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Running Head: HEALTH LITERACY AND PHYSICAL ACTIVITY

Health Literacy and Physical Activity in Women
Diagnosed with Breast Cancer

Leigh Plummer and Dr. Kerry Chalmers

School of Psychology, The University of Newcastle, NSW Australia

(3937 words)

Corresponding author:

Dr. Kerry Chalmers

The University of Newcastle

University Drive

Callaghan NSW 2308

AUSTRALIA

Phone: +61 2 4921 5757

Fax: +61 2 4921 6906

Email: Kerry.Chalmers@newcastle.edu.au

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Abstract

Objective

Physical activity after a diagnosis of breast cancer is associated with many health benefits. Health literacy has been shown to relate to physical activity, but there is limited research on this relationship. The aim of this study was to explore the relationship between health literacy and physical activity in women diagnosed with breast cancer. Specifically, we examined which of Nutbeam's three levels of health literacy (functional, interactive, and critical health literacy) predicted physical activity in women who have completed treatment for breast cancer.

Methods

Participants were women ($N = 36$) who had attended a local cancer care centre for breast cancer treatment. During a telephone interview conducted 6 to 18 months after completion of treatment, women completed a measure of health literacy and reported on their engagement in physical activity.

Results

Results showed that health literacy predicted physical activity after breast cancer treatment. Of the three levels of health literacy proposed by Nutbeam, functional health literacy was shown to be the most important predictor of physical activity.

Conclusions

These findings highlight the role of health literacy in physical activity in women diagnosed with breast cancer and have implications for targeted supportive physical activity interventions.

Keywords: breast cancer, health literacy, oncology, physical activity, recovery

Health Literacy and Physical Activity in Women Diagnosed with Breast Cancer

Background

Breast cancer is the most commonly diagnosed cancer in Australian women [1], with the number of new cases each year expected to continue to increase [2]. Earlier detection and better treatment regimes have led to an increase in the five-year survival rate for women from 72% in 1982, to 89% in 2011 [3]. Women who undergo treatment for breast cancer report many related concerns and side effects that can be quite debilitating. Some women may experience anxiety and depression [4]. Fatigue is a common complaint and can be experienced for many years after the completion of treatment [5], often co-occurring with depression, pain and sleep-disturbance [6]. Other reported concerns relate to a decrease in sexual interest, sexual functioning and body image [7].

Physical activity has been associated with better health outcomes for women diagnosed with breast cancer, including reduced risk of breast cancer recurrence [8], all-cause mortality [9-11] and breast cancer mortality [8,10]. Other benefits associated with physical activity for women diagnosed with breast cancer include improvement in fatigue levels [e.g., 12], physical functioning [13,14], functional quality of life [13], and quality of sleep [15]. Women who participate in physical activity after a diagnosis of breast cancer have also reported a decrease in depression, stress and anxiety [13,15,16], and improvements in body image [16,17].

Although there is no consensus for an optimal amount of physical activity after a diagnosis of breast cancer, Breast Cancer Network Australia [18] recommend gradually building up to 150 minutes of moderate exercise per week (min/week), where moderate

is defined as requiring effort to perform but still able to hold a conversation [19]. This level of physical activity is much the same as the lower level of the recommended guidelines for the general population, which is 150 to 300 moderate min/week for adults aged 18 to 64 years [20]. After a diagnosis of breast cancer, however, some women do not engage in a sufficient amount of physical activity, which could reduce their opportunity for health benefits.

Milne et al. [21] reported that only 13% of women were meeting the physical activity guidelines during treatment for breast cancer and 31% were meeting guidelines after treatment. Harrison et al. [22] assessed participation in physical activity at 6, 12 and 18 months post breast cancer diagnosis. They found that although more than 80% of women were engaged in physical activity at each of these stages, half of them did not meet physical activity guidelines.

Breast cancer survivors have been found to engage in significantly less physical activity than healthy controls (282.8 min/day vs. 346.9 min/day; including light, lifestyle, and moderate-vigorous intensity activities combined) and significantly more sedentary behavior (555.5 min/day vs. 500.6 min/day) [23]. Compared with healthy controls, breast cancer survivors were found to participate in more moderate-vigorous physical activity (21.6 min/day vs. 15.9 min/day), but these levels did not meet physical activity guidelines.

Health literacy has been defined by Nutbeam [24] as ‘...cognitive and social skills, which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.’ (p. 357). Nutbeam [25] proposed three sequential levels of health literacy that build upon one another: 1) *functional health literacy* is having sufficient basic reading and writing

skills; 2) *interactive health literacy* requires advanced cognitive, literacy and social skills in order to find, understand and apply health information; and 3) *critical health literacy* requires more advanced cognitive and social skills to be able to critically analyse and use more personal control in health-related situations.

Functional health literacy has been associated with physical activity in non-cancer studies. In older adults, low levels of health literacy were associated with physical inactivity [26] and higher levels of sedentary behaviour [27]. Inadequate health literacy has also been associated with poor compliance with physical activity guidelines in older adults [28]. In a community-based sample aged 15 years and older, those who engaged in sufficient levels of physical activity were more likely to have adequate health literacy [29].

A comprehensive review of the literature found no studies that have assessed the relationship between health literacy and physical activity in women diagnosed with breast cancer. The aim of the present research was therefore to examine the relationship between health literacy and physical activity in women who had completed treatment for breast cancer. Specifically, we examined Nutbeam's [25] three levels of health literacy (functional, interactive, and critical health literacy) in women diagnosed with breast cancer and the extent to which each of these levels of health literacy predict physical activity. We also examined women's participation in physical activity after the completion of treatment for breast cancer. Based on previous research showing a relationship between health literacy and physical activity in the general population [26-29], we predicted that health literacy would be associated with physical activity in women diagnosed with breast cancer.

Method

Participants

Thirty-six women diagnosed with breast cancer (stages I-V) (Mean age = 58 years, $SD = 9.11$, range: 39-69) were recruited from a regional, publicly funded, cancer care centre. Women were invited to participate if they were between 18 and 69 years of age and had completed treatment (no longer receiving active treatment) between 6 and 18 months prior to taking part in the study. Women who were receiving hormonal therapy were included in the study. All women who met the eligibility criteria ($N = 127$) were invited to participate via an information pack, which consisted of an information statement describing the research and a consent form. A total of 41 women expressed interest in participating (32%). Of the five women who were not included in the final sample, two could not be contacted, one was outside the 6-18 month post treatment criterion, one withdrew from the study as she was unable to find time to complete the interview and one reported physical activity data that was more than four standard deviations from the sample mean. Women were offered a \$AUD10 voucher for participating in the research.

Measures

Health literacy was assessed using the Health Literacy Questionnaire (HLQ) [30], a self-report measure that provides a multi-dimensional assessment of health literacy needs and abilities. The HLQ consists of 44 items from which nine scales are constructed. The HLQ scales have strong to very strong psychometric properties [30], including good construct validity and reliability [31].

According to Osborne *et al.* [30], Nutbeam's three levels of health literacy are linked to the nine HLQ scales as follows: 1) *functional health literacy* is linked to

‘understanding health information well enough to know what to do’, ‘having sufficient information to manage health’ and ‘finding health information’; 2) *interactive health literacy* is linked to ‘feeling understood and supported by healthcare providers’, ‘actively manage health’, ‘social support for health’, ‘engage with healthcare providers’, ‘navigating the healthcare system’, and ‘finding health information’; and 3) *critical health literacy* is linked to ‘critical appraisal of health information’, ‘actively manage health’ and ‘social support for health’.

Physical activity was assessed using questions from the Active Australia Survey (AAS), which has good reliability, face validity, criterion validity and acceptability [32]. Participants are asked to report on their physical activity for a 7-day period in each of the following categories: *moderate intense physical activity* (e.g., gentle swimming); *vigorous intense physical activity* (e.g., jogging); and *walking* for at least 10 minutes, for recreation, exercise or to get to and from places (categorised as moderate activity). The ‘Compendium of Physical Activities’ [33], which equates the physical activity type to an associated Metabolic Equivalent Task (MET) value (e.g., high impact aerobics = 7.3 METs), was used to classify moderate and vigorous activities reported by participants.

Procedure

Recruitment took place between January 2014 and October 2015, with participants having completed active treatment between July 2013 and April 2015. The same assessor conducted a single telephone interview with each participant between 6 and 18 months after completion of breast cancer treatment. During the interview, participants provided demographic information, completed the HLQ, and reported on their participation in physical activity for each of the previous 7 days.

Ethics approval was obtained from the Central Coast Local Health District (CCLHD) Research Office and the University of Newcastle, Australia, Human Research Ethics Committee. In order to maintain the privacy of hospital patient records, a CCLHD employee was required to undertake the recruitment process.

Data manipulation and analysis

Statistical analysis was performed using SPSS V.22. [34]. For physical activity, minutes engaged in walking, moderate and vigorous activities were summed over each day of the 7-day period of reporting. Total weekly physical activity was calculated by weighting vigorous activity minutes by two to convert them to moderate minutes (e.g., 30 vigorous min = 60 moderate min) and summing over the three categories (walking, moderate, and vigorous) of activity. The total physical activity minutes were then used as the dependent variable for the analyses.

Scores on the HLQ were used to create a score for each of Nutbeam's three levels of health literacy (functional, interactive, and critical health literacy). This was achieved by firstly converting the raw scores of the nine HLQ scales to *z*-scores. The *z*-scores for the relevant HLQ scales were then averaged to create a single score for each of Nutbeam's levels.

Pearson's correlations were used to assess the relationship between physical activity and functional, interactive, and critical health literacy. Stepwise regression was used to determine the relative importance of the health literacy levels in predicting physical activity.

Results

A summary of basic demographic characteristics of the sample and type of treatment completed is presented in Table 1. All participants completed more than one

treatment (15 completed all four treatments, 18 completed three, and 3 completed two). Preliminary analysis showed there were no associations between the demographic variables and either health literacy scores or level of physical activity.

The mean total level of moderate physical activity over the 7-day period prior to interview reported by participants was 220 min/week ($SD = 160$, $range = 0-610$ moderate min/week). This included walking ($M = 120$, $SD = 101$), moderate activity ($M = 65$, $SD = 108$) and vigorous activity ($M = 17$, $SD = 37$, which converts to 35 moderate minutes with rounding). The majority of participants (58%) met the national guidelines of a minimum of 150 moderate min/week, 36% were physically active but did not meet the guidelines, and 6% were inactive/sedentary.

Health literacy scores for each of the nine scales of the HLQ are presented in Table 2. Pearson correlations between each health literacy scale and physical activity are also shown. There were moderately strong positive correlations between physical activity and ‘actively manage health’, ‘understanding health information well enough to know what to do’, ‘having sufficient information to manage health’, ‘feeling understood and supported by healthcare providers’ and ‘navigating the healthcare system’. Higher levels of health literacy were associated with higher levels of physical activity. Scores for Nutbeam’s three levels of health literacy were also associated with physical activity. Moderate positive correlations were found between physical activity and ‘functional health literacy’ ($r = .474$, $p < .01$) and ‘interactive health literacy’ ($r = .443$, $p < .01$). A weak but significant positive correlation between physical activity and ‘critical health literacy’ was also found ($r = .358$, $p < .05$). Higher levels of functional, interactive and critical health literacy were associated with higher levels of physical activity.

Stepwise regression analysis was used to determine the relative contribution of

each of Nutbeam's three levels of health literacy to the prediction of physical activity after completion of treatment for breast cancer. The results are presented in Table 3. Both interactive and critical health literacy were excluded from the model, leaving functional health literacy as the only significant predictor, explaining 22% of the variance in physical activity.

Further analysis was conducted to examine which of the three HLQ scales corresponding to functional health literacy predict physical activity after the completion of treatment for breast cancer. Stepwise regression with 'understanding health information well enough to know what to do', 'having sufficient information to manage health' and 'finding health information' as predictors and physical activity as the criterion revealed that 'understanding health information well enough to know what to do' and 'finding health information' were excluded from the final model, with 'having sufficient information to manage health' explaining 26% of the variance in physical activity (see Table 3).

Discussion

The aim of the present study was to examine health literacy and physical activity in women who had completed treatment for breast cancer. It is the first study of which we are aware to report on the relationship between health literacy and physical activity in women after the completion of treatment for breast cancer.

Physical activity after the completion of treatment

Women in this study reported participating in an average of 220 moderate min/week of physical activity after the completion of treatment. The average level of physical activity in Australian women aged 18 and over is 207 minutes of physical

activity a week [35]. When averaged over the age categories closest to the ages of women in the present study (35-74), the Australian average is 225 min/week, which is just 5 minutes more than in the current sample. The proportion of Australian women aged 18 and over meeting the national guidelines is 41.5% [35]. A higher proportion of women in the sample from this study (58%) were meeting the national physical activity guidelines. This differs from previous research showing that breast cancer survivors participate in significantly less physical activity than healthy controls [23]. These differences may be due to the measurement and categorisation of physical activity expenditure. *Phillips et al.* [23] assessed physical activity with an objective measure (accelerometer) and categorised energy expenditure into light, moderate-vigorous and lifestyle activities. The present study captured subjective reports of physical activity categorised as moderate or vigorous activity, as well as walking at a moderate level of energy expenditure. Lower levels of energy expenditure (light) and lifestyle activities were not assessed.

Relationship between health literacy and physical activity after treatment for breast cancer

We examined the associations between Nutbeam's functional, interactive and critical health literacy and physical activity. Each of the three health literacy levels was related to physical activity after breast cancer treatment. When assessing the relative contribution of the three levels of health literacy to the prediction of physical activity, interactive and critical health literacy were excluded from the model, leaving functional health literacy as the only significant predictor of physical activity after treatment. Previous studies in the general population have also found a positive association between physical activity and basic health literacy abilities, such as reading and

understanding information [26-29]. The present findings suggest this association is also important in women who have been diagnosed with breast cancer.

Further analysis of functional health literacy using stepwise regression showed that ‘having sufficient information’ was the only HLQ scale that significantly predicted physical activity in the final model. These findings indicate that for women in this study, a sufficient level of knowledge to make decisions and manage one’s condition is related to participation in physical activity after breast cancer treatment. Women who feel they do not have a sufficient amount of health information may struggle to implement self-care strategies, such as physical activity.

Clinical implications

The present results show that health literacy is a significant predictor of physical activity in women diagnosed with breast cancer. Of the three levels of health literacy proposed by Nutbeam [25], functional health literacy appears to be the most important component in this relationship. This finding has implications for healthcare providers. Administration of the HLQ scales corresponding to functional health literacy could be useful in screening individuals who may benefit from provision of resources to assist in finding, understanding and having sufficient information to manage health. At the most basic level, simply asking patients if they are confident they have sufficient quality health information in order to manage their health and health problems, may assist the practitioner in identifying patients who require additional support. Women who are identified as not having sufficient information to manage their health may be less likely to engage in self-care behaviours such as physical activity. These women can be directed to resources that are sensitive to their health literacy needs.

For healthcare providers supporting women diagnosed with breast cancer to participate in physical activity, the manner in which health information is communicated needs to be considered. The Centre for Disease Control (CDC) advocates for health professionals to use ‘plain language’ to help patients understand and use health information [36]. Krug [37] suggests a number of methods to communicate with people after a diagnosis of cancer, including providing visuals, repeating the intended message, using concise information with fewer key points and using teach-back methods to review the patient’s understanding. These strategies may assist patients in the implementation of self-care strategies, such as physical activity.

Limitations and future directions

The results of this study are based on a relatively small sample, primarily due to participants being sourced from one regional cancer treatment centre. Difficulties in recruiting young adult cancer survivors have been reported [38]. Even the most successful methods of recruitment, mail-out and approaching in-person at an oncology clinic, resulted in only 1% and 8%, respectively, of cancer survivors enrolling in their study [38]. In the current study we identified 127 potential participants and achieved a response rate of 32%. While one-on-one recruitment has been found to be a preferred method of recruitment in previous research, this was not an option in the present study, due to ethical considerations.

The results of the present study are encouraging in terms of identifying the relationship between health literacy and physical activity in women diagnosed with breast cancer. A large-scale multi-site study is now required to establish the

generalisability of the present results to the wider population of women diagnosed with breast cancer.

This study did not include a control group to compare physical activity levels in women with and without breast cancer. While we were interested in the level of participation in physical activity in women after the completion of treatment for breast cancer, the main aim of the study was to examine the association between health literacy and physical activity in women diagnosed with breast cancer. As noted above, the existence of published Australian norms allowed us to compare the present sample with the established norms and show that the average level of physical activity of women in this study after the completion of treatment is very similar to the average physical activity levels of women in the general population.

This study used self-report measures to assess health literacy and participation in physical activity. While it is acknowledged that self-report measures may be less precise than objective measures, self-report measures are flexible in what they can evaluate and may be less taxing on the participant. The AAS measures physical activity participation for the 'previous week'. This indicates a limitation as other factors may influence physical activity reported for a 'previous week' as opposed to a 'typical week'. Future research could establish whether physical activity recorded by an objective measure has a similar relationship with health literacy as that found here. Similarly, objective and self-report methods of assessing health literacy could be used in a future research to examine whether the relationship between physical activity and health literacy is the same regardless of method of assessment.

Conclusion

The results of this study show that health literacy is related to the level of physical activity in women after the completion of treatment for breast cancer. Women who reported higher levels of functional health literacy also reported higher levels of physical activity. These findings highlight the importance of ensuring women diagnosed with breast cancer are provided with, and are able to understand information concerning engagement with physical activity after a diagnosis of breast cancer. As the CDC guidelines advocate, health professionals can help by providing information, both verbal and written, to patients in 'plain-language'. Health professionals who identify patients that are not engaging in physical activity may recommend they attend an educational intervention that is sensitive to the health literacy needs and abilities of patients. Ultimately, supporting women to engage in physical activity after a diagnosis of breast cancer may increase the likelihood of them achieving benefits to their health.

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Table 1.

Participant Characteristics

	<i>n (%)</i>
Breast Cancer Treatment	
Surgery	35 (97)
Radiotherapy	34 (94)
Chemotherapy	24 (67)
Hormonal treatment	27 (75)
Education (highest level)	
Diploma or degree	15 (42)
High school	11 (31)
TAFE/equivalent	9 (25)
Attended high school (not completed)	1 (3)
Employment Status	
Casual/part-time	12 (33)
Full-time	9 (25)
Not working	4 (11)
Retired	10 (28)
Student	1 (3)
Country of Birth	
Australia	29 (81)
Other	7 (19)
Relationship Status	
Married/in relationship	19 (53)
Single/separated/divorced	17 (47)

Table 2.

Mean Score (and Standard Deviation) for each Health Literacy Scale and its Correlation with Physical Activity

Health Literacy Scale	Mean (<i>SD</i>)	Pearson <i>r</i>
Feeling understood and supported by healthcare providers	3.38 (.53)	.441**
Having sufficient information to manage health	3.22 (.51)	.528**
Actively manage health	3.27 (.49)	.478**
Social support for health	3.43 (.47)	.180
Critical appraisal of health information	3.06 (.50)	.146
Engage with healthcare providers	4.08 (.68)	.241
Navigating the healthcare system	4.00 (.54)	.413*
Finding health information	3.99 (.58)	.287
Understanding health information well enough to know what to do	4.24 (.49)	.451**

* $p < .05$. ** $p < .01$.

Table 3.

Stepwise Regression Results for Health Literacy as a Predictor of Physical Activity

	R^2	$Adjusted-R^2$	df	F	B	p	95% CI
Nutbeam's Health Literacy Level							
Functional	.22	.20	1,34	9.84*	88	.004	31, 146
Interactive					<i>excluded</i>	.468	
Critical					<i>excluded</i>	.681	
Health Literacy Scale							
Having sufficient information	.26	.24	1,34	11.93*	82	.001	34, 130
Understanding health information					<i>excluded</i>	.161	
Finding health information					<i>excluded</i>	.827	

Note. df , degrees of freedom. B , unstandardised coefficient. CI, confidence interval.

* $p < .01$.