blood advances

American Society of Hematology
2021 L Street NW, Suite 900,
Washington, DC 20036
Phone: 202-776-0544 | Fax 202-776-0545
bloodadvances@hematology.org

Virtual frailty assessment for older adults with hematologic malignancies

Tracking no: ADV-2022-007188R2

Clark DuMontier (Brigham and Women's Hospital, United States) Tim Jaung (Dana-Farber Cancer Institute, United States) Nupur Bahl (Dana-Farber Cancer Institute, United States) Brad Manor (Harvard Medical School, United States) Marcia Testa (Harvard T.H. Chan School of Public Health, United States) Christina Dieli-Conwright (Harvard Medical School, United States) Dae Hyun Kim (Harvard Medical School, United States) Tammy Hshieh (Harvard Medical School, United States) Jane Ann Driver (Harvard Medical School, United States) Gregory Abel (Harvard Medical School, United States)

Abstract:

Conflict of interest: No COI declared

COI notes:

Preprint server: No;

Author contributions and disclosures: Design (all authors); data collection (N.B. and T.H.); data analysis (T.J.); data interpretation (all authors); manuscript preparation (all authors)

Non-author contributions and disclosures: No;

Agreement to Share Publication-Related Data and Data Sharing Statement: Data and protocol requests will be considered on a case by case basis and in accordance with the regulations of the Dana-Farber Harvard Cancer Center Office for Human Research Studies.

Clinical trial registration information (if any):

Virtual frailty assessment for older adults with hematologic malignancies

Clark DuMontier*, MD, MPH, New England Geriatric Research Education and Clinical Center, VA Boston Healthcare System; Brigham and Women's Hospital, Boston, MA

Tim Jaung, MS, Dana-Farber Cancer Institute, Boston, MA

Nupur E. Bahl, BA, Dana-Farber Cancer Institute, Boston, MA

Brad Manor*, PhD, Hinda and Arthur Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, MA

Marcia Testa, MPH, MPhil, PhD, Harvard T.H. Chan School of Public Health, Boston, MA

Christina M. Dieli-Conwright*, PhD, MPH, Dana-Farber Cancer Institute, Boston, MA

Dae Kim*, MD, ScD, MPH, Hinda and Arthur Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, MA

Tammy Hshieh* MD, MPH, Brigham and Women's Hospital, Dana-Farber Cancer Institute, Boston, MA

Jane A. Driver* MD, MPH, Geriatrics and Extended Care, VA Boston Healthcare System; Brigham and Women's Hospital, Boston, MA

Gregory A. Abel* MD, MPH, Dana-Farber Cancer Institute, Brigham and Women's Hospital, Boston, MA

**Harvard Medical School, Boston, MA*

Word Count: 1238 Tables: 2 Supplemental Files: 1

Keywords: Virtual assessment, telehealth, frailty, geriatric oncology, geriatric hematology

Prior publication: Preliminary results of this study were presented at the American Geriatrics Society Annual Meeting 2021 and at the American Society of Hematology Annual Meeting 2021.

Corresponding author:

Gregory A. Abel, MD, MPH

Director, Older Adult Hematologic Malignancy Program

Dana-Farber Cancer Institute

450 Brookline Ave, Boston, MA 02215

Email: gregory_abel@dfci.harvard.edu

Data sharing: Data and protocol requests will be considered on a case-by-case basis and in accordance with the regulations of the Dana-Farber Harvard Cancer Center Office for Human Research Studies. Please contact the corresponding author: gregory_abel@dfci.harvard.edu.

To the Editor:

Oncologists cite limited time and resources in busy practices as major barriers to implementing geriatric and frailty assessments,[1] which are now recommended for all older adults with cancer undergoing systemic treatment. The COVID-19 pandemic has further challenged implementation by reducing the number of in-person clinic visits during which frailty assessments might occur. To overcome these barriers to conducting geriatric and frailty assessments, clinicians and researchers have developed virtual assessments for use in videoconference or telephone visits. However, analyses regarding the feasibility of such assessments in older adults with blood cancers are sparse. Moreover, most virtual assessments consist of patient-reported measures without objective performance measures such as standardized tests of mobility and cognition. We and others have shown that these measures are important predictors of outcomes in this patient population. Accordingly, we developed and tested a virtual frailty assessment for older adults with hematologic malignancies that incorporates both patient-reported and objective performance measures.

Please see our **Supplemental File** for detailed methods and analysis plan. Briefly, this is an observational study of transplant ineligible patients with blood cancers who enrolled in the Older Adult Hematologic Malignancies Program after presenting for their initial consult at Dana-Farber Cancer Institute (DFCI, Boston, Massachusetts). We included separate cohorts of patients who were assessed in-person (age ≥ 75 years) and virtually (age ≥ 73 years). For our in-person cohort, those who consented to participate in the study underwent an in-person screening geriatric assessment administered by a research assistant on the same day as his/her initial hematologic oncology consultation, as described previously. The screening geriatric assessment includes patient-reported and objective measures, spanning the domains of comorbidity, functional status (e.g., instrumental activities of daily living, IADLs), physical performance (e.g., gait speed), and cognition (e.g., delayed recall and the Clock-in-the Box Test[13]). All in-person measures collected are included in **Supplemental Table 1**, and detailed scoring of each measure is included in **Supplemental Table 2**. We enrolled patients from February 2015 to March 2020, after which observational studies at DFCI were placed on hold due to the COVID-19 pandemic, and resumed partial in-person enrollment in June of 2021. We included patients enrolled in-person through March of 2022, with the exception of a four-week pause in in-person enrollment in January of 2022 due to a rise in coronavirus cases.

From the results of the screening geriatric assessment, we derived frailty status using both phenotypic and deficit-accumulation approaches, two of the most widely-studied approaches to measuring frailty in aging research (see protocol in **Supplemental Table 2** for

further details regarding these approaches and their cut-off values that classified severity of frailty). For both in-person and virtual assessments, we classified patients as robust, pre-frail, or frail based on the phenotypic approach, the deficit accumulation approach, and overall by the more severe classification between both approaches.

To virtually adapt our screening geriatric assessment (**Supplemental Table 1**), patient-reported items were readily converted to administration over video- or teleconference by a research assistant. Our **Supplemental File** describes our adaptation of objective performance measures. We began enrolling patients for virtual frailty assessments in November of 2020 and included patients enrolled through March of 2022.

During the period of enrollment for virtual assessments, 254 eligible patients were contacted for recruitment into our study, and 185 (72.8%) patients consented to enroll (**Supplemental Figure 1**). Of those enrolled, 150 (81.1%) completed the virtual assessment. No falls or other safety events occurred during the virtual assessments. During the period of enrollment for in-person assessments, 1,017 patients were approached, of whom 876 (86.1%) enrolled and completed assessments. **Table 2** presents the baseline characteristics of the population, restricted to age ≥ 75 years.

Among patients age ≥ 75 years, we did not find differences in the distributions of age, gender, disease type, and self-reported ECOG PS between in-person and virtual assessments (**Table 1**). Across frailty measures (overall frailty status, frailty phenotype, and frailty by deficit accumulation), we observed a slightly lower proportion of pre-frail and frail patients who completed virtual assessments compared to those who completed in-person assessments. In univariable ordinal regression models (**Table 2**), virtual assessments trended toward a lower odds of classifying patients as overall frail (odds ratio [OR] = 0.76; 95% confidence interval [CI] = 0.52-1.11), as frail by the phenotypic approach (OR = 0.66, 95% CI = 0.45-0.98), and as frail by the deficit accumulation approach (OR = 0.75, 95% CI = 0.51-1.11). These trends weakened in multivariable ordinal regression models adjusting for age, gender, disease type, and self-reported ECOG PS.

Our findings suggest that virtual frailty assessments entailing both patient-reported and objective performance measures are safe and feasible, but may be associated with less severe frailty classification when compared to in-person assessments. Given that this association weakened after adjustment for any differences between assessment types with respect to age, gender, disease type, and ECOG PS, the difference in frailty classification may be more explained by the differences in the populations completing each assessment rather than by differences inherent in the assessments themselves. A more ideal design to compare

differences between assessments would have been to measure both in the same individuals from one cohort; however, this design was not possible since many of our virtual assessments took place during surges of the pandemic when in-person assessments were high risk. Even if our virtual frailty assessment is less sensitive at detecting frailty, the degree of reduced sensitivity is small and must be balanced against the increased burden and risk of in-person assessments. In our example, our virtual frailty assessment allowed our research and clinical program for older adults with blood cancers to continue through several waves of the pandemic, and could allow for decentralization of assessments beyond the pandemic to potentially reach more older adults with blood cancers.

We bring specific data from patients with hematologic malignancies into the expanding literature on virtual assessment and care in older adults from other populations. The high percentage of our patients who completed virtual assessments is encouraging, especially given that other studies have identified lower uptake of telehealth among older adults compared to younger populations. Further education regarding the purpose and benefits of frailty assessment could increase our enrollment rate, which was lower than our in-person enrollment rate. This lower rate may in part be due to the fact that our virtual frailty assessments require an additional appointment in the days after initial contact and consent, whereas our in-person assessments occur at the same time we approach patients for consent while they are waiting for their appointment at DFCI.

Our adaptation of gait speed and cognitive assessment to virtual formats is of particular interest to clinical and research programs focused on older adults with hematologic malignancies. However, 29% of our virtual patients were unable to complete the clock draw test and 46% of patients were unable to complete the caregiver-administered gait speed test. The majority of patients who were unable to complete these tests cited a lack of access to or ability to operate videoconferencing technology or lack of an available caregiver to administer the test (gait speed). More engagement with caregivers and more technical assistance could increase the ability of older patients to complete the objective performance tests developed in our study. Technologic advances in patient wearables and passive monitoring devices offer promising ways of remotely measuring objective performance tests without need for videoconferencing with staff or for caregivers to administer. Such technology could facilitate home-based interventions that target mobility and cognition, such as virtual exercise programs for cancer survivors.

Acknowledgments/Funding: This work was supported by the Harvard Translational Research in Aging Training Program (National Institute on Aging of the National Institutes of Health: T32AG023480) (C.D.); the Dana-Farber/Harvard Cancer Center SPORE in Multiple Myeloma (National Cancer Institute of the National Institutes of Health: P50 CA100707) (C.D.); The Boston Claude D. Pepper Older Americans Independence Center (National Institute on Aging of the National Institute of Health: P30 AG031679) (C.D.); the Older Adult Hematologic Malignancy Program is supported by the Murphy Family Fund from the Dana-Farber Cancer Institute (G.A.A.).

Author Contributions: Design (all authors); data collection (N.B. and T.H.); data analysis (T.J.); data interpretation (all authors); manuscript preparation (all authors)

Conflict of Interest Disclosure: No conflicts to disclose

References

1. Dale W, Williams GR, A RM, et al. How Is Geriatric Assessment Used in Clinical Practice for Older Adults With Cancer? A Survey of Cancer Providers by the American Society of Clinical Oncology. *JCO Oncol Pract*. 2021;17(6):336-344.
2. Mohile SG, Dale W, Somerfield MR, et al. Practical Assessment and Management of Vulnerabilities in Older Patients Receiving Chemotherapy: ASCO Guideline for Geriatric Oncology. *J Clin Oncol*. 2018;36(22):2326-2347.
3. DiGiovanni G, Mousaw K, Lloyd T, et al. Development of a telehealth geriatric assessment model in response to the COVID-19 pandemic. *J Geriatr Oncol*. 2020;11(5):761-763.
4. Chien L, Roberts E, Soto-Perez-de-Celis E, et al. Telehealth in geriatric oncology: A novel approach to deliver multidisciplinary care for older adults with cancer. *J Geriatr Oncol*. 2020;11(2):197-199.
5. Wall SA, Knauss B, Compston A, et al. Multidisciplinary telemedicine and the importance of being seen. *J Geriatr Oncol*. 2020;11(8):1349-1351.
6. Bahl NE, Magnavita ES, Hshieh T, et al. Objective performance tests of cognition and physical function as part of a virtual geriatric assessment. *J Geriatr Oncol*. 2021;12(8):1256-1258.
7. Hshieh TT, Jung WF, Grande LJ, et al. Prevalence of Cognitive Impairment and Association With Survival Among Older Patients With Hematologic Cancers. *JAMA Oncology*. 2018;4(5):686-693.
8. Liu MA, DuMontier C, Murillo A, et al. Gait speed, grip strength, and clinical outcomes in older patients with hematologic malignancies. *Blood*. 2019;134(4):374-382.
9. Saad M, Loh KP, Tooze JA, et al. Geriatric assessment and survival among older adults receiving postremission therapy for acute myeloid leukemia. *Blood*. 2020;136(23):2715-2719.
10. Klepin HD, Geiger AM, Tooze JA, et al. Geriatric assessment predicts survival for older adults receiving induction chemotherapy for acute myelogenous leukemia. *Blood*. 2013;121(21):4287-4294.
11. DuMontier C, Liu MA, Murillo A, et al. Function, Survival, and Care Utilization Among Older Adults With Hematologic Malignancies. *J Am Geriatr Soc*. 2019;67(5):889-897.
12. DuMontier C, Uno H, Hshieh T, et al. Randomized controlled trial of geriatric consultation versus standard care in older adults with hematologic malignancies. *Haematologica*. 2021.

13. Chester JG, Grande LJ, Milberg WP, McGlinchey RE, Lipsitz LA, Rudolph JL. Cognitive screening in community-dwelling elders: performance on the clock-in-the-box. *Am J Med*. 2011;124(7):662-669.
14. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. 2001;56(3):M146-156.
15. Rockwood K, Mitnitski A. Frailty in relation to the accumulation of deficits. *J Gerontol A Biol Sci Med Sci*. 2007;62(7):722-727.
16. Frydman JL, Li W, Gelfman LP, Liu B. Telemedicine Uptake Among Older Adults During the COVID-19 Pandemic. *Ann Intern Med*. 2021.
17. Fischer SH, Ray KN, Mehrotra A, Bloom EL, Uscher-Pines L. Prevalence and Characteristics of Telehealth Utilization in the United States. *JAMA Netw Open*. 2020;3(10):e2022302.
18. Lam K, Lu AD, Shi Y, Covinsky KE. Assessing Telemedicine Unreadiness Among Older Adults in the United States During the COVID-19 Pandemic. *JAMA Intern Med*. 2020;180(10):1389-1391.
19. Nieman CL, Oh ES. Connecting With Older Adults via Telemedicine. *Ann Intern Med*. 2020;173(10):831-832.
20. Romano MF, Sardella MV, Alboni F, et al. Is the digital divide an obstacle to e-health? An analysis of the situation in Europe and in Italy. *Telemed J E Health*. 2015;21(1):24-35.
21. Gusdorf RE, Shah KP, Triana AJ, et al. A patient education intervention improved rates of successful video visits during rapid implementation of telehealth. *J Telemed Telecare*. 2021:1357633x211008786.
22. Hawley CE, Genovese N, Owsiany MT, et al. Rapid Integration of Home Telehealth Visits Amidst COVID-19: What Do Older Adults Need to Succeed? *Journal of the American Geriatrics Society*. 2020;68(11):2431-2439.
23. Callisaya ML, Lee AH-C, Khushu A. Rapid implementation of telehealth in geriatric outpatient clinics due to COVID-19. *Internal Medicine Journal*. 2021;51(7):1151-1155.
24. Zhang G, Vahia IV, Liu Y, et al. Contactless In-Home Monitoring of the Long-Term Respiratory and Behavioral Phenotypes in Older Adults With COVID-19: A Case Series. *Frontiers in Psychiatry*. 2021;12(1885).
25. Manor B, Yu W, Zhu H, et al. Smartphone App-Based Assessment of Gait During Normal and Dual-Task Walking: Demonstration of Validity and Reliability. *JMIR Mhealth Uhealth*. 2018;6(1):e36.

Table 1: Baseline characteristics of in-person and virtually assessed patients age ≥ 75 years

Variable	In-Person (870)	Virtual (110)	p-value*
Age, mean (SD)	79.57 (4.04)	79.45 (3.75)	0.763
Age, n (%)			0.659
75-79	508 (58.4)	64 (58.2)	
80-84	254 (29.2)	36 (32.7)	
85-89	89 (10.2)	9 (8.2)	
≥90	19 (2.2)	1 (0.9)	
Gender, n (%)			0.647
Male	546 (62.8)	66 (60.0)	
Female	324 (37.2)	44 (40.0)	
Disease type n (%)			0.407
Leukemia	271 (31.1)	34 (30.9)	
Lymphoma	298 (34.3)	44 (40.0)	
Multiple Myeloma	301 (34.6)	32 (29.1)	
Self-Reported ECOG PS			0.118
0	495 (56.9)	63 (57.3)	
1	252 (29.0)	41 (37.3)	
2	66 (7.6)	5 (4.5)	
3	48 (5.5)	1 (0.9)	
4	5 (0.6)	0 (0.0)	
Missing	4 (0.5)	0 (0.0)	
Frailty (overall), n (%)			0.322
Robust	223 (25.6)	33 (30.0)	
Pre-frail	500 (57.5)	64 (58.2)	
Frail	147 (16.9)	13 (11.8)	
Frailty (phenotype), n (%)			0.082
Robust	250 (28.7)	43 (39.1)	
Pre-frail	527 (60.6)	57 (51.8)	
Frail	93 (10.7)	10 (9.1)	
Frailty (deficit accumulation), n (%)			0.455
Robust	453 (52.1)	64 (58.2)	
Pre-frail	294 (33.8)	36 (32.7)	
Frail	122 (14.0)	10 (9.1)	
Missing	1 (0.1)	0 (0.0)	

*A t-test was performed to assess for a difference between the mean ages of patients who completed in-person and virtual assessments. Chi-square tests were performed to assess for differences between in-person and virtual assessments in the distributions of age (as a categorical variable) and frailty status.

Table 2: Univariable and multivariable ordinal regression models assessing the association between virtual versus in-person frailty assessment and the odds of classifying patients as frail.

CI = Confidence Interval; ECOG PS = Eastern Oncology Group Performance Status (self-reported)

Frailty Measure	In-Person Assessment	Virtual Assessment (Odds ratio [95% CI])	P-value
Univariable models			
Frailty (Overall)	Reference	0.76 (0.52-1.11)	0.155
Frailty (Phenotype)	Reference	0.66 (0.45-0.98)	0.040
Frailty (Deficit Accumulation)	Reference	0.75 (0.51-1.11)	0.154
Multivariable models, adjusting for age, gender, disease type, and ECOG PS			
Frailty (Overall)	Reference	0.86 (0.56-1.31)	0.467
Frailty (Phenotype)	Reference	0.73 (0.48-1.11)	0.139
Frailty (Deficit Accumulation)	Reference	0.88 (0.55-1.37)	0.563