

# Telehealth Interventions for Supportive Management and Early Recognition of Treatment-Related Symptoms in Patients With Hematologic Malignancies

CHASITY YAJIMA, MSN, APRN, FNP-C, AOCNP®, CHRISTI BOWE, DNP, APRN, ANP-C, NPD-BC, CPHQ, DIANE BARBER, PhD, APRN, ANP-BC, AOCNP®, FAANP, FAAN, and JOYCE DAINS, DrPH, JD, APRN, FNP-BC, FAANP, FAAN

From The University of Texas MD Anderson Cancer Center, Houston, Texas

Authors' disclosures of conflicts of interest are found at the end of this article.

Correspondence to: Chasity Yajima, MSN, APRN, FNP-C, AOCNP®, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, TX 77030.

E-mail: [clidom@mdanderson.org](mailto:clidom@mdanderson.org)

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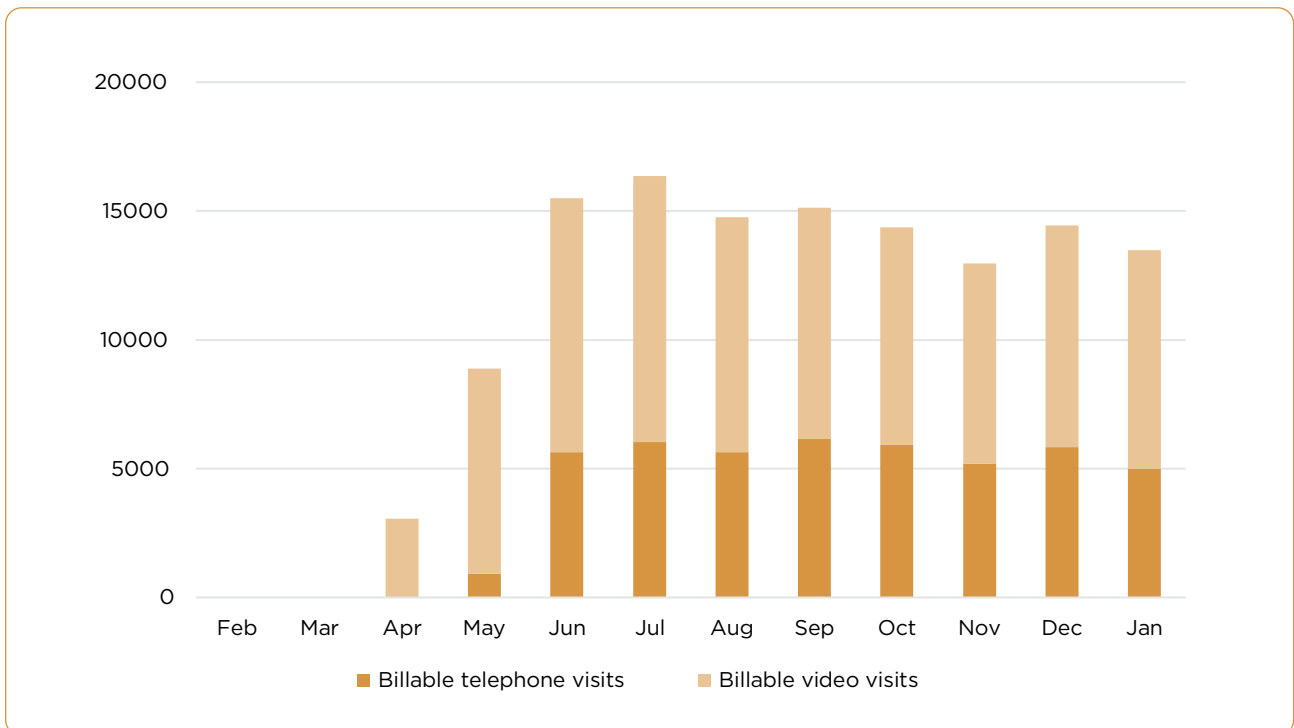
## Abstract

**Purpose:** The purposes of this literature review were to (1) establish the utility of supportive telehealth interventions focusing on early identification of treatment-related symptoms in adult patients with hematologic malignancies, with a secondary aim to (2) evaluate acceptability and feasibility. **Methods:** A literature review was conducted using PubMed, Cochrane Database of Systematic Reviews, CINAHL, Scopus, and Embase. Dates searched were from January 2007 through December 2019. Inclusion criteria included a diagnosis of hematologic malignancy, incorporation of telehealth interventions, effects on physiological outcomes, and participants ages 18 or older. Articles were excluded if they were a duplicate, had an irrelevant title, or were an incomplete study. **Results:** Results indicated overall utility, acceptability, and feasibility of the interventions, including improved awareness of late and long-term therapy-related sequelae in survivorship, an overall decline in the number of chemotherapy delays with decreased rates in dose reductions, a means to further manage exercise remotely, and finally, improved communication between provider and patient with real-time management of acute and chronic treatment-related side effects using supportive telemetric interventions. **Conclusion:** Overall, the use of telehealth interventions in adult patients with hematologic malignancies positively impacts patient health, and telehealth interventions were found to be both accepted and feasible. Future studies should be directed at the role and involvement of the advanced practitioner, and current literature calls for well-planned studies as methodologic limitations remain in the evidence.

Across the globe, as we work to navigate through the COVID-19 pandemic and adapt to the changing landscape of health-care delivery, providers are searching for ways to continue to provide high-quality care to patients, without compromising the health and safety of the public. To do this, the utilization of telehealth applications is being explored and fast tracked into practice, with particular interest on virtual visits. In one institution alone, billable telehealth visits prior to the pandemic were not being performed. Between April 1, 2020, and January 31, 2021, the number of billable telehealth visits was calculated at 128,907, including both telephone and video visits (Figure 1). Additionally, electronic solutions, such as telehealth, can improve access to care, provide support, and promote positive patient outcomes. The term “telehealth,” which can be interchanged with the term “telemedicine,” is defined as the use of telecommunication technologies and electronic information to support patient health-related education, remote monitoring, long-distance clinical health care, and adjuvant supportive therapies (Balestra, 2018).

Telehealth methodologies may include, but are not limited to, real-time audio-video and telecommunication tools, mobile device applications, web-based health-related educational resource tools, and wireless electronic patient data collection devices. Inadequate broadband services has been a logistical barrier to the deployment of telemetric services; however, 75% of Americans were reported to have access to wireless broadband services in recent years (Pew Research Center, 2019). Those who are less likely to have access to broadband services are racial minorities, rural residents, older adults, and individuals with lower levels of education (Pew Research Center, 2019). In this setting, one in five Americans without broadband internet services will use smartphones to access the internet (Pew Research Center, 2019). Overall, internet usage has increased. In the early 2000s, roughly half of Americans used the internet. By 2019, 90% of Americans were internet users (Pew Research Center, 2019).

Telehealth has been successfully utilized in a variety of patient populations, such as in family medicine and in solid tumor malignancies; however, it has not been extensively studied in patients with hematologic malignancies. This population



**Figure 1.** Billable telehealth visits by visit type February 2020 to January 2021.

remains at an increased risk for treatment-related acute and chronic side effects, and in a more recent study, adult patients with a hematologic malignancy and a concurrent COVID-19 infection were found to have a 34% risk of mortality (Vijenthira et al., 2020). Prevention, early identification of side effects, and supportive monitoring are essential in the management of this population. Telehealth may be a means to facilitate both early identification and remote monitoring; however, the most effective approach to remote monitoring that yields the best patient outcomes is not fully understood. The primary purpose of this review was to establish the utility of supportive telehealth interventions in the early identification and monitoring of treatment-related symptoms in adult patients with hematologic malignancies, with a secondary aim to evaluate the acceptability and feasibility of the interventions in this population.

## METHODS

A literature search was conducted with the assistance of a research librarian. Databases included PubMed, Cochrane Database of Systematic Reviews, CINAHL, Scopus, and Embase. The literature search generated 3,825 articles, from which nine articles were selected based on inclusion and exclusion criteria (Figure 2).

Inclusion criteria included English language publications from January 2007 through December 2019. Participants in the studies had to have a diagnosis of a hematologic malignancy and were aged 18 years or older. Included studies had to identify physiological side effects from cancer therapy that were addressed by a telehealth intervention. Studies were excluded if they were a duplicate, had an irrelevant title, or were a protocol or interim analysis.

## RESULTS

A total of nine articles were reviewed, including two randomized control trials (RCT), two pilot RCTs, three prospective cohort studies, one descriptive study, and one observational study (Table 1). Telehealth interventions included real-time audio-video communication tools, as well as mobile device applications, web-based health-related educational resource tools, and wireless electronic patient data collection devices. Although the stud-

ies varied in focus, scope, and specific telehealth intervention, common criteria for evaluation of the intervention included utility, acceptability, and feasibility, which serve as the framework for this review (Table 2).

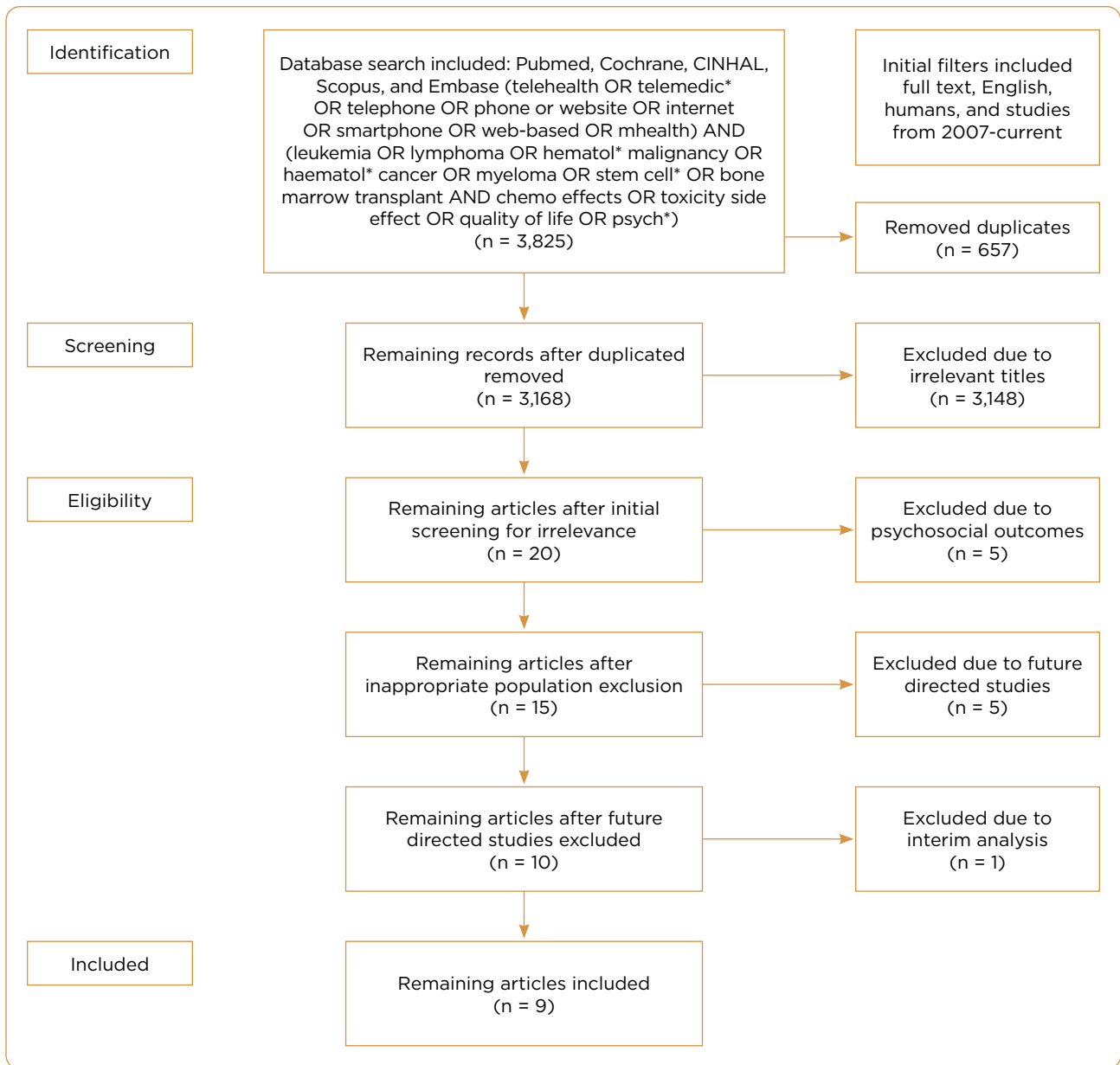
Utility is conceptualized as the overall effectiveness of the telehealth interventions as measured by an overall decline in the number of chemotherapy delays with decreased rates in dose reductions, timely identification and treatment toxicity management, improvements in nutritional status and remote exercise management, and improved awareness of late and long-term adverse effects in survivorship. Utility was addressed in eight of the nine studies. Acceptability is defined as the participants' willingness to integrate the intervention into their medical care as measured by structured interviews, postintervention surveys and questionnaires. Acceptability was addressed in four of the nine studies. Feasibility is defined as the ease in ability to incorporate the telehealth interventions into medical care and was measured using various metrics, including adherence, attrition rates, retention, number of adverse events, and follow-up. Feasibility was addressed in seven of the nine studies.

### Utility

Utility was addressed in eight of the nine studies (Compaci et al., 2011; Frick et al., 2018; Guihot et al., 2007; Louzada et al., 2018; Somers et al., 2018; Vallerand et al., 2018; Ysebaert et al., 2019).

*Chemotherapy Delays and Dose Reductions.* Interventions in this subsection included mobile-based planned telephone consultations throughout chemotherapy cycles. Fewer delayed treatments and dose reductions in chemotherapy were reported in three of the studies (Compaci et al., 2011; Louzada et al., 2018; Ysebaert et al., 2019).

Compaci and colleagues (2011) conducted a noncomparative prospective study of 100 diffuse large B-cell lymphoma (DLBCL) participants undergoing active chemotherapy treatment in France, and showed an overall lower incidence of delayed treatment, with 97 participants receiving planned cycles. Only 6% had a treatment delay, with a mean of 10.1 days. This study involved the use of planned telephone calls led by oncology nurses directed towards early identification and



**Figure 2.** PRISMA flow diagram.

management of acute treatment-related side effects. Patients were monitored in this trial over a 3-year period. A total of 92% of participants underwent relative dose intensity (RDI), which is used as an index of chemotherapy intensity, calculated by a ratio of actual dose intensity to the dose designed for that specific protocol (Yamaguchi et al., 2011). Two participants received reductions of 10% to 20%, and no patient had a dose reduction of higher than 20%. In other words, RDI can be described as the planned therapeutic chemotherapy doses a patient has received over

a period. Collectively, mean dose reduction was lowest at 6.2%. There were no participants with a calculated RDI < 80%.

Louzada and colleagues (2018) conducted a descriptive prospective cohort study of seven Hodgkin lymphoma participants undergoing chemotherapy with doxorubicin, bleomycin, vinblastine, and dacarbazine (ABVD) who received preplanned, oncology nurse-led phone calls throughout their chemotherapy cycles. The aim of this study was to identify prevalence and severity scores of patients' signs and symptoms during set points of their treat-

**Table 1. Studies Examining Telehealth Interventions in Hematologic Patients**

Author	Evidence type	Study details	Telehealth application	Study findings	Limitations
Breen et al. (2017)	Descriptive	<ul style="list-style-type: none"> <li>N = 17</li> <li>Non-Hodgkin lymphoma patients</li> <li>Peter MacCallum/Cancer Center, Victoria, Australia</li> </ul>	<ul style="list-style-type: none"> <li>Smartphone application</li> </ul>	<ul style="list-style-type: none"> <li>Easy to use, provided reassurance and empowerment, increased health awareness, adherence to self-care, promoted timely clinical intervention, and improved recall of side effects.</li> <li>Improved communication between patient and provider.</li> </ul>	<ul style="list-style-type: none"> <li>Qualitative study. Future RCTs are needed to ascertain quantitative data regarding health outcomes.</li> <li>Small sample size, limiting generalizability of the population.</li> <li>System limitations: Participants felt that the 3-point scale for recording side effects should be expanded to accurately report their symptoms. 2 patients inaccurately reported symptoms to avoid or create an alert to the nurse.</li> </ul>
Compaci et al. (2011)	Noncomparative prospective study	<ul style="list-style-type: none"> <li>N = 100</li> <li>Diffuse large B-cell lymphoma patients receiving active treatment</li> <li>Toulouse, France</li> </ul>	<ul style="list-style-type: none"> <li>Oncology nurse-led telephone calls</li> </ul>	<ul style="list-style-type: none"> <li>Grade 1 interventions in 950 cases and grade 2 interventions seen in 39 cases.</li> <li>Lower incidence of secondary hospitalizations (6%), delayed treatment (6%), reduced RDI (no patient with RDI &lt; 80%), toxic death (0%), and red blood cell transfusion (13%) compared to current literature.</li> </ul>	<ul style="list-style-type: none"> <li>Was not a comparative study</li> <li>p-value was not assessed</li> </ul>
Frick et al. (2018)	Cohort observational study	<ul style="list-style-type: none"> <li>N = 964</li> <li>Hodgkin and non-Hodgkin lymphoma survivors</li> <li>Abramson Cancer Center of the University of Pennsylvania, United States</li> </ul>	<ul style="list-style-type: none"> <li>Web-based SCP tool</li> </ul>	<ul style="list-style-type: none"> <li>Late effects reported: radiation and chemotherapy sequelae, thyroid dysfunction, speaking and/or swallowing changes, pulmonary fibrosis/pneumonitis, heart disease, chronic fatigue, neurocognitive decline, neuropathy, sexual changes, and secondary breast and skin cancers.</li> <li>66% of users reported intent to share SCP with health team.</li> </ul>	<ul style="list-style-type: none"> <li>Nonrandomized study</li> <li>Survivors treated with outdated chemotherapy and RT regimens now replaced by less toxic treatment plans leading to heterogeneity in the population and side effects reported.</li> <li>SCP tool did not inquire about RT dosing and administration, limiting conclusions of patient-reported toxicity.</li> </ul>

Note. AMA = ambulatory medical assistance; SCP = survivorship care plan; HSCT = hematopoietic stem cell transplant; EC = extended care; TCE = telephone counseling exercise; SDE = self-directed exercise; MBGDadj = mean-adjusted between-group difference; RDI = relative dose intensity; PFS = progression-free survival; OS = overall survival; MSAS = Memorial Symptom Assessment Scale; PCST = pain coping skills training; UC = usual care; 2MWT = 2-minute walk test; LONIPCS = late-onset noninfectious pulmonary complications; MMF = mycophenolate mofetil.

 Continued on following page

**Table 1. Studies Examining Telehealth Interventions in Hematologic Patients (cont.)**

Author	Evidence type	Study details	Telehealth application	Study findings	Limitations
Guihot et al. (2007)	Prospective single-arm cohort study	<ul style="list-style-type: none"> <li>N = 37</li> <li>Allogeneic HSCT survivors</li> <li>Paris, France</li> </ul>	Electronic portable spirometry device	<ul style="list-style-type: none"> <li>13 episodes of spirometric deterioration detected by telemetry in 11 patients.</li> <li>8 episodes in 7 patients were seen.</li> <li>5 episodes improved and 3 stabilized with increased immunosuppressive therapy.</li> <li>Of 7 patients with LONIPC, 1 successfully stopped immunosuppressive therapy, 2 were receiving low dose MMF, and four were receiving low-dose corticosteroids.</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size with authors concluding an inability to identify statistically significant factors.</li> <li>Nonrandomized and single-arm study.</li> </ul>
Hung et al. (2014)	Pilot double-arm nonblinded RCT	<ul style="list-style-type: none"> <li>N = 37</li> <li>Autologous SCT survivors</li> <li>The Wesley Hospital, Brisbane, Australia</li> </ul>	Telephone counseling	<ul style="list-style-type: none"> <li>Clinically important increases in protein intake (<math>p = .165</math>), cognitive functioning (<math>p = .337</math>), and social functioning (<math>p = .165</math>) compared with UC.</li> <li>Less weight loss in EC vs. UC (<math>p = .062</math>).</li> <li>Physical activity was not significantly different between the groups.</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size</li> <li>Low adherence rate through telephone outlet.</li> <li>Limited to telephone intervention, could consider alternate media to promote adherence (e.g., video conferencing).</li> <li>Unable to monitor home exercise adherence.</li> <li>Short intervention interval.</li> </ul>
Louzada et al. (2018)	Descriptive, prospective cohort study	<ul style="list-style-type: none"> <li>N = 7</li> <li>Hodgkin lymphoma</li> <li>Federal University of Sao Paulo, Sao Paulo State, Brazil</li> </ul>	Oncology nurse-led telephone calls	<ul style="list-style-type: none"> <li>286 telephone calls, generating 1,870 symptomatic complaints.</li> <li>Prevalent complaints included fatigue, nausea, vomiting, distress, and lack of appetite.</li> <li>Rapid identification of symptoms and symptom management.</li> <li>Increase in nausea and vomiting as cycles progressed (<math>p = .02</math>), decrease in fatigue and shortness of breath (<math>p \leq .03</math>), improvement in sleep (<math>p = .02</math>), and decrease in stress (<math>p = .02</math>).</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size.</li> <li>Study restricted to only reviewing prevalence and severity of symptoms.</li> </ul>

*Note.* AMA = ambulatory medical assistance; SCP = survivorship care plan; HSCT = hematopoietic stem cell transplant; EC = extended care; TCE = telephone counseling exercise; SDE = self-directed exercise; MBGDadj = mean-adjusted between-group difference; RDI = relative dose intensity; PFS = progression-free survival; OS = overall survival; MSAS = Memorial Symptom Assessment Scale; PCST = pain coping skills training; UC = usual care; 2MWT = 2-minute walk test; LONIPCs = late-onset noninfectious pulmonary complications; MMF = mycophenolate mofetil.



**Table 1. Studies Examining Telehealth Interventions in Hematologic Patients (cont.)**

Author	Evidence type	Study details	Telehealth application	Study findings	Limitations
Somers et al. (2018)	Pilot randomized control trial, two-arm study	<ul style="list-style-type: none"> <li>N = 36 (33 completed the study)</li> <li>HSCT survivors</li> <li>Duke University Medical Center, United States</li> </ul>	Web-based mobile videoconferencing	<ul style="list-style-type: none"> <li>Acceptability: Participants enjoyed and appreciated videoconferencing interactions with the therapist.</li> <li>Pain severity: Higher baseline pain severity in those who did not complete study (<math>p = .03</math>).</li> <li>Pain disability: greater improvements in intervention group (<math>d = .79</math>).</li> <li>Pain self-efficacy: greater improvements in intervention group (<math>d = .61</math>).</li> <li>Fatigue: greater improvements in intervention group (<math>d = .94</math>).</li> <li>2MWT: greater improvements in intervention group (<math>d = .66</math>).</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size and single institution with short follow-up.</li> <li>Study used iPad, requiring data plans or internet connection to be able to use the videoconferencing with the therapist. Future work is looking to make the program accessible and inclusive to all possible devices.</li> </ul>
Vallerand et al. (2018)	Two-arm blinded RCT	<ul style="list-style-type: none"> <li>N = 51</li> <li>Leukemia, Hodgkin lymphoma, and non-Hodgkin lymphoma survivors</li> <li>Alberta, Canada</li> </ul>	Telephone counseling	<ul style="list-style-type: none"> <li>Increased weekly aerobic exercise by 218 min compared to 93 min in the control group (<math>p &lt; .001</math>).</li> <li>Increased moderate intensity minutes (<math>p = .007</math>), and vigorous intensity minutes (<math>p = .004</math>) compared to control group.</li> <li>92% achieved recommended goals for increasing weekly aerobic exercise by at least 60 min, compared with only 48% in control group (<math>p = .001</math>).</li> <li>Clinically meaningful improvements in quality of life (<math>p = .08</math>) and mental health component subscales (<math>p = .10</math>).</li> </ul>	<ul style="list-style-type: none"> <li>Unrepresentative, small sample size.</li> <li>Self-reported exercise measures with a lack of physical and fitness health measures.</li> <li>Short intervention duration with a lack of long-term follow-up, and no contact control group.</li> </ul>
Ysebaert et al. (2019)	Multicenter phase III double-arm RCT	<ul style="list-style-type: none"> <li>N = 60</li> <li>CLL patients receiving fludarabine-cyclophosphamide-rituximab</li> <li>Toulouse, France</li> </ul>	Oncology nurse-led telephone calls	<ul style="list-style-type: none"> <li>RDI &lt; 80% reported in 31% of patients, shortening PFS (median 26 months vs. not reached <math>p = .021</math>) and OS to 3 years (100% vs 70%, <math>p = .0089</math>).</li> <li>Intervention group resulted in RDI &lt; 80% of 20.7% vs. 41.4% in control group (<math>p = .09</math>).</li> <li>Rates of infections and febrile neutropenia were found to be higher in the intervention group vs. the control.</li> </ul>	<ul style="list-style-type: none"> <li>Limited sample size; however, patient characteristics measured through a Chi-square test <math>p</math> value showed variability in the sample.</li> <li>Limited sustainability past 3 years.</li> </ul>

Note. AMA = ambulatory medical assistance; SCP = survivorship care plan; HSCT = hematopoietic stem cell transplant; EC = extended care; TCE = telephone counseling exercise; SDE = self-directed exercise; MBGDadj = mean-adjusted between-group difference; RDI = relative dose intensity; PFS = progression-free survival; OS = overall survival; MSAS = Memorial Symptom Assessment Scale; PCST = pain coping skills training; UC = usual care; 2MWT = 2-minute walk test; LONIPCs = late-onset noninfectious pulmonary complications; MMF = mycophenolate mofetil.

**Table 2. Results Summary**

Study	Utility	Acceptability	Feasibility
Breen et al. (2017)	NA	<ul style="list-style-type: none"> <li>Application found to be reassuring, sense of shared responsibility, educational</li> <li>1 participant found app to be overwhelming if introduced right after diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>Utilized for chemotherapy education</li> <li>Aided in symptom recall</li> <li>System ease of use and functional</li> </ul>
Compaci et al. (2011)	<ul style="list-style-type: none"> <li>97% received planned chemotherapy cycles</li> <li>92% received planned RDI</li> <li>RDI &lt; 80% = 0</li> <li>↓ Secondary hospitalizations</li> <li>↓ RBC infusions</li> </ul>	NA	<ul style="list-style-type: none"> <li>Patients were on time for planned calls and accepted allotted time limit</li> <li>An estimated 1.5 hr saved for the provider per patient due to preplanned nursing interventions</li> </ul>
Frick et al. (2018)	<ul style="list-style-type: none"> <li>Identification and prevalence of long-term treatment sequelae in lymphoma survivors</li> </ul>	<ul style="list-style-type: none"> <li>Found to have the right amount of information</li> <li>84% reported the SCP as excellent, very good, or good</li> <li>40% suggested a more detailed care plan</li> <li>Only 1% thought the SCP was not relevant to their care</li> </ul>	<ul style="list-style-type: none"> <li>Deemed an efficient method for survivorship data collection</li> <li>66% of participants reported they would use their SCP with their health-care team</li> </ul>
Guihot et al. (2007)	<ul style="list-style-type: none"> <li>Provided early diagnosis and intervention for LONIPC</li> <li>Median time to diagnosis 11 months post-transplant</li> <li>8 episodes of LONIPC diagnosed through telemetric monitoring, 3 were asymptomatic on diagnosis</li> </ul>	NA	<ul style="list-style-type: none"> <li>Minimal device technical difficulties</li> <li>Study ended for 9 patients due to lack of compliance, 2 moved out of the area</li> <li>Those diagnosed with pulmonary deterioration continued to use the device</li> <li>Satisfactory cooperation with good reproducibility of flow-volume curves</li> </ul>
Hung et al. (2014)	<ul style="list-style-type: none"> <li>↓ Fat loss</li> <li>↑ Protein intake</li> <li>↑ Cognitive functioning</li> <li>↑ Social functioning</li> </ul>	NA	<ul style="list-style-type: none"> <li>↓ Adherence, 47% completed 3/5 scheduled phone calls</li> <li>Interventions were found to be safe</li> </ul>
Louzada et al. (2018)	<ul style="list-style-type: none"> <li>No delays seen throughout chemotherapy cycles</li> <li>Toxicity identification</li> <li>↑ N/V as cycles progressed</li> <li>Improved sleep as cycles progressed</li> <li>↓ Fatigue, SOB, stress as cycles progressed</li> </ul>	NA	NA
Somers et al. (2018)	<ul style="list-style-type: none"> <li>↑ Pain in participants who did not complete video sessions</li> <li>↓ Pain disability</li> <li>↑ Pain self-efficacy</li> <li>↓ Fatigue</li> <li>↑ 2MWT</li> </ul>	<ul style="list-style-type: none"> <li>CSQ reported satisfaction between patient-provider interaction, and skills taught were well received</li> </ul>	<ul style="list-style-type: none"> <li>Attrition rate low: 8%</li> <li>↑ Adherence to videoconferencing sessions</li> </ul>

*Note.* RDI = relative dose intensity, PFS = progression-free survival; LONIPC = late-onset noninfectious pulmonary complications; 2MWT = 2-minute walk test; RBC = red blood cell; N/V = nausea and vomiting; QOL = quality of life; SCP = survivorship care plan; CSQ = client satisfaction survey; AMA = ambulatory patient medical assistance.



**Table 2. Results Summary (cont.)**

Study	Utility	Acceptability	Feasibility
Vallerand et al. (2018)	<ul style="list-style-type: none"> <li>• ↑ Weekly aerobic exercise</li> <li>• ↑ Moderate intensity minutes</li> <li>• ↑ Vigorous intensity minutes</li> <li>• 92% intervention group achieved exercise goals, compared to 48% control</li> <li>• ↑ QOL</li> </ul>	<ul style="list-style-type: none"> <li>• 92% preferred telephone counseling</li> <li>• 1 suggested email</li> <li>• 1 suggested in-person</li> <li>• 96% satisfied with length of duration of program</li> <li>• 92% satisfied with weekly calls</li> </ul>	<ul style="list-style-type: none"> <li>• No adverse events</li> <li>• Follow-up 100%</li> <li>• ↑ Adherence rate, 93% completed weekly sessions</li> </ul>
Ysebaert et al. (2019)	<ul style="list-style-type: none"> <li>• AMA reduced risk of ↓ RDI</li> <li>• RDI &lt; 80% was 31% shortening PFS</li> <li>• RDI 20.7% intervention</li> <li>• RDI 41.4% in control</li> <li>• ↑ Infections, febrile neutropenia</li> </ul>	NA	NA

Note. RDI = relative dose intensity, PFS = progression-free survival; LONIPC = late-onset noninfectious pulmonary complications; 2MWT = 2-minute walk test; RBC = red blood cell; N/V = nausea and vomiting; QOL = quality of life; SCP = survivorship care plan; CSQ = client satisfaction survey; AMA = ambulatory patient medical assistance.

ment. The study was conducted between November 2015 through February 2017. This information was obtained to assist in the prediction and early identification of symptoms, as well as timely symptom management and rapid communication between the oncology team and the patient. No delays in therapy were seen throughout cycles.

Ysebaert and colleagues (2019) reported findings from a multicenter phase III double-arm RCT of 60 patients with chronic lymphocytic leukemia receiving fludarabine-cyclophosphamide-rituximab (FCR) in France. The trial had a median follow-up time of 3 years. This was an oncology nurse-led intervention, using planned telephone calls focused on alleviating adverse events and supporting patient adherence, compared with standard care. The ambulatory patient medical assistance (AMA) intervention program was found to be a protective factor and reduced the risk of lowering RDI ( $p = .04$ ). Ysebaert and colleagues (2019) reported shortened progression-free survival (PFS) in both the intervention and control groups when RDI dropped below 80%, with a total of 31% of participants with RDI of < 80%. Unlike in the Compaci and colleagues (2011) study, some participants in the intervention group did experience RDI < 80% (20.7%) but were significantly fewer than in the control group (41.4%,  $p = .09$ ).

*Symptom Identification and Management.* Six of the nine studies addressed symptom identification and management (Compaci et al., 2011; Frick

et al., 2018; Guihot et al., 2007; Louzada et al., 2018; Somers et al., 2018; Ysebaert et al., 2019).

When comparing rates to similar patient populations not involving telehealth interventions, Compaci and colleagues (2011) reported a 6% prevalence in secondary hospitalizations as compared with 22% in a similar study by Bosly and colleagues (2008) and 29% in the Salar and colleagues (2009) study. Fewer red blood cell transfusions were also seen, which involved 13% in the Compaci and colleagues study as compared with 32% in Bosly and colleagues (2008) and 47% in Pfreundschuh and colleagues (2008). The authors concluded that this was likely due to a tighter control of hemoglobin count with recombinant erythropoietin (Compaci et al., 2001).

Frick and colleagues (2018) conducted a cohort observational study of 964 participants, using an internet-based survivorship care plan (SCP) tool to allow survivors of Hodgkin and non-Hodgkin lymphoma to input data regarding experienced toxicities and survivorship care. This study was ongoing between 2011 through 2016. The tool was designed to take an adaptive approach to each patient and generated questions based off previous responses throughout data collection. These reports generated an SCP tailored to the individual, which was then provided to the patient. The SCP could be utilized to improve understanding of symptom prevalence, awareness of late and long-term therapy-related sequelae, and provide

improvement in communication between survivors and their providers. Overall, 66% of users reported they intended to share the SCP with their health-care team.

Guihot and colleagues (2007) conducted a prospective single-arm cohort study of 37 allogeneic hematopoietic stem cell transplant (SCT) survivors, roughly 3 months status post transplant, undergoing telemetric spirometry monitoring with an electronic portable home spirometry device. Data were transmitted twice per week to a central computer at a respiratory function testing laboratory via landline telephone and an individual modem unit. This study was conducted over a 2.5-year period. A key outcome was early detection of pulmonary deterioration. Additionally, use of the telemetric home spirometry Spirotel device improved detection of late-onset noninfectious pulmonary complications (LONIPC) and provided early diagnosis of LONIPC at a median time of 11 months post allogeneic stem cell transplant. The Spirotel telemetric device was able to detect early-onset spirometric deterioration, even in some cases of asymptomatic patients, promoting early initiation of further pulmonary workup and treatment.

In the Louzada and colleagues' (2018) descriptive study of seven Hodgkin lymphoma participants, nurses were able to track and identify specific chemotherapy side effects throughout treatment cycles with the use of a symptom measuring scale (MD Anderson Symptom Inventory [MDASI]-core tool). Using the instrument with the planned nurse telephone calls allowed early identification, rapid communication, and timely intervention for symptoms.

Somers and colleagues (2018) conducted a pilot RCT two-arm study that incorporated a web-based mobile videoconferencing protocol vs. usual care among 33 SCT survivors from Duke University Medical Center. The mobile health protocol addressed skill training, coping, and specific pain, and psychosocial challenges. Additionally, the protocol included six, 50-minute sessions that were delivered over a 6-to-10-week period, with the initial visit in person to establish a patient therapist relationship. Remaining visits were scheduled via videoconferencing through an iPad or Skype. Participants who did not complete the video confer-

encing pain clinic program reported higher pain severity at baseline compared with those who completed interventions (mean score of 6.17 vs. 3.14; Mann-Whitney  $U = 13.50$ ,  $p = .03$ ). The effect sizes in the intervention group suggested participants experienced greater improvements in pain disability ( $d = 0.79$ ), pain self-efficacy ( $p = 0.03$ ,  $d = .61$ ), fatigue ( $d = .94$ ), and the 2-minute walk test (2MWT;  $p = .03$ ,  $d = .66$ ).

In the multicenter study in France, Ysebaert and colleagues (2019) reported higher rates of infections and febrile neutropenia in the intervention group vs. the control group. This was thought to be due to earlier recognition of symptoms and more frequent reporting with the planned nurse telephone calls.

*Nutritional Status and Exercise Management.* Hung and colleagues (2014) recruited 37 autologous stem cell transplant (SCT) survivors from Australia to participate in an RCT involving telephone counseling covering nutrition and exercise support. Towards the end of the 12-week home-based exercise and nutritional support program, clinically important levels of increased protein intake were seen in those involved with the intervention (14.7 g; 95% confidence interval [CI] =  $-6.5$ – $35.9$ ;  $p = .165$ ). Additionally, from preadmission to 100 days post transplant, the intervention group experienced less weight loss ( $-3.3$  kg; 95% CI =  $-6.7$ – $0.2$ ;  $p = .062$ ). Statistically significant levels of less fat loss were also seen in the group receiving the remote counselling compared with usual care ( $p = .030$ ). Clinically significant levels of cognitive functioning (7.2; 95% CI =  $-7.9$ – $22.2$ ;  $p = .337$ ) and social functioning (16.5; 95% CI =  $-7.3$ – $40.3$ ;  $p = .165$ ) were seen compared with usual care; however, these were not statistically significant.

Vallerand and colleagues (2018) conducted a 3-month two-arm blinded RCT of 51 leukemia, Hodgkin, and non-Hodgkin lymphoma survivors from Alberta, Canada. The majority (78%) of participants were 5 years post diagnosis, with the remaining 22% less than 5 years from diagnosis. The intervention involved remote telephone nutrition and exercise counseling. The telephone counseling exercise (TCE) group increased their weekly aerobic exercise by 218 minutes vs. 93 minutes in usual care (95% CI =  $65$ – $213$ ;  $p < .001$ ;  $d = 2.19$ ). Increased levels of moderate inten-

sity minutes in the intervention group (adjusted mean between-group difference [MBGDadj] = 56; 95% CI = 16–97;  $p = .007$ ;  $d = 1.23$ ), as well as increased levels in vigorous intensity minutes (MBGDadj = 39; 95% CI = 13–65;  $p = .004$ ;  $d = 1.86$ ) were seen as compared with the control group (Vallerand et al., 2018). Additionally, 92% of the TCE group achieved recommended goals for increasing weekly aerobic exercise by at least 60 minutes, compared with only 48% in control group ( $p = .001$ ; relative risk = 1.9; Vallerand et al., 2018). Clinically meaningful improvements were seen in quality of life, favoring the TCE group for mental health (MBGDadj = 3.7; 95% CI = -0.4–7.9;  $p = .08$ ;  $d = .42$ ) and mental health component subscales (MBGDadj = 3.6; 95% CI = -0.8–8.1;  $p = .10$ ;  $d = .35$ ; Vallerand et al., 2018).

### Acceptability

Overall, four of the nine studies addressed the acceptability of telehealth interventions (Breen et al., 2017; Frick et al., 2018; Somers et al., 2018; Vallerand et al., 2018).

In a descriptive study of 17 non-Hodgkin lymphoma participants from Australia receiving chemotherapy, Breen and colleagues (2017) specifically examined the acceptability of implementing a mobile phone application into care. The application was introduced prior to the first cycle of chemotherapy and the trial was ongoing over a period of three chemotherapy cycles. The Advanced Symptom Management System Haematology (ASyMS-H) was designed to allow participants to enter specific side effects throughout cycles, which would then trigger alerts to the primary team if data exceeded certain thresholds. The application also incorporated educational and evidence-based self-care strategies that were used to inform as well as collect data from users. Patients found the mobile device app to be reassuring, with a sense of security in supporting shared responsibility, as well as found the intervention to be educational. On postintervention interviews, participants reported that interventions were an important contributor to their overall safety, increased confidence and sense of security with shared care and communication between provider and patient, improved their overall compliance with self-care activities, including daily temperature monitoring,

and enhanced their understanding of their disease and treatment plan. Acceptability may be tied to the timing of the intervention, as one patient suggested not introducing the mobile app right after initial diagnosis due to feeling overwhelmed.

Internet-based SCP tools were found by survivors as having the right amount of information; however, 40% felt their care plans could be more detailed and did not contain enough information (Frick et al., 2018). Most reported that they would share these SCPs with their providers. There were 150 users who completed the post-survey questionnaire, revealing 126 who thought the SCP was good, very good, or excellent. Out of 51 participants who reported that they would not share their care plan, 15 individuals felt the care plan was not relevant to their care, and 14 thought their provider would not care for the information.

In the Somers and colleagues (2018) pilot of 33 SCT survivors, participants enjoyed the in-person as well as videoconferencing interactions with the therapist. Satisfaction with patient-provider interaction and skills taught throughout the intervention were well received and measured using a client satisfaction questionnaire (CSQ) in the post-treatment assessment. The questionnaire was found to have good reliability (Cronbach alpha = .96).

Vallerand and colleagues (2018) stated that 92% of the survivors in the leukemia, Hodgkin, and non-Hodgkin lymphoma study in Alberta, Canada, reported that the telephone counseling was their preferred method of communication. One suggested email, and another suggested in-person communication. Twenty-five of the twenty-six participants who received the intervention were satisfied with the length of duration of the program, with one suggesting a longer duration. Additionally, 92% were satisfied with weekly calls, with two participants who would have preferred biweekly calls.

### Feasibility

Feasibility was assessed in seven of the nine studies (Breen et al., 2017; Compaci et al., 2011; Frick et al., 2018; Guihot et al., 2007; Hung et al., 2014; Somers et al., 2018; Vallerand et al., 2018).

Breen and colleagues (2017) found the mobile app to be feasible in the prechemotherapy setting

for education of therapy-related side effects and self-care management. Feasibility was measured through a postintervention survey of ease of use and functionality. The intervention aided in symptom recall, and many patients reported they would be happy to continue reporting data in the application device throughout all chemotherapy cycles.

Nearly one third of phone calls in the Compaci and colleagues (2011) study resulted in significant changes to initial care plans, suggesting that providers cannot rely on primary care plans alone without likely needing modifications for supportive care. Additionally, oncology nurses managed and triaged grade 1 interventions without direct involvement from the oncologists, using preset written protocols. Assuming these interventions would have been made by the provider, an estimated 1.5 hours was saved per patient using a 10-minute phone call with the AMA intervention. Patients were on time for calls and accepted the allotted time frame for visits.

A web-based SCP tool in lymphoma survivorship was deemed a feasible and an efficient method for data collection (Frick et al., 2018). Of the 150 participants who completed follow-up surveys, 66% reported they would share their SCP with their health-care team, and 84% rated the information in the plan as good, very good, or excellent.

With appropriate teaching prior to implementation of an electronic spirometric device, Guihot and colleagues (2007) reported use of the device as feasible with overall good compliance and minimal technical difficulties. Feasibility was measured through adherence to the intervention, with a median of 17-month follow-up post transplantation. Attrition rates were at 29%, with two participants who moved away from the area and the study ending after 4.5 months for nine patients due to compliance issues; however, overall patient compliance and cooperation was reported as satisfactory with good reproducibility of flow-volume curves. Patients diagnosed with pulmonary function deterioration continued to use the equipment.

Hung and colleagues (2014) found that adherence to telephone counseling for nutrition and exercise support was low when based on preset criteria to complete at least three out of five phone calls. A majority (70%) of participants completed at least three of five nutrition follow-up calls

and 70% completed at least three of five exercise calls; however, when combining groups, only 47% completed at least three out of the five scheduled phone calls. Of these 47%, the intervention was found to be feasible and safe.

Somers and colleagues (2018) were able to measure feasibility by overall accrual, attrition rate, and adherence to planned videoconferencing sessions, which was promoted by reviewing previously planned assignments with the participants at the beginning of each session, development of action plans, and providing positive reinforcement. Overall attrition rate was low at 8%.

Feasibility in the Vallerand and colleagues (2018) study was assessed via adverse events, follow-up, retention, and adherence, and overall was found to be highly feasible. No adverse events occurred during the study, follow-up was calculated at 100% of participants through postintervention assessments, and retention and adherence were 93%, as calculated by the number of TCE sessions completed.

## DISCUSSION

Through implementation of a telehealth intervention, studies reported early detection of pulmonary deterioration, specific identification of symptom prevalence and severity throughout chemotherapy cycles, as well as symptom prevalence in survivorship patients. Decreased rates of unplanned chemotherapy dose reductions and delays were seen across several studies, impacting PFS and OS; however, no differences were seen past 3 years in one study, which prompts future studies to address sustainability of interventions. One study found the intervention to be more effective in the detection of adverse events, as reported higher rates of infections and febrile neutropenia were seen. The authors had concluded this to likely be due to the intervention's ability to capture more mild, although troublesome events, that may have otherwise been minimized (Ysebaert et al., 2019).

Although remote nutritional and exercise management studies resulted in improvements in fat and weight loss in the telehealth intervention group in both the Hung and colleagues (2014) and Vallerand and colleagues (2018) studies, the amount of weekly physical activity did not show



similar gains between the two. Participant completion of the telehealth intervention was substantially lower in the Hung and colleagues (2014) study, which may explain the difference.

The wide acceptance of telehealth interventions by participants, despite utilization of various modalities, suggests that the type of telehealth intervention is less important than having the intervention. Participants found interventions engaging, provided a sense of security, and were easy and convenient. They felt that the interventions contributed to their overall safety and were reassured by the close provider attention; however, the studies included only the adult patient population and specific age groups may have varied opinions and acceptability regarding telemetric monitoring interventions.

Extensive feasibility of the telehealth interventions was appreciated across the studies and found in one study to save an estimated 1.5 hours per patient for the provider due to preplanned nursing interventions through enactment of written protocols. Differing telehealth modalities were utilized and results may reflect participant preference for videoconferencing vs. telephone counseling; however, adherence rates continued to be high across all but one study. Although device difficulties were reported by only a handful or participants, this represents a potential downside to the use of remote monitoring. Choice of modality in the context of the digital environment, improvements in devices and technology, and increasing patient sophistication with use of electronic devices may address both access and utilization issues.

### Limitations

Inclusion in this review of studies with small sample sizes, limitation to the adult population, and variations in research methodology as well as telehealth modalities limit the generalizability of this review. Given the fast pace of development in digital technology, RCTs may not be the best approach to evaluate for effect (Osborn et al., 2019). Researchers run the risk of technology obsolescence given the fact that the average duration of an RCT is roughly 5.5 years (Pham et al., 2016). Various methodological frameworks have been created to effectively evaluate telehealth applica-

tions. One of these is the Continuous Evaluation of Evolving Behavioral Intervention Technologies (CEEBIT), which is a framework that addresses many RCT considerations, including inclusion/exclusion criteria to statistical analysis and is statistically powered to evaluate efficacy throughout trial duration, while matching the pace of evolving technology (Mohr et al., 2013). As this framework was designed for mobile device applications, there remains the need to evaluate additional frameworks to be able to measure effect in varying telehealth modalities. Additional limitations included noncomparison of telehealth applications head-to-head; therefore, it is unknown which application could potentially provide more positive patient outcomes.

### IMPLICATIONS FOR PRACTICE

The landscape of clinical practice is evolving as society continues to become a more digital culture. Telehealth interventions should be tailored to the patient, and barriers as well as educational limitations with technology should be assessed on a case-by-case basis. Several constraints and logistical barriers need to be addressed before these interventions can be used to their fullest potential in the hematologic malignancy patient subgroup. Issues of licensure and credentialing for cross-state practice, reimbursement, appropriate use of equipment, and development of peer-reviewed guidelines will also need to be addressed. Ultimately, supportive telehealth tools are likely associated with a positive impact in patients with hematologic malignancies, and a multidisciplinary team approach will be needed to implement these interventions.

The role of the advanced practitioner also needs further exploration in the clinical area involving telehealth interventions in hematologic malignancy patients. Only one study involved the skills of the advanced practitioner. Practitioners should also be aware of cultural competence and take into consideration any language, ethnicity, disability status, or age-related barriers that may interfere with a remote visit (Balestra, 2018). Additionally, individual patient preference for interventions and communication should be taken into consideration. When treating patients from a distance, it is imperative that advanced practitioners

be aware of the legal limitations of their practicing license. Currently, no compact license model for advanced practitioners that allows multistate practice exists. Until then, cross-state licensure, credentialing, privileging, as well as institutional policies and operational issues that include online prescribing, privacy, security, fraud, and abuse remain logistical barriers to telehealth interventions (American Hospital Association, 2019).

In 2019, Original Medicare began covering virtual check-ins across the country, connecting through phone and videoconferencing (Centers for Medicare and Medicaid Services, 2019). Additionally, since the COVID-19 pandemic, telehealth coverage has temporarily been expanded to allow for continued patient care and protection of the public; however, adaptations will need to be made across state and federal law during the post-COVID-19 era to maintain telehealth coverage in the long-term setting.

## CONCLUSION

Overall, the use of telehealth interventions in adult patients with hematologic malignancies positively impacts patient health with early symptom identification and management, remote nutritional support, and information gathering in the survivorship setting. Furthermore, telehealth interventions were found to be accepted and feasible. Future research, including incorporation of the role of the advanced practitioner, is needed before these interventions can be utilized to their fullest potential. ●

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## Disclosure

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