educated—84% of our sample reported at least some college or postgraduate education. Women in our sample also could be healthier than the population, although the rate of comorbidities in our sample is similar to that of a large national study of associations between care patterns and mortality among women with OC.(33) Furthermore, our sample was drawn from members of an OC advocacy organization, who may not reflect the general population of OC survivors, and the 35.3% response rate to our lengthy survey is lower than the rate achieved in a much shorter survey of quality of life among OC survivors.(34) Longer surveys decrease likelihood of response;(35) further, non-responders to our survey may have had poorer health or higher symptom burden than respondents, so our results should be interpreted cautiously. Despite the lack of diversity and possible response bias in our sample, a strength is that our sample is socio-demographically similar to the sample in which the MDASI Interference Scale was validated for use in women with OC.(13)

We excluded 88 respondents from the original sample (N = 713) who were missing key clinical variables, including the outcome variable, but the 88 excluded participants were similar to the 625 participants with complete data with respect to age, race, education, cancer stage at diagnosis, and number of comorbidities. However, excluded women had a greater number of months since diagnosis (75.0 months vs. 56.8 months) and since chemotherapy (49.2 months vs. 30.3 months) than did our final sample, and fewer excluded women had active OC at the time of the survey (23.6% vs. 35.8%). Thus, our prevalence estimates of symptom-related mobility disability may be higher than the true rate in the population of all women with OC, and predictors of mobility disability we identified may be slightly different than those of the population.

As a secondary analysis, this study is limited by the variables present in the parent study's data set. We used a single item from the MDASI Interference Scale, Interference with Walking, as a measure of symptom-related mobility disability. Though it was recently used as an indicator of functional impairment in a study of chemotherapy-induced peripheral neuropathy and related functional impairment, (36) this item is not meant to capture specific aspects of physical disability. Rather, it provides a self-report evaluation with face validity of the extent to which women feel that their symptoms impact mobility. Other validated scales (Functional Assessment of Cancer Therapy or the Medical Outcomes Survey Short Form-36) that are more commonly used measures of patient-reported functional status in cancer literature may have resulted in different ratings of mobility disability and could be incorporated into future research.

Though our largely white, well-educated sample is a convenience sample not intended to be representative of the population, a strength is that it was drawn from the membership of a national organization, providing a geographically diverse respondent pool with a rich glimpse into OC symptoms and related disability. Importantly, our findings demonstrate that symptom-related mobility disability occurs in all demographic groups of OC survivors, not just in older individuals or women of lower socioeconomic status. It is also one of the few studies to examine the role of symptoms in physical disability among cancer survivors, and the only such study in women with OC to date. Longitudinal research is needed to identify relationships between symptom trajectories, symptom management interventions, and severity of mobility disability. Symptoms represent actionable intervention targets that present opportunities for clinical intervention to minimize the disabling effects of OC and its treatments. For example, pain and numbness and tingling suggest a neuropathic origin for some symptom-related mobility disability. Recent studies have shown duloxetine to be effective at reducing the severity of painful neuropathy in women with OC.(37) Further research should explore whether the use of duloxetine can improve functional limitations such as symptom-related mobility due to pain, numbness, and tingling. Similarly, growing evidence suggests that physical activity helps to decrease cancer- and treatment-related symptoms such as fatigue.(38) Research should examine whether decreased fatigue resulting from increased physical activity is associated with a corresponding decrease in numbness and tingling, as well as a decrease in symptom-related mobility disability.

Conclusion

Our preliminary findings suggest that clinicians should assess for key symptoms that are markers for symptom-related mobility disability, including abdominal bloating, fatigue, lack of appetite, numbness and tingling, and pain among OC survivors of all ages throughout the survivorship trajectory. Clinicians should also refer women reporting these symptoms for rehabilitative services to treat, or better yet, to prevent, the development of mobility disability. Longitudinal research is also needed to identify intervention targets by determining whether effective symptom management minimizes symptom-related mobility disability in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding sources: The original data collection was funded by F31 NR07556 (Donovan); analysis was supported by T32 NR11972 (Campbell; Hagan). The funding agencies had no involvement in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

References

1. Silver J, Baima JMR. Impairment-Driven Cancer Rehabilitation. *CA Cancer J Clin.* 2013; 63(5): 295–317. [Internet]. Available from: <http://onlinelibrary.wiley.com/doi/10.3322/caac.21186/abstract;jsessionid=98D963C1A479303ABAF5ACC8DF974734.f04t03>. [PubMed: 23856764]

2. Yoon H, Kim Y, Lim YO, Lee HJ, Choi K. Factors affecting quality of life of older adults with cancer in Korea. *Geriatr Gerontol Int*. 2015; 15(8):983–90. [Internet]. Available from: <http://onlinelibrary.wiley.com/doi/10.1111/ggi.12378/abstract>. [PubMed: 25303007]
3. Reeve BB, Mitchell SA, Dueck AC, Basch E, Cella D, Reilly CM, et al. Recommended patient-reported core set of symptoms to measure in adult cancer treatment trials. *J Natl Cancer Inst*. 2014; 106(7) [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4110472/>.
4. Smith BD, Smith GL, Hurria A, Hortobagyi GN, Buchholz TA. Future of Cancer Incidence in the United States: Burdens Upon an Aging, Changing Nation. *J Clin Oncol*. 2009; 27(17):2758–65. [Internet]. Available from: <http://jco.ascopubs.org/cgi/doi/10.1200/JCO.2008.20.8983>. [PubMed: 19403886]
5. Courtney-Brooks, M.; Tellawi, AR.; Scalici, J.; Duska, LR.; Jazaeri, AA.; Modesitt, SC., et al. *Gynecol Oncol*. Vol. 126. Elsevier Inc.; 2012. Frailty: An outcome predictor for elderly gynecologic oncology patients; p. 20-4.[Internet]Available from: <http://dx.doi.org/10.1016/j.ygyno.2012.04.019>
6. Wedding U, Röhrig B, Klippstein A, Pientka L, Höffken K. Age, severe comorbidity and functional impairment independently contribute to poor survival in cancer patients. *J Cancer Res Clin Oncol*. 2007; 133(12):945–50. [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17534661>. [PubMed: 17534661]
7. Owusu C, Cohen HJ, Feng T, Tew W, Mohile SG, Klepin HD, et al. Anemia and Functional Disability in Older Adults With Cancer. *J Natl Compr Canc Netw*. 2015; 13(10):1233–9. [Internet]. Available from: <http://www.jnccn.org/content/13/10/1233.long>. [PubMed: 26483063]
8. Cheville AL, Beck LA, Petersen TL, Marks RS, Gamble GL. The detection and treatment of cancer-related functional problems in an outpatient setting. *Support Care Cancer*. 2009; 17(1):61–7. [Internet]. Available from: <http://link.springer.com/10.1007/s00520-008-0461-x>. [PubMed: 18478275]
9. Schootman M, Aft R, Jeffe DB. An evaluation of lower-body functional limitations among long-term survivors of 11 different types of cancers. *Cancer*. 2009; 115(22):5329–38. [Internet]. Available from: <http://onlinelibrary.wiley.com/doi/10.1002/cncr.24606/abstract>. [PubMed: 19676109]
10. Donovan HS, Ward S, Sherwood P, Serlin RC. Evaluation of the Symptom Representation Questionnaire (SRQ) for Assessing Cancer-Related Symptoms. *J Pain Symptom Manage*. 2008; 35(3):242–57. [Internet]. Available from: <http://dx.doi.org/10.1016/j.jpainsymman.2007.04.017>. [PubMed: 18201866]
11. National Cancer Institute. [cited 2016 Aug 3] 2014. No Title [Internet]Page: Office of Cancer Survivorship-Definitions. Available from: <http://cancercontrol.cancer.gov/ocs/statistics/definitions.html>
12. Cleeland CS, Mendoza TR, Wang XS, Chou C, Harle MT, Morrissey M, et al. Assessing symptom distress in cancer patients: The M. D. Anderson Symptom Inventory. *Cancer*. 2000; 89(7):1634–46. [Internet]. Available from: [http://onlinelibrary.wiley.com/doi/10.1002/1097-0142\(20001001\)89:7<1634::AID-CNCR29>3.0.CO;2-V/abstract](http://onlinelibrary.wiley.com/doi/10.1002/1097-0142(20001001)89:7<1634::AID-CNCR29>3.0.CO;2-V/abstract). [PubMed: 11013380]
13. Sailors, MH.; Bodurka, DC.; Gning, I.; Ramondetta, LM.; Williams, LA.; Mendoza, TR., et al. *Gynecol Oncol*. Vol. 130. Elsevier Inc.; 2013. Validating the M. D. Anderson Symptom Inventory (MDASI) for use in patients with ovarian cancer; p. 323-8.[Internet]Available from: <http://www.scopus.com/inward/record.url?eid=2-s2.0-84880280444&partnerID=tZOtx3y1>
14. Kamal AH, Nipp RD, Bull J, Stinson CS, Abernethy AP. Symptom burden and performance status among community-dwelling patients with serious illness. *J Palliat Med*. 2015; 18(6):542–4. [Internet]. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc11&NEWS=N&AN=2015-23043-012>. [PubMed: 25789759]
15. Guralnik JM, LaCroix AZ, Abbott RD, Berkman LF, Satterfield S, Evans DA, et al. Maintaining mobility in late life. Demographics and chronic conditions. *Am J Epidemiol*. 1993; 137(8):845–57. [PubMed: 8484376]
16. Karvonen-Gutierrez CA, Ylitalo KR. Prevalence and correlates of disability in a late middle-aged population of women. *J Aging Health*. 2013; 25(4):701–17. [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4124609/pdf/nihms598096.pdf>. [PubMed: 23676712]

17. Courtney-Long, EA.; Carroll, DD. Atlanta: 2015. CDC Morbidity and Mortality Weekly Report: Prevalence of Disability and Disability Type Among Adults — United States, 2013. [Internet]Available from:http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6429a2.htm?s_cid=mm6429a2_w
18. Kenzik, KM.; Morey, MC.; Cohen, HJ.; Sloane, R.; Demark-Wahnefried, W. J Geriatr Oncol. Vol. 6. Elsevier Inc.; 2015. Symptoms, weight loss, and physical function in a lifestyle intervention study of older cancer survivors; p. 424-32.[Internet]Available from: <http://dx.doi.org/10.1016/j.jgo.2015.08.004>
19. Doorenbos AZ, Given CW, Given B, Verbitsky N. Symptom experience in the last year of life among individuals with cancer. J Pain Symptom Manage. 2006; 32(5):403–12. [Internet]. Available from: <http://dx.doi.org/10.1016/j.jpainsymman.2006.05.023>. [PubMed: 17085266]
20. Hile ES, Fitzgerald GKK, Studenski SA. Persistent mobility disability after neurotoxic chemotherapy. Phys Ther. 2010; 90(11):1649–57. [Internet]. Available from: <http://ptjournal.apta.org/content/90/11/1649.long>. [PubMed: 20813818]
21. Overcash J, Beckstead J. Predicting falls in older patients using components of a comprehensive geriatric assessment. Clin J Oncol Nurs. 2008; 12(6):941–9. [Internet]. Available from: <https://cjon.ons.org/cjon/12/6/predicting-falls-older-patients-using-components-comprehensive-geriatric-assessment>. [PubMed: 19064388]
22. Vande Walle N, Kenis C, Heeren P, Puyvelde K Van, Decoster L, Beyer I, et al. Fall predictors in older cancer patients : a multicenter prospective study. 2014; 14(1):1–10. Available from: <http://bmgeriatr.biomedcentral.com/articles/10.1186/1471-2318-14-135>.
23. Gewandter JS, Fan L, Magnuson A, Mustian K, Peppone L, Heckler C, et al. Falls and functional impairments in cancer survivors with chemotherapy-induced peripheral neuropathy (CIPN): A University of Rochester CCOP study. Support Care Cancer. 2013; 21(7):2059–66. [Internet]. Available from: <http://link.springer.com/article/10.1007/s00520-013-1766-y>. [PubMed: 23446880]
24. Hewitt M, Rowland JH, Yancik R. Cancer survivors in the United States: age, health, and disability. J Geront A, Biol Sci Med Sci. 2003; 58(1):82–91.
25. Ward RE, Boudreau RM, Caserotti P, Harris TB, Zivkovic S, Goodpaster BH, et al. Sensory and Motor Peripheral Nerve Function and Incident Mobility Disability. J Am Geriatr Soc. 2014; 62(12):2273–2279. [Internet]. Available from: <http://doi.wiley.com/10.1111/jgs.13152>. [PubMed: 25482096]
26. Donovan HS, Hagan TL, Campbell GB, Boisen MM, Rosenblum LM, Edwards RP, et al. Nausea as a sentinel symptom for cytotoxic chemotherapy effects on the gut-brain axis among women receiving treatment for recurrent ovarian cancer: an exploratory analysis. Support Care Cancer. 2016; 24(6):2635–42. [Internet]. Available from: <http://link.springer.com/10.1007/s00520-015-3071-4>. [PubMed: 26746209]
27. Lefkowitz, C.; W Rabow, C.; Sherman, A.; K Kiet, T.; Ruskin, R.; Chan, JK., et al. Gynecol Oncol. Vol. 132. Elsevier Inc.; 2014. Predictors of high symptom burden in gynecologic oncology outpatients: Who should be referred to outpatient palliative care?; p. 698-702.[Internet]Available from: <http://dx.doi.org/10.1016/j.ygyno.2014.01.038>
28. Given B, Given CW, Sikorskii A, Jeon S, McCorkle R, Champion V, et al. Establishing Mild, Moderate, and Severe Scores for Cancer-Related Symptoms: How Consistent and Clinically Meaningful Are Interference-Based Severity Cut-Points? J Pain Symptom Manage. 2008; 35(2): 126–35. [Internet]. Available from: <http://dx.doi.org/10.1016/j.jpainsymman.2007.03.012>. [PubMed: 18158231]
29. Dodd MJ, Miaskowski C, Paul SM. Symptom clusters and their effect on the functional status of patients with cancer. Oncol Nurs Forum. 2001 Apr; 28(3):465–70. [cited 2014 Oct 1] [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/11338755>. [PubMed: 11338755]
30. Kim S, Egerter S, Cubbin C, Takahashi ER, Braveman P. Potential implications of missing income data in population-based surveys: an example from a postpartum survey in California. Public Health Rep. 2007; 122(6):753–63. [Internet]. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1997243&tool=pmcentrez&rendertype=abstract>. [PubMed: 18051668]
31. Kaplan, RM.; Howard, VJ.; Safford, MM.; Howard, G. Ann Epidemiol. Vol. 25. Elsevier Inc.; 2015. Educational attainment and longevity: Results from the REGARDS U.S. national cohort

study of blacks and whites; p. 323-8.[Internet]Available from: <http://dx.doi.org/10.1016/j.annepidem.2015.01.017>

32. Montez JK, Hayward MD. Cumulative Childhood Adversity, Educational Attainment, and Active Life Expectancy Among U.S. Adults. *Demography*. 2014; 51(2):413–35. [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4465758/pdf/nihms-695816.pdf>. [PubMed: 24281740]
33. Cliby WA, Powell MB, A-H N, Chen L, Miller JP, Roland PY, et al. Ovarian cancer in the United States: Contemporary patterns of care associated with improved survival. *Gynecol Oncol*. 2015; 136(1):11–7. [PubMed: 25449311]
34. Ferrell B, Cullinane CA, Ervine K, Melancon C, Uman GC, Juarez G. Perspectives on the impact of ovarian cancer: women's views of quality of life. *Oncol Nurs Forum*. 2005; 32(6):1143–9. [PubMed: 16270110]
35. Sykes LL, Walker RL, Ngwakongnwi E, Quan H. A systematic literature review of response rates across racial and ethnic populations. *Can J Public Heal*. 2010; 101(3):213–9. [Internet]. Available from: <http://journal.cpha.ca/index.php/cjph/article/viewFile/1927/2101>.
36. Wang XS, Shi Q, Dougherty PM, Eng C, Mendoza TR, Williams LA, et al. Prechemotherapy Touch Sensation Deficits Predict Oxaliplatin-Induced Neuropathy in Patients with Colorectal Cancer. *Oncology*. 2016; 90(3):127–35. [Internet]. Available from: <http://www.karger.com/?doi=10.1159/000443377>. [PubMed: 26882477]
37. Otake A, Yoshino K, Ueda Y, Sawada K, Mabuchi S, Kimura T, et al. Usefulness of duloxetine for Paclitaxel-induced peripheral neuropathy treatment in gynecological cancer patients. *Anticancer Res*. 2015 Jan; 35(1):359–63. [cited 2015 Apr 4] [Internet]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25550572>. [PubMed: 25550572]
38. Stevinson C, Steed H, Faught W, Tonkin K, Vallance JK, Ladha AB, et al. Physical activity in ovarian cancer survivors: Associations with fatigue, sleep, and psychosocial functioning. *Int J Gynecol Cancer*. 2009; 19(1):73–8. [PubMed: 19258945]

Highlights

1. Mobility disability (self-reported difficulty with walking) is endorsed by 59.7% of women with a history of ovarian cancer (OC).
2. Common cancer- and treatment-related symptoms including abdominal bloating, fatigue, lack of appetite, numbness and tingling, and pain are associated with mobility disability in this population.
3. Clinicians should assess for mobility disability among women with these key symptoms and refer to rehabilitation services if difficulty walking is endorsed.

Table 1

Description of the sample

	No mobility disability n = 250	1 mobility disability n = 375	Test Statistic	P value
Mean (std dev)			T	
Age (years)	52.7 (11.7)	53.7 (10.6)	-1.10	0.27
Months since diagnosis	64.7 (57.4)	51.5 (37.7)	3.48	<0.001
Months since chemo	40.3 (46.3)	24.3 (36.4)	4.55	<0.001
Median (inter quartile range)			Mann-Whitney Z value	
Number of recurrences	1 (1)	2 (2)	-6.0	0.001
n (%)			Pearson Chi-square	
Race				
Non-white	9 (3.6)	18 (4.8)	0.52	0.47
White	241 (96.4)	357 (95.2)		
Education				
High school or less *	38 (15.2)	53 (14.1)	6.83	0.009
Some college or college graduate	129 (51.6)	233 (62.1)		
Post graduate training	83 (32.5)	88 (23.5)		
# of comorbidities				
None *	164 (65.6)	184 (49.1)	7.15	0.007
One	53 (21.2)	99 (26.4)		
2 or more	33 (13.2)	92 (24.5)		
Months since chemotherapy				
Never had chemotherapy *	37 (14.8)	21 (5.6)	45.93	< .001
Currently receiving chemotherapy, or stopped < 1 month before survey	27 (10.8)	103 (27.5)		
1-5.99 months since chemotherapy	21 (8.4)	59 (15.7)		
6-11.99 months since chemotherapy	20 (8.0)	26 (6.9)		
More than 12 months since chemotherapy	145 (58.0)	166 (44.3)		
Number with active Ovarian Cancer	51 (20.4)	173 (46.1)	18.67	< 0.001

* Denotes referent group

Table 2
Hierarchical multivariate regression predicting level of mobility disability after adjusting for covariates

	B	95% CI	SE	β	p	R ²	p
<u>Block 1: Covariates</u>							
Age	-.024	-.460, -.001	.012	-.081	.040	0.159	< .001
One comorbidity	.881	.297, 1.466	.298	.117	.003		
More than one comorbidity	2.145	1.517, 2.772	.319	.265	<.001		
Active OC	1.825	.996, 2.655	.422	.271	<.001		
<u>Block 2: Symptoms</u>							
Age	-.008	-.027, .011	.010	-.028	.412	0.271	< .001
One comorbidity	.358	-.133, .848	.250	.047	.153		
More than one comorbidity	.904	.362, 1.446	.276	.112	.001		
Active OC	.745	.044, 1.446	.357	.111	.037		
Abdominal bloating	.117	0.34, .199	.042	.097	.006		
Fatigue	.348	.263, .433	.043	.314	< .001		
Lack of appetite	.096	.002, .190	.048	.072	.045		
Numbness/tingling	.134	.063, .206	.036	.127	< .001		
Pain	.194	.116, .272	.040	.181	< .001		

Key: B, unstandardized beta; CI, confidence interval; β , standardized beta; , change.

Symptoms not significantly bivariately correlated with Interference with Walking not included in the model: bowel disturbances, depression, dizziness, drowsiness, hair loss, headaches, hot flashes, memory problems, mood swings, nausea, sexuality concerns, shortness of breath, sleep disturbance, urinary problems.