

Quality and accuracy of publicly accessible cancer-related physical activity information on the Internet: a cross-sectional assessment

R.D. Buote MSc (candidate) Graduate Student¹ | S.D. Malone MSc (candidate) Graduate Student¹ | L.J. Bélanger PhD, CSEP-CEP Honorary Research Associate, Founder^{2,3} | E.L. McGowan PhD Assistant Professor¹

¹School of Human Kinetics and Recreation, Memorial University of Newfoundland, St. John's, NL, Canada

²College of Engineering, Swansea University, Singleton Park, Swansea, UK

³Knight's Cabin Cancer Retreats, Canmore, AB, Canada

Correspondence

Erin L. McGowan, School of Human Kinetics and Recreation, Memorial University of Newfoundland, St. John's, NL, Canada.
Email: emcgowan@mun.ca

In this study, we assessed the quality of publicly available cancer-related physical activity (PA) information appearing on reputable sites from Canada and other English-speaking countries. A cross-sectional Internet search was conducted on select countries (Canada, USA, Australia, New Zealand, UK) using Google to generate top 50 results per country for the keywords “‘physical activity’ AND ‘cancer’”. Top results were assessed for quality of PA information based on a coding frame. Additional searches were performed for Canadian-based sites to produce an exhaustive list. Results found that many sites offered cancer-related PA information (94.5%), but rarely defined PA (25.2%). Top 50 results from each country did not differ on any indicator examined. The exhaustive list of Canadian sites found that many sites gave information about PA for survivorship (78.3%) and prevention (70.0%), but rarely defined (6.7%) or referenced PA guidelines (28.3%). Cancer-related PA information is plentiful on the Internet but the quality needs improvement. Sites should do more than mention PA; they should provide definitions, examples and guidelines. With improvements, these websites would enable healthcare providers to effectively educate their patients about PA, and serve as a valuable resource to the general public who may be seeking cancer-related PA information.

KEYWORDS

cancer, evaluation, exercise, Internet, physical activity, quality

1 | INTRODUCTION

The Internet has become an invaluable resource, and represents an increasingly important way to seek health information (Bennett & Glasgow, 2009). Seeking information regarding health conditions is one of the most researched topics on the Internet (McMullan, 2006). A recent report of the Canadian population identified that in 2009, 69.9% of individuals used the Internet to obtain medical or health-related information (Statistics Canada, 2010). Similarly, an increasing number of Europeans are using the Internet to seek information about health and

illness (Kummervold & Wynn, 2012). Although the public is consulting the Internet for health information, little is available on the quality of the information being offered. In fact, the quality of health information on the Internet has been questioned (Eysenbach, Powell, Kuss, & Sa, 2002), and studies have found that online health information can be limited, and of poor quality (Athanasopoulou et al., 2013; Hajjar, Gable, Jenkinson, Kane, & Riley, 2005; Hendrick et al., 2012). This may reflect the fact that a considerable amount of information available on the Internet is unedited, unfiltered and health-related content can be authored by anyone, regardless of credentials (Silberg, Lundberg, & Musacchio, 1997).

The search term “cancer” is used on average 18,100 times in Canada, and 450,000 globally each month (Google, 2014). This high frequency is not surprising, since in 2012, there were over 14.1 million new cancer diagnoses around the world (World Cancer Research Fund International, 2014), and over 191,000 new diagnosed cases in Canada yearly (CCSACCS, 2014). Therefore, understanding what cancer information is available, and its quality, is essential. In a study on the quality of breast cancer-related information available on the Internet, Quinn et al. (2012) found that the quality of information available online was quite variable. When searching for breast cancer information, only 42% of the webpages returned through a Google search engine contained applicable information. Accuracy of the information presented in webpages ranged from 20% to 100% with more accurate information coming from governmental, educational and charity sites. Similarly, Chan et al. (2012) assessed the quality of gastrointestinal cancer information online. When reviewing the top 30 results from three search engines, they found that only 12% of the sites reviewed received “excellent” scores with the highest scores coming from charity sites. These results suggest that accurate information is available, but it is dependent on the sites explored, and the ability to “judge” the quality of information presented is essential. Furthermore, Quinn et al. (2012) suggested that patients lack the knowledge and ability to evaluate the information they find on the Internet, and even when they do have the skills to do so, they may not apply them (Eysenbach & Kohler, 2003).

Physical activity (PA) has been consistently found to prevent multiple cancer types, such as colon, breast, endometrial and lung (e.g. Gonçalves et al., 2014; Winzer, Whiteman, Reeves, & Paratz, 2011; Wolin, Yan, Colditz, & Lee, 2009), may reduce symptoms and improve quality of life for those undergoing cancer treatment (e.g. Courneya et al., 2013; Mishra et al., 2015; van Waart et al., 2015) and improve supportive care outcomes among cancer survivors (e.g. Ballard-Barbash et al., 2012; Fong et al., 2012; Rock et al., 2012; Speck, Courneya, Mâsse, Duval, & Schmitz, 2010). These findings are backed by a significant amount of evidence, yet they are rarely disseminated to the general population. Wilder Smith et al. (2011) found that less than half (48.7%) of the primary care physicians reported providing specific guidance for PA, although over 94% reported asking patients about their PA behaviours. Among cancer survivors, this information is rarely communicated. This is unfortunate, considering a cancer diagnosis offers a “teachable moment” where cancer survivors are highly motivated to make healthy lifestyle changes (Humpel, Magee, & Jones, 2007). Jones and Courneya (2002) found that only 42.3% of cancer survivors had discussed PA with their oncologist, although 97.4% felt that exercise should be discussed during treatment consultation.

Despite the established benefits of PA for cancer prevention and survivorship, participation rates are low. Globally, it is estimated that 31% of adults are inactive (Hallal et al., 2012). Typically PA is lower in wealthier countries (World Health Organization [WHO], 2015) due to increased urbanisation in these countries leading to less active transportation (e.g. biking, walking) and/or lower air quality. For example, only 52.5% of Canadians (Colley et al., 2011) and 33.9% of people from England (Townsend et al., 2012) reported meeting recommended

guidelines for PA. Additionally, those who currently have cancer or have had cancer in the past are less likely to be sufficiently active when compared to those who have never had cancer. Results from a recent community health survey in Canada found that only 17.8% of those with cancer and 22.6% of those with a past cancer diagnosis were classified as “active” ($>3.0 \text{ kcal kg}^{-1} \text{ day}^{-1}$) compared to 27.8% of those who had no history of cancer (Neil, Gotay, & Campbell, 2014). Cancer treatment can have lasting side effects including reduced bone density, loss of muscle mass and increased body fat (Rock et al., 2012). Considering PA has been found to be successful at offsetting these side effects, it is especially important for this population to be active. Cancer survivors should be taking part in regular PA, including resistance training, to achieve the greatest improvements (Rock et al., 2012). Therefore, it is essential that survivors be made aware of this information, and since oncologists typically do not inform patients of the benefits of PA (Jones & Courneya, 2002), an online avenue to provide PA information may be one feasible option. However, it is important to ensure PA information on the Internet is accurate, and includes details about the benefits and risks associated with PA for cancer survivors. Cancer-specific sites should, therefore, offer PA information for cancer prevention, as well as for cancer survivors to improve quality of life and survivorship.

Considering patients are not always receiving PA direction from their physicians, they may seek out information elsewhere. From a recent study among cancer patients in the United States (USA), it was found that over 63% of cancer patients used the Internet to seek out cancer-related information (Castleton et al., 2010). The most common reasons for their Internet searches were to develop questions to ask physicians (52.1%), verify information received (39.4%) or to explore alternative treatment options (27.6%). Those seeking information most often utilised a search engine to obtain this information (71.1%) as opposed to a specific site (13.3%) (Castleton et al., 2010). Since cancer patients are seeking cancer-related information on the Internet, it seems like a missed opportunity to promote healthy behaviours, such as PA. Therefore, the purpose of this study was to determine the quality, accuracy and extent of cancer-related PA information available on the Internet. Specifically, this study evaluated the: (1) top search results in a selection of English-speaking countries (i.e. Canada, USA, United Kingdom [UK], Australia and New Zealand [NZ]), and (2) reputable Canadian websites (e.g. charities, cancer centres, universities and other organisations), which present cancer-related PA information (e.g. Public Health Agency of Canada, Canadian Cancer Society).

2 | METHODS

To evaluate the information available from the top 50 Google results on PA and cancer in a selection of English-speaking countries (i.e. Canada, Australia, USA, UK and NZ), all searches began at the country's Google search base to determine the sites most accessible for people searching in these countries (e.g. Australian Google search engine—www.google.au). The keywords “physical activity” AND cancer’ were entered into the search bar, and the

first 50 results were taken for evaluation; however, only the reputable sites were evaluated. Screenshots of the top 50 sites were taken at this time, as the top results can vary depending on time of the search. The first 50 websites were then evaluated using a coding frame containing 20 items (e.g., PA defined) that allowed us to consistently evaluate the quality of the PA information presented. The coding frame was developed based on: (1) previous research which evaluated health-related information available on the Internet (Athanasopoulou et al., 2013; Shahar, Shirley, & Noah, 2013; Stinson et al., 2011); (2) the authors' expertise in the field of PA and cancer and (3) what content would be necessary to provide individuals who were seeking cancer-related PA information (e.g. reference to PA guidelines).

The details of the coding framework are outlined in Table 1. From the developed coding framework, a score of 5 was assigned using the following categories: PA defined, reference to PA guidelines, PA information for cancer prevention, PA information for cancer survivors and providing references to published research. These coding items assessed were determined to be the most important for those seeking cancer-related PA information, and were the best indicators of a high quality and accurate site. If a site was coded as "Yes" for defining PA and referencing PA guidelines that would indicate the site accurately defined PA ("any bodily movement produced by skeletal muscles that requires energy expenditure" [WHO, 2015]), and appropriately referenced the guidelines (150-min of moderate-to-vigorous PA weekly). However, this exact definition of PA was not required. Additionally, although "physical activity" was used as the primary search term, when coding websites, reviewers allowed for additional terms (e.g. exercise, strength training and sport). Sites that receive a score closer to 5 provided higher quality and more accurate PA and cancer information on their website. Website evaluations were performed by two graduate students (R.B. and S.M.), whose research focus is PA and cancer. Interrater reliability was tested using Kappa scores and reviewers were found to have an agreement of, at minimum, $\kappa = .8$ on all coding items from a subset of 20 sites.

Websites that were links to articles, blogs, magazines or news websites were excluded, as well as non-credible sources such as Wikipedia. These websites are not considered reputable or reliable because they could have been authored by anyone, regardless of credentials, and may not be subject to review by an expert in the field (Adams, 2010). The flow of the study procedure is outlined in Figure 1. Ethical standards of the American Psychological Association were followed in the conduct of this study.

The evaluation of reputable (e.g. charities, cancer centres, government, etc.) Canadian sites presenting PA and cancer information was completed in two phases in order to compile a thorough and exhaustive search. The first phase involved conducting a Google search from the Canadian site (www.google.ca) using the keywords "physical activity" AND cancer" and to subsequently evaluate the relevant websites generated. Following this, a more inclusive search was done on Canadian websites in order to find reliable pages offering information on the link between PA and cancer. The purpose of this secondary search was to emulate a patient search using some other keywords such as

"exercise" and "prevention" and to determine if this would generate relevant reputable sites. Examples of some other search terms used to produce different results were: "exercise + cancer", "physical activity + cancer prevention" and "exercise + cancer prevention." The criteria for inclusion on the Canadian list were: (1) the website must contain some information on the link between PA and cancer, (2) reputable and (3) the website must be Canadian-based.

The second phase of the Canadian cancer websites portion was carried out using the Canada Revenue Agency website. This website provided a detailed list of all the registered Canadian cancer charities and non-profit organisations. Coders examined the list and removed any charities that no longer exist, and charities that did not provide PA information. Upon completing these steps, reputable sites were coded based on the same 20-item coding frame as mentioned previously.

2.1 | Statistical analyses

All statistical analyses were performed using SPSS for Windows (version 21.0). Percentages and frequencies were calculated for the website characteristics of interest (i.e. PA and cancer-related information). Chi-squared analyses or ANOVAs were conducted to assess differences in website characteristics.

Readability was calculated using the Flesch-Kincaid readability statistics (Kincaid, Fishburne, Rogers, & Chissom, 1975), where reading grade and ease is calculated using formulas involving number of words per sentence and average number of syllables per word. Sentences with more words or containing words with a greater number of syllables will have a higher reading grade. For this review, blocks of text were taken from each site reviewed and copied into Microsoft Word to calculate reading ease and grade.

3 | RESULTS

3.1 | Top 50 search engine result characteristics

Descriptive statistics for the website characteristics of the top 50 search engine results are presented in Table 2. In total, 35 unique sites were analysed with more than half (57.1%) appearing in the top 50 results on three or more different countries' search results. A charity or a non-profit group authored 62.9% of the websites reviewed. American search results yielded the greatest number of reputable sites in their top 50 results with 56% reviewed, while Australia and the UK had the lowest percentage of reviewable sites at 36.0% (USA $N = 28$, NZ $N = 24$, Canada $N = 23$, UK $N = 18$, Australia $N = 18$). Among the items from the coding frame, the most common topics covered by these sites included information about energy balance (97.1%), PA (94.3%) and PA information for cancer prevention (93.7%). Sites received an average score of 3.53; with the Top 50 Canadian sites receiving the highest score overall (3.65), although this difference was not statistically significant. More sites referenced the effects of PA for cancer prevention (91.4%) than PA for cancer survivors (80.0%).

TABLE 1 Coding frame for cancer-related physical activity information website analysis

Coded items
Website name
Website address
Date accessed
Website type (1) Government/hospitals (2) Charity/non-profit, etc. (3) Other
Country (1) Canada (2) United States (3) United Kingdom (4) Australia (5) New Zealand (6) Other
PA/exercise and cancer information Yes = 1 No = 2
Information on PA/exercise and cancer guidelines Yes = 1 No = 2
Links to PA/exercise resources Yes = 1 No = 2
PA/exercise defined Yes = 1 No = 2
Relationship between PA/exercise and cancer discussed (cancer prevention) Yes = 1 No = 2 Only hyperlinks = 3
Relationship between PA/exercise and cancer survivorship discussed Yes = 1 No = 2 Only hyperlinks = 3
Direct reference to research studies Yes = 1 No = 2
Additional resources provided Yes = 1 No = 2
Weight/energy balance discussed Yes = 1 No = 2
Fundraisers advertised related to PA/exercise (e.g., runs, walks, bike rides) Yes = 1 No = 2
Cancer types All cancer = 1 Breast cancer = 2 Colon cancer = 3 Prostate = 4 Endometrial = 5 Lung = 6

(Continues)

TABLE 1 (Continued)

Coded items
Pancreatic = 7 Rectum = 8 Kidney = 9 esophagus = 10 Ovarian = 11 Testicular = 12 Cervical = 13 Skin = 14 Stomach = 15 Thyroid = 16 Brain = 17 Blood = 18 Gallbladder = 19 Head and neck = 20 Gynaecological = 21
PA/exercise classes or programmes for cancer survivors offered Yes = 1 No = 2
PA/exercise mentioned for paediatric cancer or survivors of paediatric cancers Yes = 1 No = 2
Representative text examples/quotes
International component Yes = 1 No = 2

PA, physical activity.

Information on PA and cancer prevention appeared on 100.0% of Australian sites. Although many referenced PA and cancer, only 22.2% of sites defined PA, which had the greatest impact on the score websites from each country received.

Twenty-three of the 35 sites reviewed (65.7%) gave information about three or more types of cancer, with the Australian results having the greatest proportion at 88.9%. Information on PA and specific cancer type results are shown in Table 3. Breast cancer was the most common cancer type mentioned with 77.1% of sites offering breast cancer-specific information, followed by colon cancer appearing in 71.4% of sites. Colon cancer information appeared in 100.0% of Australian search results. Prostate and lung cancer appeared in 28.6% and 25.7% of sites, respectively. Results are influenced by the large number of sites repeated in each country's results, and show the sites appearing more often are more likely to contain information for more than one cancer type (90.0% vs. 33.3%; $p < .01$). Sites that appeared on three or more countries' results were more likely to reference PA guidelines (80.0% vs. 60.0%; $p = .195$), define PA (30.0% vs. 6.7%; $p = .088$) and reference research studies (85.0% vs. 66.7%; $p = .201$), although none of these differences were found to be significant.

These sites were quite readable on average with about a grade 7 reading level and reading ease score of 54.82. Sites appearing in UK search results were the most readable (56.21 reading ease; 7.09 grade level) on both measures but this difference was not significant.

Website Analysis Procedures

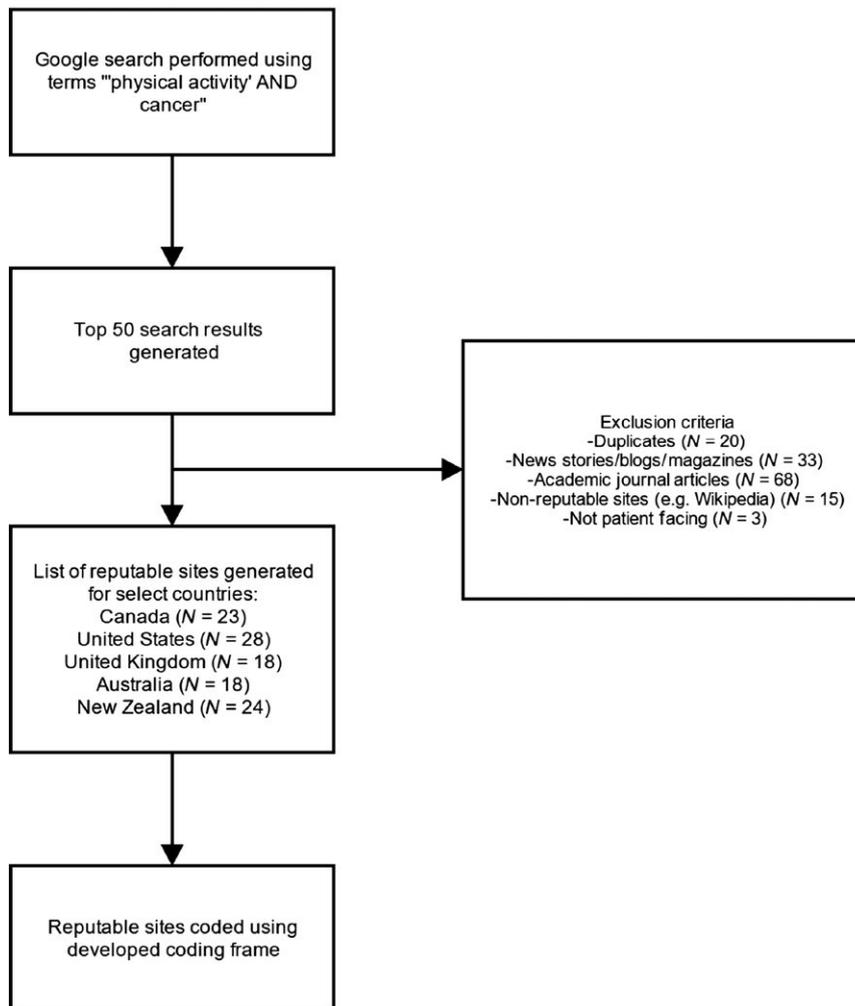


FIGURE 1 Flow chart reflecting study design

3.2 | Canadian cancer information website characteristics

Of the 294 registered Canadian cancer charities and non-profit organisations found on the Canada Revenue Agency website, 234 were excluded, as they either no longer existed or did not contain PA information. Sixty Canadian websites were reviewed for cancer and PA information. Descriptive statistics for the website characteristics of the Canadian cancer websites are presented in Table 2. The most common topics from the coding frame discussed on these sites were: (1) information about PA for cancer survivors (78.3%), (2) energy balance (76.7%) and (3) information about PA and cancer prevention (70.0%). Although 58 of the 60 sites reviewed contained some information about PA and cancer, these sites had an average score of 2.22. This score was due to the fact that only four (7.0%) of these sites defined PA, and only 17 (29.3%) referenced PA guidelines, which provide recommendations about the amount, intensity and duration of PA required to attain health benefits. In addition, less than half of the sites

referenced research studies when providing PA information. Over half of the sites referenced a PA-related fundraiser (e.g. walk/run for cure), unsurprisingly; charity sites (80.5%) were far significantly more likely to do so than government/hospital sites (31.8%) ($\chi^2[2, N = 60] = 16.62, p < .001$). Government/hospital sites were slightly more likely than charity sites to have information about PA classes (40.9% vs. 33.3%, $p = .17$). Only 15% of sites offered specific PA information about more than one type of cancer. The most common cancer-specific PA information was provided for breast cancer (43.3%), followed by colon (15.0%), prostate (13.3%) and lung (3.3%) cancer. On average, the sites reviewed were highly readable, with an average reading ease of 55.3, around a grade 7 reading level. Canadian charity/non-profit sites were slightly more readable on both measures compared to government/hospital sites (53.5 vs. 56.37 reading ease; 7.18 vs. 7.87 reading level) but this difference was not significant. A complete list of websites and dates accessed for this study can be found in Table 4. Websites in this table are compiled from both phases of this study.

TABLE 2 Site characteristics of top 50 search engine results for respective country

Characteristic of site	Sites N (%)					
	Canada (N = 23)	United Kingdom (N = 18)	USA (N = 28)	Australia (N = 18)	New Zealand (N = 24)	Exhaustive Canadian search (N = 60)
Country of search engine						
Website type						
Government/hospital	9 (39.1)	4 (22.2)	9 (32.1)	5 (27.8)	10 (41.7)	22 (36.7)
Charity/non-profit	13 (56.5)	13 (72.2)	18 (64.3)	12 (66.7)	13 (54.2)	36 (60.0)
Other	1 (4.3)	1 (5.6)	1 (3.6)	1 (5.6)	1 (4.2)	2 (3.3)
Does the site contain information about cancer and PA?						
Yes	22 (95.7)	17 (94.4)	26 (92.9)	18 (100.0)	22 (91.7)	58 (96.7)
No	1 (4.3)	1 (5.6)	2 (7.1)	0 (0.0)	2 (8.3)	2 (3.3)
Does the site refer to PA guidelines?						
Yes	17 (73.9)	13 (72.2)	21 (75.0)	14 (77.8)	18 (75.0)	17 (28.3)
No	6 (26.1)	5 (27.8)	7 (25.0)	4 (22.2)	6 (25.0)	43 (71.7)
Does the site only link externally for PA information/resources?						
Yes	1 (4.3)	1 (5.6)	2 (7.1)	0 (0.0)	2 (8.3)	5 (8.3)
No	22 (95.7)	17 (94.4)	26 (92.9)	18 (100.0)	22 (91.7)	55 (91.7)
Does the site define PA?						
Yes	7 (30.4)	4 (22.2)	6 (21.4)	4 (22.2)	7 (29.2)	4 (6.7)
No	16 (69.6)	14 (77.8)	22 (78.6)	14 (77.8)	17 (70.8)	56 (93.3)
Did the site give information about PA and cancer prevention?						
Yes	22 (95.7)	17 (94.4)	25 (89.3)	18 (100.0)	22 (91.7)	42 (70.0)
No	1 (4.3)	1 (5.6)	3 (10.7)	0 (0.0)	2 (8.3)	18 (30.0)
Did the site give information about PA for cancer survivors?						
Yes	19 (82.6)	14 (77.8)	23 (82.1)	14 (77.8)	18 (75.0)	47 (78.3)
No	4 (17.4)	4 (22.2)	5 (17.9)	4 (22.2)	6 (25.0)	13 (21.7)
Did the site have references to research studies when referring to PA?						
Yes	19 (82.6)	13 (72.2)	22 (78.6)	15 (83.3)	20 (83.3)	25 (41.7)
No	4 (17.4)	5 (27.8)	6 (21.4)	3 (16.7)	4 (16.7)	35 (58.3)
Did the site offer other resources?						
Yes	21 (91.3)	16 (88.9)	24 (85.7)	16 (88.9)	20 (83.3)	53 (88.3)
No	2 (8.7)	2 (11.1)	4 (14.3)	2 (11.1)	4 (16.7)	7 (11.7)
Did the site refer energy balance and cancer?						
Yes	23 (100.0)	18 (100.0)	27 (96.4)	18 (100.0)	23 (95.8)	46 (76.7)
No	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (4.2)	14 (23.3)
Did the site give information about PA fundraisers? (e.g. walks/runs)						
Yes	13 (56.5)	12 (66.7)	18 (64.3)	12 (66.7)	13 (54.2)	36 (60.0)
No	10 (43.5)	6 (33.3)	10 (35.7)	6 (33.3)	11 (45.8)	24 (40.0)
Does the site give specific information for three or more types of cancer?						
Yes	19 (82.6)	13 (72.2)	21 (75.0)	16 (88.9)	19 (79.2)	9 (15.0)
No	4 (17.4)	5 (27.8)	7 (25.0)	2 (11.1)	5 (20.8)	51 (85.0)
Did the site give information about PA classes?						
Yes	5 (21.7)	4 (22.2)	7 (25.0)	7 (38.9)	5 (20.8)	23 (38.3)
No	18 (78.3)	14 (77.8)	21 (75.0)	11 (61.1)	19 (79.2)	37 (61.7)
Does the site give specific information for PA and paediatric cancer survivors?						
Yes	4 (17.4)	4 (22.2)	5 (17.9)	4 (22.2)	4 (16.7)	6 (10.0)
No	19 (82.6)	14 (77.8)	23 (82.1)	14 (77.8)	20 (83.3)	54 (90.0)
PA information quality and accuracy score	3.6522	3.3889	3.4643	3.6111	3.5417	2.2241
Mean Flesch-Kincaid reading ease score	(n = 22) 53.35	(n = 17) 56.21	(n = 27) 53.68	(n = 17) 52.68	(n = 23) 52.12	(n = 58) 55.30
Mean Flesch-Kincaid reading grade level	(n = 22) 7.65	(n = 17) 7.09	(n = 27) 7.57	(n = 17) 7.73	(n = 23) 7.79	(n = 58) 7.45

PA, physical activity.

TABLE 3 Information for specific cancer type by country of search result

Information for cancer type	Sites N (%)					
	Country of search engine	Canada (N = 23)	United Kingdom (N = 18)	USA (N = 28)	Australia (N = 18)	New Zealand (N = 24)
Breast		20	14	23	17	20
Colon		20	14	22	18	20
Prostate		7	5	9	6	7
Lung		6	4	9	6	6

4 | DISCUSSION

This is the first study to our knowledge to explore the quality and extent of cancer-related PA information available on the Internet. Findings clearly demonstrate that there is an ample amount of cancer-related PA information available on the Internet, but the quality of this information is variable. Most sites included some form of PA information, but the information provided was generally very vague. For example, sites provided advice such as “Regular physical activity may help lower your risk of cancer, as well as improve your quality of life and mood” or “Exercising regularly throughout your life helps you stay healthy.” Although these statements offer information about the benefits of PA, they do not provide tangible information about PA (i.e. intensity, frequency, duration) or define PA. Table 5 highlights additional examples of informational statements provided by cancer websites. Sites should suggest 150 min of moderate-to-vigorous activity weekly, consistent with the PA guidelines (Canadian Society for Exercise Physiology [CSEP], 2012; United States Department of Health and Human Services [USDHHS], 2008). Additionally, examples of activities should be provided to allow for a greater understanding of these guidelines for the public. It should also be made clear that people of all ages should be active and the benefits of activity for different age groups (e.g. flexibility training for older persons to prevent falls). By increasing the public’s understanding of PA, this may lead to increases in activity levels and reductions in chronic disease.

Sites that provided cancer-related PA information were found to have a Flesch–Kincaid reading ease score between 50 and 60, on average. Information presented at this level is considered “fairly difficult,” and translates to a high school reading level (grades 10–12; Flesch, 2002). Previous studies, which have evaluated online health information, have found similar reading levels, making this information potentially inaccessible to some (Cochrane, Gregory, & Wilson, 2012; Tian, Champlin, Mackert, Lazard, & Agrawal, 2014). Reading literacy influences one’s ability to understand and process health information (i.e. health literacy; USDHHS, 2015). Low health literacy is associated with increased mortality, poorer health outcomes and reduced preventive health action (Bostock & Steptoe, 2012; U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010). Therefore, it is important to ensure that health-related information is available to all, regardless of their health literacy

level. To do this, websites should be evaluated for accessibility and usability. The USDHHS (2015) suggests sites could improve accessibility to individuals with lower literacy skills by providing audio files along with written material, ensuring larger font size (12 point minimum), providing tailored, personalised information and reducing the number of ideas presented simultaneously, among other recommendations. Additional research should explore the health literacy level required to comprehend cancer-related PA information available on the Internet, as this will help to ensure that information is accessible to all.

Few websites referenced PA and cancer research when presenting PA information. This is unfortunate, as highlighting research would add credibility to the information being presented. There is also a need to increase knowledge dissemination between the research community and the general population, and help move research into practice. One potential means of incorporating research into existing websites would be through the addition of components of successful Internet-based PA behaviour change interventions. Web-based interventions have been successful at creating positive changes in diet, tobacco use and alcohol consumption (Mouton & Cloes, 2013). Because of this success in other health-related behaviours, Internet-based interventions have been developed as a means to increase PA (e.g. Irvine, Gelatt, Seely, Macfarlane, & Gau, 2013; Mouton & Cloes, 2013). For example, Napolitano et al. (2003) created a website intervention aimed at increasing PA behaviours for inactive people. They utilised email tip sheets, which included goal setting and reward strategies, quizzes, and research-based PA recommendations. This method was successful at increasing PA behaviour in a sample of inactive adults and this change remained after 3 months. Similar strategies could be created and combined with additional information regarding how to manage relapses in PA and how to address barriers to PA. These behaviour change strategies could be easily added into sites offering cancer-related PA information to help provide individuals with tangible strategies to help them increase their PA levels.

When viewing websites based in the UK, it was noticed that some sites had an icon on the bottom of the webpage identifying that the UK National Health Services (NHS) certified the material presented. These sites are edited and reviewed by a qualified clinician providing the general public with high-quality health information, which is valid and reliable (NHS, 2015). The NHS reviews sites at least every 2 years to ensure continued accuracy (NHS, 2015). Canada and other countries should consider making this a priority for their governments and departments of health, as this would increase the public’s trust

TABLE 4 Cancer information websites included in review

Website name	Website address	Date accessed
National Cancer Institute	www.cancer.gov	21-02-2014
American Society of Clinical Oncology	www.cancer.net	21-02-2014
Cancer Research UK	www.cancerresearchuk.org	21-02-2014
American Cancer Society	www.cancer.org	21-02-2014
Canadian Cancer Society	www.cancer.ca	04-02-2014
Diet and Cancer Report	www.dietandcancerreport.org	03-03-2014
Macmillan Cancer Support	www.macmillan.org.uk	28-02-2014
International Agency for Research on Cancer	www.iarc.fr	01-03-2014
World Cancer Research Fund	www.wcrf.org	04-03-2014
US Department for Health and Human Services	www.guideline.gov	01-03-2014
American Institute for Cancer Research	www.aicr.org	03-03-2014
International Association for the Study of Obesity	www.iaso.org	26-02-2014
The Oral Cancer Foundation	www.oralcancerfoundation.org	26-02-2014
World Cancer Research Fund UK	www.wcrf-uk.org	28-02-2014
Abramson Cancer Center	www.pennccancer.org	03-03-2014
World Cancer Day	www.worldcancerday.org	24-02-2014
Cancer Society of New Zealand	www.cancernz.org.nz	03-03-2014
Cancer Care Ontario	www.cancercare.on.ca	12-02-2014
Cancer Council NSW	www.cancerCouncil.com.au	01-03-2014
Cancer Council Australia	www.cancer.org.au	26-02-2014
Center for Disease Control and Prevention	www.cdc.gov	24-02-2014
Irish Cancer Society	www.cancer.ie	26-02-2014
Fred Hutchinson Cancer Center	www.fhcrc.org	04-03-2014
Prostate Cancer UK	www.prostatecanceruk.org	26-02-2014
Susan G. Komen	ww5.komen.org	26-02-2014
American Lung Association	www.lung.org	26-02-2014
Cancer Council Western Australia	www.cancerwa.asn.au	24-02-2014
MD Anderson Cancer Center	www.mdanderson.org	24-02-2014
Cancer Council Queensland	www.cancerqld.org.au	24-02-2014

(Continues)

TABLE 4 (Continued)

Website name	Website address	Date accessed
University College London Cancer Institute	www.ucl.ac.uk/	24-02-2014
Breakthrough Breast Cancer	www.breakthrough.org.uk	24-02-2014
Public Health Agency of Canada	www.phac-aspc.gc.ca	10-02-2014
Prostate Cancer Canada	www.prostatecancer.ca	10-02-2014
Movember Canada	ca.movember.com	12-02-2014
Sunnybrook Health Sciences	sunnybrook.ca	12-02-2014
Prostate Cancer Foundation BC	www.prostatecancerbc.ca	12-02-2014
Rethink Breast Cancer Foundation	rethinkbreastcancer.com	12-02-2014
Canadian Breast Cancer Foundation	www.cbcbf.org	12-02-2014
Team Shan Breast Cancer Awareness	teamshan.ca	12-02-2014
Pancreatic Cancer Canada	www.pancreaticcancercanada.ca	12-02-2014
Kidney Cancer Canada	www.kidneycancer-canada.ca	12-02-2014
Quebec Breast Cancer Foundation	rubanrose.org	12-02-2014
Cancer Control Planet	www.cancercontrolplanet.ca	12-02-2014
Behavioural Medicine U of A	www.behaviouralmedlab.ualberta.ca	12-02-2014
Thrive University of Calgary	www.ucalgary.ca	17-02-2014
Ovarian Cancer Canada	www.ovariancanada.org	17-02-2014
Canadian Cancer Research Alliance	www.ccra-acrc.ca	17-02-2014
Brain Tumour Foundation of Canada	www.braintumour.ca	17-02-2014
Alberta Cancer Foundation	albertacancer.ca	17-02-2014
Canadian Research Society	www.crs-src.ca	17-02-2014
Leukemia And Lymphoma Society	www.llscanada.org	17-02-2014
Wellspring Calgary	wellspringcalgary.ca	17-02-2014
Wellspring Ontario	www.wellspring.ca	17-02-2014
Ottawa Hospital	www.ottawahospital.on.ca	17-02-2014
Western University	www.uwo.ca	17-02-2014
Young Adult Cancer Canada	www.youngadultcancer.ca	17-02-2014
F*** Cancer	www.letsfcancer.com	17-02-2014
University of Waterloo	uwaterloo.ca	17-02-2014
Cancer Bridges	www.cancerbridges.ca	17-02-2014

(Continues)

TABLE 4 (Continued)

Website name	Website address	Date accessed
Prostate Cancer Network Ottawa	pccnottawa.ca	17-02-2014
After Breast Cancer	afterbreastcancer.ca	17-02-2014
NWT Breast Health	www.breasthealth-nwt.ca	17-02-2014
Princess Margaret Cancer Centre	www.theprincess-margaret.ca	17-02-2014
Alberta Health Services	www.albertahealth-services.ca	17-02-2014
CancerCare Manitoba	www.cancercare.mb.ca	17-02-2014
Juravinski Cancer Centre	www.jcc.hhsc.ca	17-02-2014
Cancer Centre of Southeastern Ontario	www.krcc.on.ca	17-02-2014
R.S. McLaughlin Durham Regional Cancer Centre	yourportal.lakeridgehealth.on.ca	17-02-2014
Thunder Bay Regional Health	www.tbrhsc.net	19-02-2014
Windsor Regional Cancer Centre	www.wrhc.on.ca	19-02-2014
McGill University Health Centre	www.muhealthpatient-education.ca	19-02-2014
Saskatchewan Cancer Agency	www.saskcancer.ca	19-02-2014
Breast Cancer Society of Canada	www.bccsc.ca	19-02-2014
Kensington Cancer Screening Centre	www.kensington-health.org	19-02-2014
Manitoba Prostate Cancer Support Group	www.manprosg.org	19-02-2014
The Dragon Flies Breast Cancer Survivor Group	www.thedragonflies.org	19-02-2014
Thyroid Cancer Canada	www.thyroidcancer-canada.org	18-02-2014
Willow Breast Cancer Support Canada	www.willow.org	18-02-2014
Climb Back From Cancer Foundation	climbback.com	18-02-2014
Colorectal Cancer Association of Canada	www.colorectal-cancer.ca	18-02-2014
Cancer Recovery Foundation of Canada	cancerrecovery.ca	18-02-2014
Coalition to Cure Prostate Cancer	ctcpc.org	18-02-2014
Breast Cancer Supportive Care Foundation	bccsf.com	17-02-2014
Breast Cancer Support Services Inc	www.breastcancer-support.org	17-02-2014
British Columbia Cancer Agency Branch	www.bccancer.bc.ca	17-02-2014
Canadian Breast Cancer Network	www.cbcn.ca	17-02-2014
Canadians Abreast	www.canadians-abreast.com	17-02-2014

in the material being presented. If health-related sites were validated for their content, these sites could be used as tools for physicians and other healthcare professionals to help educate their patients on health-related behaviours. Additionally, a specific website could be created to disseminate research-based, cancer-related PA information. Stakeholders in healthcare and cancer care (e.g. cancer charities, hospitals, cancer researchers, etc.) could contribute to a single international site, which offers accurate PA information across the cancer control continuum (Courneya & Friedenreich, 2007; e.g. cancer prevention, during treatment, and survivorship). Interested information seekers could be directed to such a website where they could retrieve high-quality and accurate information. This would not only relieve the barriers that physicians experience related to counselling patients (e.g. lack of knowledge about health behaviours, lack of educational materials, Cabana et al., 1999; Jones, Courneya, Peddle, & Mackey, 2005) but it would also provide a valuable resource for creating awareness about the benefits of PA for health, and more specifically cancer.

The strengths of the study are that it was the first to explore the quality and extent of PA and cancer information on the Internet, included a comprehensive evaluation of PA information, and only examined reputable sites. Limitations include the use of a single search engine, Google. Although this was the case, Google is the most commonly used search engine worldwide, accounting for around 90% of searches from desktop, tablets and consoles (Statcounter Global Stats, 2015). The searches were also limited by the use of only the terms “physical activity AND cancer”. Regardless, an exhaustive review of Canadian sites was performed and coded for information irrespective of the exact wording. If a site used the term “exercise” as opposed to PA, it would be positively coded for including PA information. It would be impossible to complete an exhaustive search of every term a person may use to seek out PA information. Future studies could assess the quality and availability of resistance training and sport information for those with cancer and cancer survivors. Research has established the importance of resistance training along the cancer care continuum (Singh, Newton, Galvão, Spry, & Baker, 2013; Strasser, Steindorf, Wiskemann, & Ulrich, 2013) and this information needs to be translated to the public. Furthermore, results from a Google search are ranked according to site popularity. This led to the large amount of overlap between countries and fewer unique sites available in the top search results. Although there was a large overlap, the sites that appeared more often were found to be from reputable organisations (e.g. American Cancer Society), to be of higher quality and contained a greater amount of cancer-related PA information.

In summary, our results demonstrate that there is a large proportion of cancer-related PA information presented on the Internet. Nevertheless, it is clear that the quality of the PA information is variable and the detail presented is limited. Based on this, it is recommended that websites that present cancer-related PA information should provide: (1) tangible information about PA (e.g. intensity, frequency, duration, type), (2) reference the PA public health guidelines or the cancer survivor-specific PA guidelines (i.e. 150 min of moderate-to-vigorous PA per week (CSEP, 2012; Rock et al., 2012; Schmitz et al., 2010; USDHHS, 2008), (3) examples of what constitutes PA and define PA

TABLE 5 Examples of advice provided by cancer information websites

Specific, high-quality advice	General, low-quality advice
Be physically active. Exercise for 30–45 min on most days of the week. You can keep moving by working out at the gym or just taking the dog for a walk. This will help keep your body weight under control	Do some exercise every day to improve your sense of well-being
Get active at least three times a week for 30–45 min of moderate activity, such as walking	Be active every day and maintain a healthy body weight
It can be easier than you think to increase your activity levels, even if you don't do much at the moment. Aim to do 2 1/2 hr of moderate activity every week...	Exercise more and eat fewer calories to maintain a healthy weight
Regular physical activity at least 150 min of moderate activity or 75 min of vigorous activity per week for adults) may improve quality of life after a cancer diagnosis	Light exercise or physical activity can improve your energy
Get active, move your body: only 30 min of physical activity per day is necessary to reduce your risk of cancer. For school aged children/teenagers at least 60 min of daily physical activity is recommended for noticeable health benefits	Regular physical activity helps improve your overall physical, emotional and social health and well-being

and (4) reference PA and cancer literature. Future studies should conduct longitudinal studies to explore whether the quality and extent of PA information improves over time. Additionally, future studies may also consider evaluating additional aspects of these websites, such as usability to capture a more comprehensive view of website quality. Finally, since the Internet is extensively used to seek out cancer-related information, improving the quality and accuracy of the PA information presented is crucial.

CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

REFERENCES

- Adams, S. A. (2010). Revisiting the online health information reliability debate in the wake of "web 2.0": An inter-disciplinary literature and website review. *International Journal of Medical Information, 79*, 391–400.
- Athanasopoulou, C., Hätonen, H., Suni, S., Lionis, C., Griffiths, K. M., & Välimäki, M. (2013). An analysis of online health information on schizophrenia or related conditions: A cross-sectional survey. *BMC Medical Informatics and Decision Making, 13*, 98–108.
- Ballard-Barbash, R., Friedenreich, C. M., Courneya, K. S., Siddiqi, S. M., McTiernan, A., & Alfano, C. M. (2012). Physical activity, biomarkers, and disease outcomes in cancer survivors: A systematic review. *Journal of the National Cancer Institute, 104*, 815–840.
- Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the Internet: Actualizing their potential. *Annual Review of Public Health, 30*, 273–292.
- Bostock, S., & Steptoe, A. (2012). Association between low functional health literacy and mortality in older adults: Longitudinal cohort study. *British Medical Journal, 344*.
- Cabana, M. D., Rand, C. S., Powe, N. R., Wu, A. W., Wilson, M. H., Abboud, P. C., & Rubin, H. R. (1999). Why don't physicians follow clinical practice guidelines? A framework for improvement. *Journal of the American Medical Association, 282*, 1458–1465.
- Canadian Cancer Society's Advisory Committee on Cancer Statistics (CCSACCS) (2014). *Canadian cancer statistics 2014*. Toronto, ON: Canadian Cancer Society.
- Canadian Society for Exercise Physiology (CSEP) (2012). *Canadian physical activity guidelines and Canadian sedentary behaviour guidelines*. Ottawa, ON: Author. Available from: <http://www.csep.ca/english/view.asp?x=804> [last accessed 20 May 2015].
- Castleton, K., Fong, T., Wang-Gillam, A., Waqar, M. A., Jeffe, D. B., Kehlenbrink, L., ... & Govindan, R. (2010). A survey of internet utilization among patients with cancer. *Supportive Care in Cancer, 19*, 1183–1190.
- Chan, D. S. Y., Willicombe, A., Reid, T. D., Beaton, C., Arnold, D., Ward, J., ... & Lewis, W. G. (2012). Relative quality of internet-derived gastrointestinal cancer information. *Journal of Cancer Education, 27*, 676–679.
- Cochrane, Z. R., Gregory, P., & Wilson, A. (2012). Readability of consumer health information on the internet: A comparison of US government-funded and commercially funded websites. *Journal of Health Communication: International Perspectives, 17*, 1003–1010.
- Colley, R., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). *Physical activity of Canadian Adults: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey* (pp. 7–14). Ottawa, ON: Statistics Canada.
- Courneya, K. S., & Friedenreich, C. M. (2007). Physical activity and cancer control. *Seminars in Oncology Nursing, 23*, 242–252.
- Courneya, K. S., McKenzie, D. C., Mackey, J. R., Gelmon, K., Friedenreich, C. M., Yasui, Y., ... & Segal, R. J. (2013). Effects of exercise dose and type during breast cancer chemotherapy. *Journal of the National Cancer Institute, 105*, 1821–1832.
- Eysenbach, G., & Kohler, C. (2003). What is the prevalence of health-related searches on the World Wide Web? Qualitative and quantitative analysis of search engine queries on the internet. *AMIA Annual Symposium Proceedings, 2003*, 225–229.
- Eysenbach, G., Powell, J., Kuss, O., & Sa, E. R. (2002). Empirical studies assessing the quality of health information for consumers on the World Wide Web: A systematic review. *Journal of the American Medical Association, 287*, 2691–2700.
- Flesch, R. (2002). *How to write plain English*, Chapter 2. Available from: http://www.mang.canterbury.ac.nz/writing_guide/writing/flesch.shtml [last accessed 4 April 2016].
- Fong, D. Y. T., Ho, J. W. C., Hui, B. P. H., Lee, A. M., Macfarlane, D. J., Leung, S. S. K., ... & Cheng, K. K. (2012). Physical activity for cancer survivors: Meta-analysis of randomised controlled trials. *British Medical Journal, 344*, e70.
- Goncalves, A., Florencio, G., Silva, M., Cobucci, R., Giraldo, P., & Cote, N. (2014). Effects of physical activity on breast cancer prevention: A systematic review. *Journal of Physical Activity and Health, 11*, 445–454.
- Google (2014). Adwords [Software]. Available from: <https://adwords.google.com> [last accessed 15 March 2015].
- Hajjar, I., Gable, S. A., Jenkinson, V. P., Kane, L. T., & Riley, R. A. (2005). Quality of internet geriatric health information: The GeriatricWeb project. *Journal of the American Geriatric Society, 53*, 885–890.
- Hallal, P. C., Anderson, L. B., Bull, F. C., Guthold, R., Haskell, W., & Ekelund, U. (2012). Global physical activity levels: Surveillance progress, pitfalls, and prospects. *The Lancet, 380*, 247–257.

- Hendrick, P. A., Ahmed, O. H., Bankier, S. S., Chan, T. J., Crawford, S. A., Ryder, C. R., ... & Schneiders, A. G. (2012). Acute low back pain information online: An evaluation of quality, content accuracy and readability of related websites. *Manual Therapy*, 17, 318–324.
- Humpel, N., Magee, C., & Jones, S. C. (2007). The impact of a cancer diagnosis on the health behaviors of cancer survivors and their family and friends. *Supportive Care in Cancer*, 15, 621–630.
- Irvine, B., Gelatt, V. A., Seely, J. R., Macfarlane, P., & Gau, J. M. (2013). Web-based intervention to promote physical activity by sedentary older adults: Randomized controlled trial. *Journal of Medical Internet Research*, 15, e19.
- Jones, L. W., & Courneya, K. S. (2002). Exercise discussions during cancer treatment consultations. *Cancer Practice*, 10, 66–74.
- Jones, L. W., Courneya, K. S., Peddle, C., & Mackey, J. R. (2005). Oncologists' opinions towards recommending exercise to patients with cancer: A Canadian national survey. *Supportive Care in Cancer*, 13, 929–937.
- Kincaid, J. P., Fishburne, R. P., Rogers, R. L., & Chissom, B. S. (1975). Derivation of new readability formulas (automated readability index, Fog Count, and Flesch reading ease formula) for Navy enlisted personnel. Research Branch Report 8-75. Chief of Naval Technical Training: Naval Air Station Memphis.
- Kummervold, P. E., & Wynn, R. (2012). Health information accessed on the Internet: The development in 5 European countries. *International Journal of Telemedicine and Applications*, 2012, 1–3.
- McMullan, M. (2006). Patients using the Internet to obtain health information: How this affects the patient-health professional relationship. *Patient Education and Counseling*, 63, 24–28.
- Mishra, S. I., Scherer, R. W., Snyder, C., Geigle, P. M., Berlanstein, D. R., & Topaloglu, O. (2015). The effectiveness of exercise interventions for improving health-related quality of life from diagnosis through active cancer treatment. *Oncology Nursing Forum*, 42, E33–E53.
- Mouton, A., & Cloes, M. (2013). Web-based interventions to promote physical activity by older adults: Promising perspectives for a public health challenge. *Archives of Public Health*, 71, 16.
- Napolitano, M. A., Fotheringham, M., Tate, D., Sciamanna, C., Leslie, E., Owen, N., ... & Marcus, B. (2003). Evaluation of an internet-based physical activity intervention: A preliminary investigation. *Annals of Behavioral Medicine*, 25, 92–99.
- National Health Service (NHS) (2015). Editorial policy. Available from: <http://www.nhs.uk/aboutNHSchoices/aboutnhschoices/Aboutus/Pages/Editorialpolicy.aspx> [last accessed 15 November 2015].
- Neil, S. E., Gotay, C. C., & Campbell, K. L. (2014). Physical activity levels of cancer survivors in Canada: Findings from the Canadian Community Health Survey. *Journal of Cancer Survivorship*, 8, 143–149.
- Quinn, E. M., Corrigan, M. A., McHugh, S. M., Murphy, D., O'Mullane, J., Hill, A. D. K., & Redmond, H. P. (2012). Breast cancer information on the internet: Analysis of accessibility and accuracy. *The Breast*, 21, 514–517.
- Rock, C. L., Doyle, C., Demark-Wahnefried, W., Meyerhardt, J., Courneya, K. S., Schwartz, A. L., ... & Gansler, T. (2012). Nutrition and physical activity guidelines for cancer survivors. *CA: A Cancer Journal for Clinicians*, 62, 242–274.
- Schmitz, K. H., Courneya, K. S., Matthews, C., Demark-Wahnefried, W., Galvão, D. A., Pinto, B. M., ... & Schwartz, A. L. (2010). American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Medicine and Science in Sports and Exercise*, 42, 1409–1426.
- Shahar, S., Shirley, N., & Noah, S. A. (2013). Quality and accuracy assessment of nutrition information on the web for cancer prevention. *Informatics for Health and Social Care*, 38, 15–26.
- Silberg, W. M., Lundberg, G. D., & Musacchio, R. A. (1997). Assessing, controlling, and assuring the quality of medical information on the Internet: Caveant lector et viewer—let the reader and viewer beware. *Journal of the American Medical Association*, 277, 1244–1245.
- Singh, F., Newton, R. U., Galvão, D. A., Spry, N., & Baker, M. K. (2013). A systematic review of pre-surgical exercise intervention studies with cancer patients. *Surgical Oncology*, 22, 92–104.
- Speck, R. M., Courneya, K. S., Mâsse, L. C., Duval, S., & Schmitz, K. H. (2010). An update of controlled physical activity trials in cancer survivors: A meta-analysis. *Journal of Cancer Survivorship*, 4, 87–100.
- Statcounter Global Stats (2015) (Graph Illustration Top 5 Search Engines from May 2014 to April 2015). StatCounter Global Stats Top 5 Search Engines from May 2014 to April 2015. Available from: http://gs.statcounter.com/#all-search_engine-ww-monthly-201405-201504 [last accessed 10 May 2015].
- Statistics Canada (2010). Internet use by individuals, by type of activity. Available from: <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/comm29a-eng.htm> [last accessed 20 February 2015].
- Stinson, J. N., White, M., Breakey, V., Chong, A. L., Mak, I., Low, K. K., & Low, A. K. (2011). Perspectives on quality and content of information on the Internet for adolescents with cancer. *Pediatric Blood Cancer*, 57, 97–104.
- Strasser, B., Steindorf, K., Wiskemann, J., & Ulrich, C. (2013). Impact of resistance training in cancer survivors: A meta-analysis. *Medicine and Science in Sports and Exercise*, 45, 2080–2090.
- Tian, C., Champlin, S., Mackert, M., Lazard, A., & Agrawal, D. (2014). Readability, suitability, and health content assessment of web-based patient education materials on colorectal cancer screening. *Gastrointestinal Endoscopy*, 80, 284–290.
- Townsend, N., Bhatnagar, P., Wickramasinghe, K., Scarborough, P., Foster, C., & Rayner, M. (2012). *Physical activity statistics 2012*. London: British Heart Foundation.
- United States Department of Health and Human Services (USDHHS) (2008). *2008 physical activity guidelines for Americans*. Washington, DC: Author.
- U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion (2010). *National action plan to improve health literacy*. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion.
- U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion (2015). Health Literacy Online: A guide to simplifying the user experience. Available from: <http://health.gov/healthliteracyonline/> [last accessed 4 April 2016].
- van Waart, H., Stuiver, M. M., van Harten, W. H., Geleijin, E., Kieffer, J. M., Buffart, L. M., ... & Aaronson, N. K. (2015). Effect of low-intensity physical activity and moderate- to high-intensity physical exercise during adjuvant chemotherapy on physical fitness, fatigue, and chemotherapy completion rates: Results of the paces randomized clinical trial. *Journal of Clinical Oncology*, 33, 1918–1927.
- Wilder Smith, A., Borowski, L. A., Liu, B., Galuska, D. A., Signore, C., Klambunde, C., ... & Ballard-Barbash, R. (2011). U.S. primary care physicians' diet-, physical activity-, and weight-related care of adult patients. *American Journal of Preventative Medicine*, 41, 33–42.
- Winzer, B. M., Whiteman, D. C., Reeves, M. M., & Paratz, J. D. (2011). Physical activity and cancer prevention: A systematic review of clinical trials. *Cancer Causes and Control*, 22, 811–826.
- Wolin, K. Y., Yan, Y., Colditz, G. A., & Lee, I. M. (2009). Physical activity and colon cancer prevention: A meta-analysis. *British Journal of Cancer*, 100, 611–616.
- World Cancer Research Fund International (2014). World wide data – cancer facts and figures. Available from: <http://www.wcrf.org/int/cancer-facts-figures/worldwide-data> [last accessed 20 February 2015].
- World Health Organization (WHO) (2015). Physical activity. Available from: <http://www.who.int/mediacentre/factsheets/fs385/en/> [last accessed 10 May 2015].

How to cite this article: Buote, R. D., Malone, S. D., Bélanger, L. J. and McGowan, E. L. (2016), Quality and accuracy of publicly accessible cancer-related physical activity information on the Internet: a cross-sectional assessment. *European Journal of Cancer Care*, 00: 1–11. doi:10.1111/ecc.12518