6-1-2018

# The Effect of Telehealth Interventions on Quality of Life of Cancer Patients: A Systematic Review and Meta-Analysis

Jamie L. Larson
*University of Nebraska Medical Center*

Adam B. Rosen
*University of Nebraska at Omaha*, arosen@unomaha.edu

Fernando A. Wilson

## Recommended Citation

Larson, Jamie L.; Rosen, Adam B.; and Wilson, Fernando A., "The Effect of Telehealth Interventions on Quality of Life of Cancer Patients: A Systematic Review and Meta-Analysis" (2018). *Health and Kinesiology Faculty Publications*. 28.
https://digitalcommons.unomaha.edu/hperfacpub/28

# The Effect of Telehealth Interventions on Quality of Life of Cancer Patients: A Systematic Review and Meta-Analysis

Running Title: The Effect of Telehealth Interventions

Jamie Larson, MBA[1]

Adam B. Rosen, PhD[2]

Fernando A. Wilson, PhD[1]

[1] Department of Health Services Research and Administration, College of Public Health, University of Nebraska Medical Center, Omaha, NE

[2] School of Health and Kinesiology, College of Education, University of Nebraska Omaha, Omaha, NE

Corresponding author:

Ms. Jamie Larson, MBA

Department of Health Services Research and Administration

College of Public Health

984350 Nebraska Medical Center

Omaha, NE 68198-4350

jamie.larson@unmc.edu

402.559.5260

Tables: 2

Figures: 2

Text word count: 2,937

# ABSTRACT

Introduction: In 2016, approximately 1.7 million new cases of cancer were diagnosed. Cancer patients can have physical, functional, and psychosocial issues when dealing with cancer treatment. Telehealth has been effectively introduced to help deliver treatment to patients suffering from chronic disease, however, there is little consensus on its effectiveness in administering socio-behavioral cancer treatments.  Thus, this study determines the benefits of telehealth-based interventions providing emotional and symptom support in improving quality of life (QOL) among cancer patients.

Methods: Two researchers conducted comprehensive searches on PubMed, SCOPUS, Medline, PsycINFO, ERIC, Psychology and Behavioral Collection, and Medline Complete. Key search terms included telehealth or telemedicine and quality of life and cancer. Manuscripts were included if they assessed a telehealth delivered intervention for adult cancer patients and provided a QOL assessment. Data were extracted to calculate mean effect sizes for QOL measures on the effectiveness of telehealth relative to usual care for cancer treatments.

Results: Out of 414 articles identified in our initial search, nine articles fit our inclusion criteria. Both telehealth (Hedges $g = 0.211$, $p=0.016$) and standard of care (Hedges $g = 0.217$, $p<0.001$) cancer treatment delivery methods demonstrated small but statistically significant improvements in QOL measures. However, there were no statistically significant differences in effectiveness between the telehealth interventions and usual care ($p=0.76$).

Conclusions: The results indicate that telehealth interventions are as effective at improving QOL scores in patients undergoing cancer treatment as in-person usual care. Further studies should be undertaken on different modalities of telehealth to determine its appropriate and effective use in interventions to improve the quality of life for cancer patients undergoing treatment.

## INTRODUCTION

Nearly two million new cases of cancer are diagnosed every year in the United States.[1] Cancer patients can experience multiple issues during treatment, including physical, functional, and psychosocial symptoms and complications.[2–7] Cancer diagnoses can lead to severe psychological distress and disrupt patients' lives, increasing strains on work, family, and social relationships.[2,8,9] Improved management of emotional distress and symptoms, especially after new diagnoses and treatments, could significantly improve quality of life for cancer patients.[10] Furthermore, the need for effective and cost-efficient interventions to address psychosocial symptoms resulting from treatment will increase in the future with the aging demographic distribution in the US and consequent increase in cancer diagnoses.[11]

Telehealth has been effectively used to help manage many chronic conditions and to improve compliance with treatment and patients' overall well-being.[4] The terms 'telehealth' or 'telemedicine' are often used interchangeably and can have multiple definitions. Telemedicine is often used to refer to diagnosis and monitoring technology, whereas telehealth may be used to include management, education, and other allied health care services.[12] The Health Resources and Services Administration defines telehealth as the use of technology to deliver health care, health information, or health education at a distance.[13] Telehealth technologies, including telephone, videoconferencing, and internet-based interventions, have the capability of bringing services into the patient's home and helping them manage their symptoms without needing to be physically present at a hospital or clinic.[3,10] Telemedicine patients have reported good acceptance of and satisfaction with the use of technology in comparison with in-person visits.[14,15] Providing patients greater access to symptom management and emotional support services may lead to patients taking a more active role in their health care and could improve patient outcomes including overall quality of life (QOL).[3]

The purpose of this systematic review and meta-analysis is to examine the effect that telehealth interventions providing emotional and symptom management have on cancer patients' QOL. To our knowledge, there has been no study done to date that has examined the overall effect of supporting patients in the management of their symptoms via telehealth technology in comparison to in-person usual care (UC). We determine whether interventions utilizing telehealth-delivered support are more effective in improving QOL versus UC from baseline until the end of the intervention period.

## METHODS

The recommendations outlined in the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement were used to guide this systematic review and meta-analysis.[16]

### 2.1 Data Acquisition

An electronic database search was initially conducted from inception to December, 31 2016 by two of the coauthors using the following databases: National Library of Medicine Catalog (Medline/PubMed), SCOPUS, the Cumulative Index for Nursing and Allied Health Literature (CINAHL), Ebsco Health (Medline complete). The initial key-term search consisted of: "telehealth OR telemedicine" AND "Cancer" AND "quality of life OR assessment". After the initial search, article titles and abstracts were inspected for relevance to the inclusion and exclusion criteria, followed by obtaining full-texts for identified manuscripts. Manuscripts were then further scrutinized for inclusion and exclusion criteria post-retrieval. Reference lists of full-text manuscripts were then hand-searched and cross-referenced for potentially relevant papers. Another separate search on the Cochrane Library was conducted for systematic reviews containing similar content. Relevant systematic reviews were then obtained and cross-referenced for additional manuscripts missed during the original search. Consensus among all the authors was then sought for an article's final inclusion in the meta-analysis.

## 2.2 Inclusion and Exclusion Criteria

All manuscripts included in the systematic review and meta-analysis must have been published in a peer-reviewed journal and met the following inclusion criteria: 1) Patients included must have had any form of cancer and been undergoing active treatment; 2) Patients must have been adults, 18 years of age or older; 3) Interventions must have used some form of telehealth/telemedicine, including but not limited to telephone calls and/or web based interventions; 4) The focus of each intervention must have been on emotional support or self-management of symptoms through counseling, educational intervention or telepsychiatry; and 5) Studies must have used a measurable QOL scale or questionnaire. Studies were excluded if they: 1) Were written in a language other than English; 2) Included pediatric patients; 3) If they assessed the efficacy of palliative care; or 4) Combined in-person and telehealth in the same intervention.

## 2.3 Data extraction and analysis

For the systematic review portion of this study, descriptive data were extracted from each of the included articles pertaining to their methodology and results. Numerical data extracted for the meta-analysis included sample sizes, QOL measures means and standard deviations from baseline and post-intervention as well as effect sizes for each study whenever data were available. If effect size results were not reported, they were conservatively estimated based on the obtainable data from each included study. Following the retrieval of study data, standardized mean differences between baseline and post-test while adjusting for small sample bias (Hedges g) were calculated for telehealth interventions and usual care (UC) separately.[17] A mean effect size ($\Delta$) for both telemedicine and UC was determined using a random effects model due to the uncertainty of evaluating a homogenous population.[18] Heterogeneity was assessed via $I^2$ and Q-statistics. To gauge the impact of bias from unpublished studies on the mean effect size, the fail-safe N was also evaluated.[18] All effect-size data and heterogeneity statistics were calculated with the Comprehensive Meta-Analysis (V3.3.070, Biostat, Inc., Englewood, NJ) software package. Effect size data were interpreted as 0.1-0.3=small, 0.3-0.5=moderate and >0.5= large effects. [19] After effect size calculations were acquired, independent *t*-tests were then used to determine if differences existed between the effect sizes of the telemedicine and UC cancer delivery interventions utilizing the IBM Statistical Package for the Social Sciences (SPSS) software (Version 24.0, IBM, Inc., Armonk, NY). The significance level was set to $p<.05$ for all statistical analyses a-priori.

## RESULTS

Figure 1 is a flow diagram of our article selection process. Our initial search for articles using our search terms within the designated literature databases yielded a total of 414 articles. A search in the Cochrane database for systematic reviews containing similar content provided 5 systematic reviews, and all the references within the systematic reviews, totaling 370 article titles, were screened. After titles and abstracts were screened, 57 articles were retained to be assessed by two authors to ensure consensus on inclusion. After duplicates and those that did not fit the inclusion criteria were excluded, full text assessments were performed on the 21 remaining articles. Nine articles were excluded due to the patient population being cancer survivors and not in active treatment, and one article was excluded because the intervention was exercise-based. Nine articles (Table 1) ultimately fit all systematic review and meta-analysis criteria.

Five out of nine articles used telephone-based interventions (56%), another three studies used web-based designs or connected devices (33%) and one (11%) utilized videoconferencing. The time period for the studies varied, ranging from 6 weeks to one year. One article did not specifically report the time period from baseline to final assessment, but stated it was one month after treatment.[20] The mean age of the patients within the 9 articles ranged from 53 to 67 years of age. Five of the articles focused on specific cancers, e.g., colorectal, breast, and head and neck cancers,[7,21–24] whereas three articles included three or more types of cancer within their study population.[20,25,26] Pfeifer et al. (2015) included both breast and prostate cancer patients. [27]

Of the nine articles included, only one had statistically significant results for overall QOL scores from baseline to end of the study period and did not have a comparable control group. [20] Two articles did find clinically significant improvements in the intervention effect on QOL, but were not statistically significant. Berry et al. (2014) did not find statistically significant between-group changes in QOL overall, but did report statistical significance for a sub-analysis by age. There was a statistically significant intervention effect for those ≥50 years of age, though not for those younger.[26] Hegel et al (2011) found statistically significant improvements for the intervention group compared to the usual care control for overall QOL as well as emotional and social well-being subscales at 6 weeks. However, after the intervention was completed, the 12-week end of study QOL scores were not statistically significant between groups.[22] A similar effect was found in Pfeifer's (2015) study, as there was no statistically significant difference between groups in the overall QOL score, although there were statistically significant differences in physical well-being after the intervention.[27] The Ruland (2013) and Rhyanen (2013) studies reported no statistically significant between-group results for the telehealth intervention on QOL. Both studies did find other statistically significant results related to lower anxiety and depression scale scores for those in the intervention groups compared to the usual care controls over the study period.[23,24] Ruland et al. (2013) found that the intervention group had significant decreases in depression scale scores and did not have the significant decreases that were found over time in the control group for QOL and self-efficacy scores.[23] Rhyanen et al. (2013) collected data more frequently and were able to associate QOL changes with events such as increases in QOL after surgery and decreases in QOL at the end of radiotherapy.[24] The intervention group had a continual decrease in anxiety over time, whereas the control group had greater anxiety before surgery and chemotherapy, as well as during chemotherapy treatments.[24] In the study, anxiety was statistically significantly associated with overall QOL scores and physical, psychological, and spiritual well-being subscales.[24]

In total, 16 individual effect sizes—nine for telehealth interventions and seven for UC—were calculated.  Across the nine studies included in the meta-analysis, 680 patients received telehealth cancer interventions, while 602 patients received UC. The distribution for all unweighted effect sizes calculated are displayed on a forest plot in Figure 2. The summary statistics for the mean effect sizes for telehealth and UC with their 95% confidence intervals, heterogeneity statistics and fail safe N calculations are reported in Table 2. Both telehealth (**Δ** = 0.211, *p*=0.016) and UC (**Δ** = 0.217, *p*<0.001) demonstrated small but statistically significant mean effects compared to baseline QOL across the included studies. They each had relatively low Q and $I^2$ values indicating homogeneity across the included studies (refer to supplemental materials for funnel plot files). No statistically significant differences were present between the mean effect sizes of telehealth and UC interventions (*t*= -0.31, *p*=0.76).

Multiple sensitivity secondary analyses were performed by revising the meta-analysis to include only those articles that used the Functional Assessment for Cancer Therapy (FACT) scale for quality of life. Including only these six studies increased the effect size of the intervention group (**Δ** = 0.338, *p*=0.006), and the effect size was considered moderate. The control group in this analysis had a smaller increase in effect size (**Δ** = 0.256, *p*=0.013). This suggests that using different scales for measuring QOL may affect the measurable impact of the telehealth interventions. We also stratified the meta-analysis to compare telephone interventions (n=5) versus internet/device interventions (n=4). This resulted in telephone interventions having a larger, moderate effect size (**Δ=**0.325, *p=0.028)* than the internet/device interventions (**Δ=**0.092, *p=0.341)*. However, these were not statistically different (*t*= -0.584, *p* = 0.577), likely due to the low sample of studies.

## DISCUSSION

Our study performed a systematic review of peer-reviewed studies that utilized telehealth interventions to improve emotional support and symptom self-management for patients receiving treatment for cancer. Our findings demonstrated a statistically significant, albeit small increase in QOL for the telehealth intervention group relative to baseline across the nine studies in the meta-analysis. The UC group had a similar, statistically significant improvement across seven studies, but we found telehealth to be non-inferior to UC in improving quality of life for cancer patients. Sensitivity analysis suggested that telephone-based interventions may be superior to internet/device interventions for cancer patients.

The studies in our meta-analysis and systematic review were relatively homogenous as demonstrated by funnel plots (refer to supplemental materials). Harrison et al. (2011) was the only potential outlier showing significantly improved effectiveness of telehealth versus UC; however, this was the only study analyzing patients with colorectal cancer.[21] It is possible that telehealth-based psychosocial treatments would vary in effectiveness across cancer diagnoses. Unfortunately, there has been insufficient research to demonstrate this. [21]

Our findings are consistent with prior research demonstrating non-inferiority of tele-psychiatry interventions versus face-to-face treatment.[28–30] Thus, by maintaining a comparable QOL while averting the need to travel for in-person therapy or treatment, the use of telehealth for psychosocial support of cancer patients is likely to be cost-effective. Furthermore, telehealth may be effective in improving outcomes other than QOL, however, such as patient satisfaction and acceptability of the new modality.[31] For example, a systematic review conducted by Calvin et al suggested that most patients accept and are satisfied with many forms of telehealth interventions they received.[32] Another study showed that telehealth did not lead to lower patient satisfaction in communicating with their providers. [33]

Our inclusion criteria stated that all articles must have an overall quality of life measurement. Of the nine studies in our systematic review, the majority (67%) used the FACT instrument—either the general or cancer-specific FACT instrument—as shown in Table 1. The general FACT scale was developed and validated between 1987 and 1992, in a five-phase process, including item generation, item review and reduction, scale construction and piloting, initial evaluation, and additional evaluation.[34] FACT-G is a 27-item instrument that has subscale scores for physical, functional, social, emotional well-being and satisfaction with treatment.[34] Cancer-specific FACT scales include those questions that are in the FACT-G but have additional questions that are cancer specific, such as for colorectal cancer (FACT-C), breast cancer (FACT-B), and head and neck cancer (FACT-HN).[35–38] Berry et al.(2014) used the Symptom Distress Scale (SDS), which has 15 items—the 13 included in the usual SDS instrument and an additional 2 questions related to sexual activity and interest, and fever and chills.[26] The SDS used a 5-point Likert scale ranging from no distress or normal (0) to severe distress (5), creating a total SDS score from an unweighted summation of the scores.[39] Ruland et al. (2013) also used a 15-dimensional self-administered instrument for measuring QOL based on similar symptoms to the SDS, but using a 5-point Likert score where higher scores denoted improved health status.[23, 40] The breast cancer version of the Quality of Life Instrument was used by Ryhanen and colleagues.[24] Their instrument had 46 items grouped into four subscales related to physical, psychological, social and spiritual well-being. A 10-point Likert scale was used with 0 indicating the worst outcome and 10 the best outcome. An overall QOL score was created by summing the subscale variables and calculating the mean values.[41]

Although our focus was on the improvement in quality of life of cancer patients who received a telehealth intervention for emotional or symptom management support, it is important to note that telehealth increases access to care for cancer patients, as well as for those suffering from other chronic conditions. Rural patients are at higher risk for decreased access to specialized care, and telehealth has been found to increase access to quality care. Telehealth can ease the burden of travel time, cost, and the discomfort that may be associated with long travel times.[42,43] Telehealth can also overcome issues related to ethnicity, culture, and language that affect health, by facilitating access to culturally competent providers and interpreters.[43]

Our study should be interpreted in the context of certain limitations. Our meta-analysis had a small sample size of manuscripts and patient pools, and thus we were unable to perform a moderator analysis to determine if alternative factors influenced the effectiveness of treatment delivery. On a similar note, different cancers, stage of cancer and treatment protocols may have varying impacts on QOL, which we were unable to explore due to the limited number of studies. [44–46] A study on the factors affecting the quality of life of cancer patients undergoing chemotherapy found worse quality of life in breast cancer, head and neck, sarcoma, lung and gynecological cancers. Colorectal cancer patients were found to have the better quality of life. [46] Lower quality of life in breast cancer patients may be due to changes in self-image due to surgery and hair loss, as well as decreased sexual function and early menopause. Similarly, head and neck cancers and sarcomas surgical treatment can lead to disfigurement and cause lower quality of life for patients.[46] In addition, we were unable to effectively assess manuscript quality as part of our analysis as there was a range of study designs included. Due to the low sample, we chose to include all studies relevant to our inclusion criteria and agreed upon by author consensus, regardless of design. Because of inconsistent and limited published data, we erred on the conservative side when necessary during effect size calculations; however, this only occurred for two studies, Pfeifer et al. (2015) and Hegel et al. (2011). [22,27]

## CONCLUSIONS

Our systematic-review with meta-analysis demonstrated that supplementary interventions through telehealth have a comparable impact on quality of life scores relative to in-person usual care. Utilizing telehealth, may allow clinicians and healthcare systems to increase access for those cancer patients who lack the means to travel for additional treatment or are rurally located creating increase travel costs and time. Some of the studies in this meta-analysis did see improvements in other areas such as depression, anxiety, and emotional, social, and physical well-being, even when overall quality of life was not statistically significantly improved. Our findings suggest more studies need to be conducted on the impact of telehealth interventions across different cancer diagnoses to gain better insight into the differential effect these interventions may have on quality of life for cancer patients undergoing treatment.

ACKNOWLEDGEMENTS

None

## AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

## REFERENCES

1. National Institute of Health. *Cancer Statistics.* National Cancer Institute. https://www.cancer.gov/about-cancer/understanding/statistics. Published 2017. Accessed January 1, 2017.
2. Andersen T, Ruland CM. Cancer patients' questions and concerns expressed in an online nurse-delivered mail service: Preliminary results. *Stud Health Technol Inform*. 2009;146: 149-153.
3. Ruland CM, Jeneson A, Andersen T, et al. Designing tailored Internet support to assist cancer patients in illness management. *AMIA Annu Symp Proc*. 2007:635-639.
4. Gotay CC, Bottomley A. Providing psycho-social support by telephone: what is its potential in cancer patients? *Eur J Cancer Care (Engl)*. 1998;7: 225-231.
5. Naughton M, Homsi J. Symptom assessment in cancer patients. *Curr Oncol Rep*. 2002;4: 256-263.
6. Kurtz ME, Given B, Kurtz JC, Given CW. The interaction of age, symptoms, and survival status on physical and mental health of patients with cancer and their families. *Cancer*. 1994;74(7): 2071-2078.
7. Sandgren AK, McCaul KD. Short-term effects of telephone therapy for breast cancer patients. *Heal Psychol*. 2003;22(3): 310-315.
8. Zabora J, Brintzenhofeszoc K, Curbow B, Hooker C, Piantadosi S. The prevalence of psychological distress by cancer site. *Psychooncology*. 2001;10: 19-28.
9. Cleeland CS. Cancer-related symptoms. *Semin Radiat Oncol*. 2000;10(3): 175-190.
10. Wilkie DJ, Huang HY, Berry DL, et al. Cancer symptom control: feasibility of a tailored, interactive computerized program for patients. *Fam Community Health*. 2001;24(3): 48-62.
11. DeSantis CE, Chieh Lin C, Mariotto AB, et al. Cancer treatment and survivorship statistics, 2014. *CA Cancer J Clin*. 2014;64: 252-271.
12. The Center for Connected Health Policy. *What is telehealth?* The Center for Connected Health Policy. http://www.cchpca.org/what-is-telehealth. Published 2017. Accessed January 15, 2017.
13. Health Resources & Services Administration. *Telehealth Programs.* US Department of Health and Human Services. https://www.hrsa.gov/ruralhealth/telehealth/. Published 2015. Accessed January 1, 2017.
14. Whitten P, Buis L. Private payer reimbursement for telemedicine services in the United States. *Telemed e-Health*. 2007;13(1): 15-24.

15. Head BA, Keeney C, Studts JL, Khayat M, Bumpous J, Pfeifer M. Feasibility and acceptance of a telehealth intervention to promote symptom management during treatment for head and neck cancer. *J Support Oncol*. 2011;9(1): e1-e11.

16. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*. 2009;6(7): 873-880.

17. Hedges L, Olkin I. *Statistical Methods for Meta-Analysis*. Orlando: Academic Press; 1985.

18. Lipsey M, Wilson D. *Practical Meta-Analysis*. Thousand Oaks, CA: US: Sage Publications, Inc.; 2001.

19. Cohen J. Statistical Power Analysis. *Curr Dir Psychol Sci*. 1992;1(3): 98-101.

20. Shepherd L, Goldstein D, Whitford H, Thewes B, Brummell V, Hicks M. The utility of videoconferencing to provide innovative delivery of psychological treatment for rural cancer patients: Results of a pilot study. *J Pain Symptom Manage*. 2006;32(5): 453-461.

21. Harrison JD, Young JM, Solomon MJ, Butow PN, Secomb R, Masya L. Randomized pilot evaluation of the supportive care intervention “CONNECT” for people following surgery for colorectal cancer. *Dis Colon Rectum*. 2011;54(5): 622-631.

22. Hegel MT, Lyons KD, Hull JG, et al. Feasibility study of a randomized controlled trial of a telephone-delivered problem-solving – occupational therapy intervention to reduce participation restrictions in rural breast cancer survivors undergoing chemotherapy. *Psychooncology*. 2011;20: 1092-1101.

23. Ruland CM, Andersen T, Jeneson A, et al. Effects of an Internet support system to assist cancer patients in reducing symptom distress. *Cancer Nurs*. 2013;36(1): 6-17.

24. Ryhänen AM, Rankinen S, Siekkinen M, Saarinen M, Korvenranta H, Leino-Kilpi H. The impact of an empowering Internet-based Breast Cancer Patient Pathway program on breast cancer patients’ clinical outcomes: A randomised controlled trial. *J Clin Nurs*. 2013;22: 1016-1025.

25. Chumbler NR, Mkanta WN, Richardson LC, et al. Remote patient-provider communication and quality of life: empirical test of a dialogic model of cancer care. *J Telemed Telecare*. 2007;13: 20-25.

26. Berry DL, Hong F, Halpenny B, et al. Electronic self-report assessment for cancer and self-care support: Results of a multicenter randomized trial. *J Clin Oncol*. 2014;32(3): 199-205.

27. Pfeifer MP, Keeney C, Bumpous J, et al. Impact of a telehealth intervention on patients with head and neck cancer. *J Community Support Oncol*. 2015;13(1): 14-21.

28. Aboujaoude E, Salame W, Naim L. Telemental health: A status update. *World Psychiatry*. 2015;14: 223-230.

29. Agha Z, Schapira RM, Laud PW, McNutt G, Roter DL. Patient satisfaction with physician–patient communication during telemedicine. *Telemed e-Health*. 2009;15(9): 830-839.

30. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. *Br Med J*. 2000;320(June): 1517-1520.

31. Chong J, Moreno F. Feasibility and acceptability of clinic-based telepsychiatry for low-income Hispanic primary care patients. *Telemed e-Health*. 2012;18(4): 297-304.

32. Or CKL, Karsh B-T. A systematic review of patient acceptance of consumer health information technology. *J Am Med Informatics Assoc*. 2009;16(4): 550-560.

33. Agha Z, Schapira RM, Laud PW, McNutt G, Roter DL. Patient satisfaction with physician–patient communication during telemedicine. *Telemed e-Health*. 2009;15(9): 830-839.

34. Cella BDF, Tulsky DS, Gray G, et al. The Functional Assessment of Cancer Therapy Scale: Development and validation of the general measure. *J Clin Oncol*. 1993;11(3): 570-579.

35. Brady MJ, Cella DF, Mo F, et al. Reliability and validity of the Functional Assessment of Cancer Therapy-Breast quality-of-life instrument. *J Clin Oncol*. 1997;15(3): 974-986.

36. Ward W, Hahn E, Mo F, Hernandez L, Tulsky DS, Cella D. Reliability and validity of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C) quality of life instrument. *Qual Life Res*. 1999;8: 181-195.

37. Yoo HJ, Kim JC, Eremenco S, Han OS. Quality of life in colorectal cancer patients with colectomy and the validation of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C), Version 4. *J Pain Symptom Manage*. 2005;30(1): 24-32.

38. Ringash J, Bezjak A, O'Sullivan B, Redelmeier DA. Interpreting differences in quality of life: the FACT-H&N in laryngeal cancer patients. *Qual Life Res*. 2004;13: 725-733.

39. McCorkle R, Cooley ME, Shea JA. *A User's Manual for the Symptom Distress Scale*. http://fhsson.mcmaster.ca/apn/images/stories/pdfs/Symptom_Distress_Scale_user_manual.pdf. Published 2000. Accessed March 30, 2017.

40. Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Ann Med*. 2001;33(5): 328-336.

41. Ferrell BR, Grant M, Funk B, Garcia N, Otis-Green S, Schaffner MLJ. Quality of Life in Breast Cancer. *Cancer Pract*. 1996;4(6): 331-340.

42. Baldwin L-M, Cai Y, Larson EH, et al. Access to cancer services for rural colorectal cancer patients. *J Rural Heal*. 2008;24(4): 390-399.

43. Hilty DM, Ferrer DC, Parish MB, Johnston B, Callahan EJ, Yolowlees PM. The effectiveness of telemental health: A 2013 review. *Telemed e-Health*. 2013;19(6): 444-454.

44. De Haes JCJM, Van Knippenberg FCE. The quality of life of cancer patients: a review of the literature. *Soc Sci Med*. 2002;20(8): 809-817.

45. Heydarnejad MS, Hassanpour D a, Solati DK. Factors affecting quality of life in cancer patients undergoing chemotherapy. *Afr Health Sci*. 2011;11(2): 266-270.

46. Üstündag S, Zencirci AD. Factors affecting the quality of life of cancer patients undergoing chemotherapy: a questionnaire study. *Asia-Pacific J Oncol Nurs*. 2015;2(1): 17-25.