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SPECIAL SECTION

GERIATRIC MEDICINE & CARE

GUEST EDITORS: JAMES L. RUDOLPH, MD, SM; MRIGANKA SINGH, MD

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J.L. Rudolph, MD, SM

M. Singh, MD

SPECIAL SECTION

Geriatric Medicine & Care

JAMES L. RUDOLPH, MD, SM
MRIGANKA SINGH, MD
GUEST EDITORS

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Geriatric Medicine: Treatises on Assessment of Function

JAMES L. RUDOLPH, MD, SM
MRIGANKA SINGH, MD
GUEST EDITORS

Every man desires to live long, but no man wishes to be old.[1]
—Jonathan Swift

Some 80-year-olds run marathons, some are bedbound with advanced dementia, and half the cohort has already died. From the dawn of time, age has been reported as a chronologic, continuous number. This focus on chronology becomes problematic with advancing age because people become more heterogeneous. As clinicians in a modern medical world, we should expand our definition of aging beyond chronology. In this issue of the *Rhode Island Medical Journal* (RIMJ), we present a series of protocols from across the spectrum of healthcare settings – each paper highlights that assessment of function is critical. Taken together, these articles represent the broader accord (treatises) within the geriatric literature: that function should be used as the measure of aging to accurately identify risk and engage in shared decision-making with patients and caregivers.

RECONCEPTUALIZING FUNCTION

Function is broadly defined as the ability to engage and thrive in the world. While function is often focused on specific tasks, such as working, driving, preparing a meal, or eating, the term can be better conceptualized as performance on a spectrum of physical, cognitive, and social abilities. For example, the spectrum of physical function spans transferring from bed-to-chair to running a race. Cognitive function might include being able to add a new medication to a current regimen or taking pills which have been placed in a pillbox. The social-function spectrum might include employment or attending social events. The field of geriatrics has long used function as a metric for risk assessment, measurement of decline, engagement of supportive services, placement in nursing facilities, and enrollment in hospice.

The interplay of physical, psychological, and social function complicates a single, standardized scale for function. For example, the degree of recovery from a hip fracture is dependent on pre-fracture function, avoidance of delirium, early engagement in therapy, and the social/financial structure to support ongoing therapy beyond the hospital. Poorly functioning individuals can recover from a hip fracture if there is early therapy and the social structure to support continual rehabilitation. Conversely, a highly functioning person who develops delirium is less likely to engage in therapy and may struggle to recover without social supports. Geriatric co-management services support those who are undergoing major, short-term stressors (i.e., oncology, neurosurgery, orthopedic trauma, etc.) to improve long-term functional recovery.

RI GERIATRIC SERVICES, RESEARCH CENTERS

This issue of RIMJ highlights the importance of function, and Rhode Island's eminence in research and clinical care related to function. Each of the health systems in Rhode Island (See **Box 1**) has a robust geriatrics service, with tailored co-management programs for high-risk patients at high-risk times. The Rhode Island Geriatric Workforce Enhancement Program, based at the University of Rhode Island, has partnered with organizations to build a workforce that meets the needs of Rhode Island elders. At the Brown University School of Public Health's Center for Gerontology and Health Services Research and Center for Long Term Care Quality and Innovation, international leaders of nursing home quality measurement and improvement have been driving innovative pragmatic trials through the IMPACT Collaboratory. The Care New England Memory and Aging Center, Brown's Carney Institute for Brain Science, and the Providence VA's Center of Innovation in Long Term Services and Supports are conducting cutting-edge research.

CARING FOR AN AGING POPULATION

Since its founding in 1776, Rhode Island has witnessed the ebbs and flows of age. Rhode Island ranks 14th in population age,[2] 3rd in long-term care beds per capita (787 per 100,000),[2,3] and 10th in geriatricians per capita (2.9 per 100,000).[4] It is poised to accept the challenge of caring for an aging population. Although clinical care, education, and research infrastructures are in place, a focus on building connectivity across the existing infrastructures to the physical, cognitive, and social functional needs of elders is critical – for example, connecting individuals receiving Meals on Wheels with social services for transportation to clinical visits and volunteer visitors. Broader infrastructure investments in transportation, housing, and home-based services can pay dividends to maintain functioning in home environments.

Rhode Island has an opportunity to implement the physical and social infrastructure to promote the home-based focus that would allow RI to become an Age-Friendly State.

While time will continue its march, our thinking about aging need not stagnate – abundant evidence, both pragmatic and scientific, documents that assessment and management of function during high-stress events (e.g., acute illness, surgery, social instability, etc.) can improve the short- and long-term outcomes for the people of Rhode Island.

Box 1. Rhode Island Programs Focused on Aging Care, Education, and Research

Clinical
Brown Division of Geriatrics and Palliative Medicine
Care New England Division of Geriatrics
Lifespan Geriatrics
Hope Hospice
Program for all inclusive care of the elderly (PACE-RI)
Rhode Island Health Center Association (Federally Qualified Health Centers of RI)
Education
University of Rhode Island Geriatric Education Center
Research Centers
Brown University School of Public Health
Center for Gerontology and Health Services Research
Center for Long-Term Care Quality and Improvement
Carney Institute for Brain Science
Center for Alzheimer's Disease Research
Providence VAMC Center of Innovation in Long Term Services and Supports
Lifespan Center for Stem Cells and Aging
Home & Community-based Services
State of Rhode Island
RI Office of Healthy Aging
Access (POINT offices)
Connect (Caregiving, nutrition, housing, legal, home care and transportation supports)
Protect (Protective Services, guardianship, ombudsman)
RI Executive Office of Health and Human Services Older Adults
Rhode Island Community Resources
Age-Friendly RI
Alzheimer's Association
LeadingAge RI
Rhode Island Partnership for Home Care
Regional Non-Profit Programs for Aging in Place
Child & Family Elder Services RI
East Bay Community Action Programs Senior Services
Independent Aging Services
Jewish Alliance RI Senior Services
Saint Elizabeth Community Services & Care
Senior Services RI

References

1. Swift J. Thoughts on Various Subjects, Moral and Diverting, 1706-1711. 2007 Gutenberg Project. Accessed Dec 14, 2022. https://www.gutenberg.org/files/623/623-h/623-h.htm
2. United States Census Bureau. Annual Estimates of the Civilian Population by Single Year of Age and Sex for the United States and States: April 1, 2020 to July 1, 2021. Accessed Feb 20, 2023. https://www.census.gov/data/datasets/time-series/demo/popest/2020s-state-detail.html
3. LTCFocus Public Use Data sponsored by the National Institute on Aging (P01 AG027296) through a cooperative agreement with the Brown University School of Public Health. Available at www.ltcfocus.org. https://doi.org/10.26300/h9a2-2c26
4. American Board of Medical Specialties. Certification Report 2020-2021. Accessed Jan 3, 2023. https://www.abms.org/wp-content/uploads/2022/01/ABMS-Board-Certification-Report-2020-2021.pdf

Authors

James L. Rudolph, MD, SM, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University and Center of Gerontology and Health Services Research, Brown University School of Public Health, Providence, RI.

Mriganka Singh, MD, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

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Correspondence

James L. Rudolph, MD, SM
830 Chalkstone Ave, Providence, RI 02908
James_rudolph@brown.edu

Distribution of Adult Day Health Centers and Persons Living with Dementia Among Hospital Service Areas in Rhode Island

THOMAS A. BAYER, MD; CHRISTOPHER M. SANTOSTEFANO, MPH, BSN; JENNIFER L. SULLIVAN, PhD

ABSTRACT

INTRODUCTION: Adult day health centers (ADHCs) provide an important service to community-dwelling adults with functional dependency. This includes persons living with dementia (PLWD) and their caregivers, but we don't know how well ADHC capacity matches the distribution of PLWD.

METHODS: For this cross-sectional study, we identified community-dwelling PLWD using Medicare claims, and ADHC capacity using licensure data. We aggregated both features by Hospital Service Area. By linear regression, we determined the association between ADHC capacity and community-dwelling PLWD.

RESULTS: We identified 3836 community-dwelling Medicare beneficiaries living with dementia. We included 28 ADHCs, with licensed capacity for 2127 clients. The linear regression coefficient (95% Confidence Interval) for number of community-dwelling beneficiaries with dementia was 1.07 (0.6–1.53).

DISCUSSION: Rhode Island's ADHC capacity distribution roughly approximates the distribution of persons with dementia. Plans for the future of dementia care in Rhode Island should consider these findings.

KEYWORDS: adult day health centers; dementia; distribution

INTRODUCTION

More than 11 million Americans provide unpaid care to a person living with dementia, and most report that this causes them a high level of stress.[1] These caregivers, usually a family member of the person with dementia, often balance competing demands of paid employment with their unpaid caregiving.[2] Several high-quality studies have demonstrated that distress in dementia caregivers is associated with higher rates of institutionalization, behavioral symptoms, and abuse of the person with dementia.[3] Dementia caregivers can also suffer negative health consequences from this distress. Most dementia caregivers report feeling concerned about maintaining their own health after becoming a caregiver, and many report delaying or not doing things for their own health.[1,4] Adult day health centers are one type of program to help alleviate these caregiver challenges by providing respite where a substitute care provider provides temporary caregiving to a person with dementia.

Adult day health centers provide for social, safety, nutritional, and potentially other needs of community-dwelling adults with functional dependencies. Persons with dementia benefit from this service as well as their caregivers.[5] Adult day health centers provide service during the day, allowing their clients to continue to dwell in the community while receiving the service. The person living with dementia can spend time in a safe and supportive environment while the caregiver spends time away from caregiving. Adult day health center participation may improve quality of life in both physical and emotional domains for persons living with dementia.[6] Caregivers of adult day health center users with dementia report lower frequency of behavior problems and less time spent on behavior problems than caregivers of non-users with dementia.[7] Adult day health center participation also helps dementia caregivers complete important self-care tasks such as attending their own medical appointments.[8] Availability of adult day health centers benefits both members of the patient-caregiver dyad, and may also help health systems by delaying or substituting for more expensive forms of care such as long-term nursing home care.[5]

Adult day health centers predominantly rely on public sources of participant fees such as state Medicaid programs for financial viability. Private sources of participant fees including individual payments and health plan payments also contribute substantially.[9] Most states, including Rhode Island, require adult day health centers to undergo certification and licensing.[9–11] Rhode Island regulations require centers offering special care service for clients with Alzheimer's dementia or other dementias to offer standard disclosures.[11] These disclosures include the program philosophy, information about the processes of care, program costs, and the process of termination. However, the regulation does not clearly define a level of dementia severity at which the rule applies, leaving interpretation to the centers and to the state department of health.

Access to adult day health centers by Rhode Islanders living with dementia and their caregivers relies in part on the geographic distribution of licensed adult day center capacity within the state. Per state regulations, adult day health

centers should encourage families of participants to arrange their own transportation whenever possible.[11] Therefore, the geographic distribution of licensed adult day center capacity would ideally mirror the distribution of potential service users in the state. The Hospital Service Areas construct divides the United States into a set of clearly defined geographic areas which approximate local markets for healthcare. After reviewing abstracts and articles retrieved via relevant search terms on PubMed, we did not identify any studies comparing the geographic distribution of persons living with dementia to the geographic distribution of adult day health centers in Rhode Island. This study will compare the distribution of community- dwelling persons living with dementia by Hospital Service Area within the State of Rhode Island to the distribution of licensed adult day health center capacity.

METHODS

We completed a cross-sectional ecological study using Medicare claims and publicly available data on licensed adult day center capacity from the Rhode Island Department of Health. The use of the secondary Centers for Medicare and Medicaid Services data was reviewed and approved by the Brown University Institutional Review Board, and the Rhode Island Department of Health data was public use and exempt from IRB review. The sample of Medicare beneficiaries included 100% of beneficiaries, ages 65 and older, enrolled in Medicare parts A and B (traditional fee-for-service Medicare) or Medicare part C (Medicare Advantage) who were alive and residing in Rhode Island on January 1, 2020. We used our Residential History File[12] methodology to exclude beneficiaries who were not community dwelling as of January 1, 2020. We used the Medicare Master Beneficiary Summary File to determine the zip code of residence as of January 1, 2020. We then grouped beneficiaries by Hospital Service Area using the methodology published by The Dartmouth Atlas of Healthcare. Hospital service areas represent local health care markets.[13,14] Using the Master Beneficiary Summary File, we considered any individual who satisfied the Chronic Conditions Warehouse criteria for either Alzheimer's disease[15] or non-Alzheimer's Dementia[16] to be a person living with dementia. The updated 30-chronic condition segment algorithms use a 2-year reference period for Medicare claims identifying dementia. We used the qualifying claim period ending January 1, 2020, to reduce the impact of underutilization of routine healthcare during the Severe Acute Respiratory Syndrome Coronavirus 2019 pandemic on our results. We also used the Master Beneficiary Summary File to determine the age, race, sex, and Medicaid eligibility of beneficiaries within each Hospital Service Area.

We obtained the address and licensed capacity of each operating adult day health center in Rhode Island as of October 2022. We excluded 6 licensed centers whose original date of licensure occurred after January 1, 2020 with the aim of temporally aligning this measurement with our sample of beneficiaries with dementia. Because only 2 of the licensed centers reported special licensure for Alzheimer's Dementia and other dementias, we included all licensed centers. We used the zip codes and licensed capacities of the adult day health centers to determine the licensed capacity within each Hospital Service Area.[14]

For the primary analysis, we fit a linear regression model of licensed adult day health center capacity as a function of the number of community-dwelling Medicare beneficiaries living with dementia in each Hospital Service Area. We used R version 4.4.1 (The R Foundation for Statistical Computing, Vienna, Austria) for the regression analysis. To test the sensitivity of our result to inclusion of adult day health centers licensed after January 1st 2021, we repeated the primary analysis including all of the operating adult day health centers that were licensed as of October 2022. As an exploratory analysis, we visually assessed the distribution of adult day health centers within and between Health Service Areas by geocoding the location of each center and projecting its location on a map of the Health Service Area boundaries using ArcGIS online (Esri, Redlands, CA).

RESULTS

We identified 3836 community-dwelling Medicare beneficiaries living with dementia. In the overall sample, 2,926 (76.3%) were in the age range of 75 to 94 years old (**Table 1**). We included 28 adult day health centers, which were distributed between 5 Hospital Service Areas. (**Table 2**). The included centers had licensed capacity for a total of 2127 clients. The adult day health centers that we excluded due to initial licensure after January 1, 2020 had a total capacity of 580 and 2 of these centers were located in Hospital Service

Table 1. Sample Characteristics

Characteristic	No. (%) (n = 3836)
Age	
65–74	590 (15.4)
75–84	1435 (37.4)
85–94	1491 (38.9)
95+	320 (8.3)
Race	
White	3431 (89.4)
Black	86 (2.2)
Hispanic	210 (5.5)
Other	109 (2.8)
Male	1476 (38.5)
Eligible for Medicaid	479 (12.49)
Enrolled in Medicare A and B	3416 (89.1)

Areas without any other licensed adult day centers. Only 2 centers, both of which were licensed before 2020, were specifically licensed for Alzheimer's Dementia or Other Dementia Special Care Services. One was located in the Providence Hospital Service Area and licensed for 65 participants, and one was located in the Warwick Hospital Service Area and licensed for 80 participants.

Table 2. Comparison of beneficiaries with dementia and licensed adult day center capacity by Health Service Area.

Health Service Area	Beneficiaries No. (%) (n = 3836)	Licensed Adult Day Center Capacity No. (%) (n = 2127)
Fall River[a]	130 (3.4)	0
Newport	316 (8.2)	0
Pawtucket	194 (5.1)	110
Providence[a]	1569 (40.9)	1665
Wakefield	326 (8.5)	0
Warwick	814 (21.2)	140
Westerlya	177 (4.6)	46
Woonsocket[a]	310 (8.1)	166

[a] These Health Service Areas overlap state boundaries, and only the portion in Rhode Island is included.

In our linear regression model for the licensed adult day center capacity per Health Service Area, the coefficient (95% Confidence Interval) for the number of community dwelling beneficiaries with dementia was 1.07 (0.61–1.53). In our sensitivity analysis, the coefficient (95% Confidence Interval) for the number of community dwelling beneficiaries with dementia was 1.20 (0.70–1.71). Our map demonstrates that most of the licensed adult day health centers are centrally located in the state (**Figure 1**), and located near population centers (**Figure 2**).

DISCUSSION

We found that Hospital Service Areas had an average increase in licensed adult day center capacity of about 1 for each additional community-dwelling person with dementia. This implies that at the geographic level of Hospital Service Areas, the distribution of adult day health centers is well-matched to the distribution of community-dwelling persons

Figure 1. Distribution of adult day health centers in Rhode island, by Hospital Service Area. Black squares and circles represent adult day health centers licensed before January, 2020; with and without special Alzheimer's Dementia or Other Dementia Special Care Services, respectively. Black diamonds represent adult day health centers with initial licensure between January, 2020 and October, 2022. Color-shaded areas represent Health Services Areas, as defined by the Dartmouth Atlas of Healthcare.

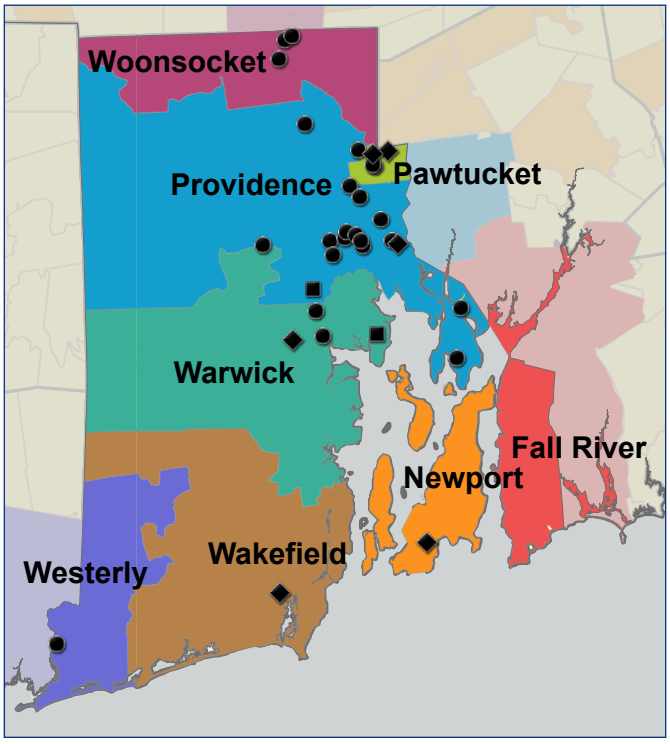
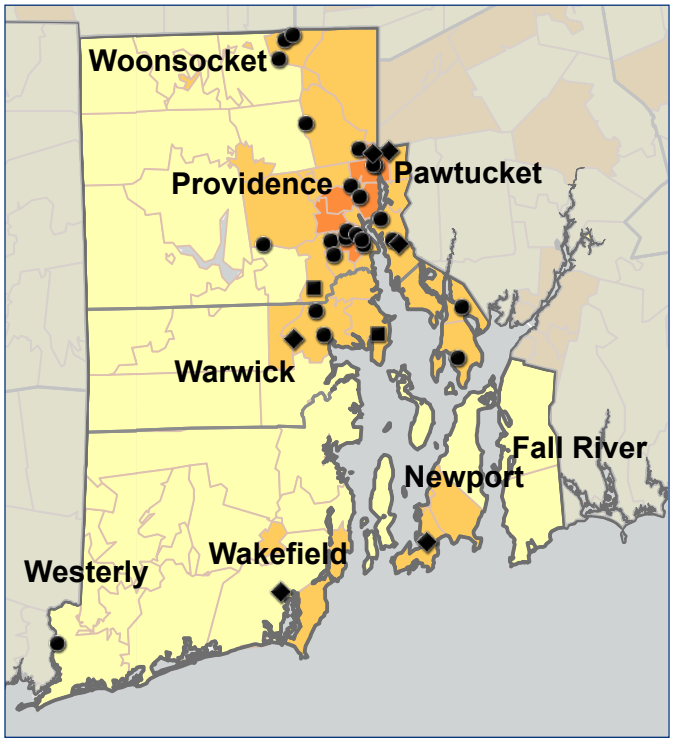


Figure 2. Distribution of adult day health centers in Rhode island, by Hospital Service Area. Black squares and circles represent adult day health centers licensed before January, 2020; with and without special Alzheimer's Dementia or Other Dementia Special Care Services, respectively. Black diamonds represent adult day health centers with initial licensure between January, 2020 and October, 2022. Background map shading represents population density based on the 2020 United States census.



living with dementia. Our sensitivity analysis examined this distribution including the adult day health centers licensed between January 2020 and October 2022, assuming that the distribution of persons living with dementia did not change. Here, we found that licensed capacity expanded in hospital service areas which did not previously contain adult day health centers. The overall distribution of centers remained well matched to the distribution of community-dwelling persons living with dementia at the Hospital Service Area geographic level. By plotting the locations of the licensed adult day health centers on a map, we found that most of their capacity was clustered in central and more populous areas of the state. This implies that persons in rural areas of the state would generally need to travel further than persons in the state's urban centers. Public and facility-provided transportation could overcome this geographic barrier. Our study did not examine the ways that existing transportation programs serve the needs of rural persons with dementia.

A study of dementia care capacity in Ireland found a much lower rate of about 17 'dementia places' per 100 persons with dementia.[17] This study used survey methods rather than licensure information to determine adult day center capacity. For estimates of dementia prevalence, the study relied on application of data from multiple international studies to the results of the 2016 Irish census, rather than healthcare claims. The study only included the 77% of responding adult day centers stating that they accepted participants with dementia. In contrast, only 2 (7%) of included Rhode Island adult day health centers had special licensure for dementia care, so we included all licensed centers. Had we restricted our sample to specially licensed centers, our overall capacity would have been much lower than that in the Irish study – about 3.7 per 100 persons with dementia. Our use of claims to estimate the prevalence of dementia is more robust than extrapolation of prevalence data from other populations. Our study is the first that we know of examining the distribution of adult day health service centers in the United States and comparing this to the distribution of community-dwelling persons living with dementia.

Limitations

Our study has several limitations. Our use of Medicare claims to identify persons with dementia would not identify those not enrolled in Medicare or Medicare beneficiaries in whom dementia was not identified in a claim. Also, our analysis does not account for the geographic distribution of other populations of people likely to benefit from adult day health centers, such as persons with developmental and intellectual disabilities. Because we made comparisons at the level of the Hospital Service Area, our quantitative analysis would not detect maldistribution of centers within Hospital Service Areas. The Hospital Service Area construct uses geographic patterns of hospital utilization to define local healthcare markets, therefore we considered this a reasonable unit of analysis for our research question. We also did not analyze other factors involved in adult day center availability such as payment considerations, availability and limitations of public or center-provided transportation, and length of waiting times for service enrollment.

CONCLUSION

Among Hospital Service Areas in Rhode Island, adult day health centers are distributed roughly according to the number of community-dwelling Medicare beneficiaries living with dementia. Within Hospital Service Areas, the same adult day health centers are clustered in population centers, a potential barrier to access for rural residents. These results may have relevance to public officials, policymakers, and health systems in the State of Rhode Island. Clearer regulations regarding the role of adult day health centers in the care of persons with mild dementia would facilitate greater precision in assessing the adequacy of the current care infrastructure. This study's approach may interest concerned parties in other jurisdictions who seek an equitable approach to licensure and financing of adult day health centers and other critical community health resources. Rhode Island's adult day health centers capacity is distributed between healthcare markets in a manner that roughly approximates the distribution of persons with dementia. Plans for the future of dementia care in Rhode Island should consider these findings.

References

1. 2022 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2022;18(4):700-789. doi:10.1002/alz.12638
2. National Alliance for Caregiving. Dementia Caregiving in the U.S. Published online February 2017. Accessed November 25, 2022. https://www.caregiving.org/wp-content/uploads/2020/05/Dementia-Caregiving-Report-2017_Research-Recommendations_FINAL.pdf
3. Stall NM, Kim SJ, Hardacre KA, et al. Association of Informal Caregiver Distress with Health Outcomes of Community-Dwelling Dementia Care Recipients: A Systematic Review. *J Am Geriatr Soc*. 2019;67(3):609-617. doi:10.1111/jgs.15690
4. Dementia Caregivers: Juggling, Delaying and Looking Forward. Published online November 2017. Accessed November 25, 2022. http://www.healthyagingpoll.org/sites/default/files/2017-10/NPHA_Caregivers-Report-PROOF_101817_v2.pdf
5. Ellen ME, Demaio P, Lange A, Wilson MG. Adult Day Center Programs and Their Associated Outcomes on Clients, Caregivers, and the Health System: A Scoping Review. *The Gerontologist*. 2017;57(6):e85-e94. doi:10.1093/geront/gnw165
6. Schmitt EM, Sands LP, Weiss S, Dowling G, Covinsky K. Adult day health center participation and health-related quality of life. *The Gerontologist*. 2010;50(4):531-540. doi:10.1093/geront/gnp172
7. Gaugler JE, Jarrott SE, Zarit SH, Stephens MAP, Townsend A, Greene R. Respite for Dementia Caregivers: The Effects of Adult Day Service Use on Caregiving Hours and Care Demands. *Int Psychogeriatr*. 2003;15(1):37-58. doi:10.1017/S1041610203008743

8. Parker LJ, Gaugler JE, Samus Q, Gitlin LN. Adult Day Service Use Decreases Likelihood of a Missed Physician's Appointment Among Dementia Caregivers. *J Am Geriatr Soc*. 2019;67(7):1467-1471. doi:10.1111/jgs.15995
9. Anderson KA, Dabelko-Schoeny H, Johnson TD. The State of Adult Day Services: Findings and Implications From the MetLife National Study of Adult Day Services. *J Appl Gerontol*. 2013;32(6):729-748. doi:10.1177/0733464812447284
10. Silverstein NM, Wong CM, Brueck KE. Adult Day Health Care for Participants With Alzheimer's Disease. *Am J Alzheimers Dis Dementiasr*. 2010;25(3):276-283. doi:10.1177/1533317510361237
11. Licensing Adult Day care Programs (216-RICR-40-10-7). https://rules.sos.ri.gov/regulations/part/216-40-10-7
12. Intrator O, Hiris J, Berg K, Miller SC, Mor V. The residential history file: studying nursing home residents' long-term care histories(*). *Health Serv Res*. 2011;46(1 Pt 1):120-137. doi:10.1111/j.1475-6773.2010.01194.x
13. The Trustees of Dartmouth College. Research Methods - Dartmouth Atlas of Healthcare. The Dartmouth Atlas of Healthcare. Published 2022. Accessed November 23, 2022. https://www.dartmouthatlas.org/research-methods/
14. The Trustees of Dartmouth College. Supplemental Data. The Dartmouth Atlas of Healthcare. Published 2022. Accessed November 23, 2022. https://data.dartmouthatlas.org/supplemental/
15. CCW C. Alzheimer's Disease Algorithms (30 CCW). Published online February 17, 2022. Accessed November 22, 2022. https://www2.ccwdata.org/documents/10280/86658989/chr-cond-algo-alzdisease.pdf
16. CCW C. Non-Alzheimer's Dementia Algorithms (30 CCW). Published online February 17, 2022.
17. Pierse T, Keogh F, O'Shea E, Cullinan J. Geographic availability and accessibility of day care services for people with dementia in Ireland. *BMC Health Serv Res*. 2020;20(1):476. doi:10.1186/s12913-020-05341-z

Authors

Thomas A. Bayer, MD, Providence Veterans Affairs Medical Center, Center of Innovation in Long Term Services and Supports; Warren Alpert Medical School of Brown University, Division of Geriatrics and Palliative Medicine, Providence, RI.

Christopher M. Santostefano, MPH, BSN, Brown School of Public Health, Center for Gerontology and Healthcare Research, Providence, RI.

Jennifer L. Sullivan, PhD, Providence Veterans Affairs Medical Center, Center of Innovation in Long Term Services and Supports; Brown School of Public Health, Department of Health Services, Policy and Practice, Providence, RI.

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Correspondence

Thomas A. Bayer, MD
Division of Geriatrics and Palliative Medicine
Warren Alpert Medical School of Brown University
593 Eddy Street POB 438
Providence, RI
thomas_bayer@brown.edu

Assessment of Frailty and Risk of Chemotherapy Toxicity at a Geriatric-Oncology Multidisciplinary Clinic

SAKEENA RAZA, MD; JAMES L. RUDOLPH, MD, SM; NADIA MUJAHID, MD; EMILY ZHOU, MD; IVA NEUPANE, MD; JOAO FILIPE G. MONTEIRO, PhD; MRIGANKA SINGH, MD; HUMERA KHURSHID, MD

ABSTRACT

BACKGROUND: Multidisciplinary Geriatric-Oncology (GO-MDC) clinic performed comprehensive geriatric assessment (CGA) to determine frailty and chemotherapy toxicity risk.

METHOD: Retrospective cohort study of patients ≥65 years seen between April 2017 to March 2022. We compared Eastern Cooperative Oncology Group-Performance Status (ECOG-PS) to CGA as a determinant of frailty and risk of toxicity from chemotherapy.

RESULTS: Mean age of the 66 patients was 79 years. Eighty-five percent were Caucasian. Predominant cancers were breast (30%), and gynecological (26%). One-third were stage 4. The CGA identified fit (35%), vulnerable (48%), and frail (17%) patients whereas ECOG-PS classified 80% as fit. CGA assessed 57% of ECOG-fit patients as vulnerable or frail ($p<0.001$). High chemotherapy toxicity risk using CGA was 41% and using ECOG was 17% ($p=0.002$).

CONCLUSION: At GO-MDC, CGA was a better predictor of frailty and toxicity risk than ECOG-PS. Treatment modification was recommended in one-third of patients.

KEYWORDS: aged; assessment; frailty; cancer; chemotherapy toxicity

INTRODUCTION

Older people are unique. In the process of aging, there is an individualized decline in organ system physiologic function. Combined with years of exposure and a constellation of comorbidities, each older person is a singular milieu of physiologic, cognitive, physical, and social function. When considering treatment for cancer, this individualized substrate needs to be considered.

Most cancers occur more commonly in older age. Cancer is the second leading cause of mortality.[1] The risk of malignancy peaks in the eighth decade[2] and 42% of the overall cancer population in the US is seventy years of age or older.[3-5] Despite the high incidence, older people are under-represented in cancer clinical trials.[6,7] As a result, the practice of cancer treatment in an aging population is evolving, with increasing consideration to the individualized physiology and performance measures as a marker of potential tolerability and toxicity of chemotherapy.

Oncologic societies recommend[8,9] comprehensive functional assessment prior to chemotherapy. The classic tools developed to assess functional status in cancer, such as the Eastern Cooperative Oncology Group-Performance Status (ECOG-PS)[10] and the Karnofsky Performance Status (KPS)[11] lack validation in an older population. More recently, tools have been developed which focus on an older population. For example, the Cancer and Aging Research Group Toxicity Tool (CARG-TT)[12] and the Chemotherapy Risk Assessment Scale for High-age patients (CRASH)[13] score compile components of the Comprehensive Geriatric Assessment (CGA) to predict chemotoxicity. However, the elements of CGA require time and training to deliver.

Working together, oncology and geriatric co-management can bring CGA reliably to an older population to modify the outcomes. The CGA-based frailty status of patients evaluated at the Lifespan Geriatric Oncology Multidisciplinary Clinic (GO-MDC) was compared to ECOG-PS and the risk of moderate to severe chemotoxicity (grade 3-5) using the CARG-TT. We also compared ECOG-PS and the CARG-TT.

The primary outcome was to determine if CGA-based assessment would identify more people with frailty in comparison to ECOG-PS. The secondary outcome was to assess if CGA reveals high chemotherapy toxicity in greater number of older cancer patients when compared to ECOG, thereby resulting in treatment modification favoring lower toxicity.

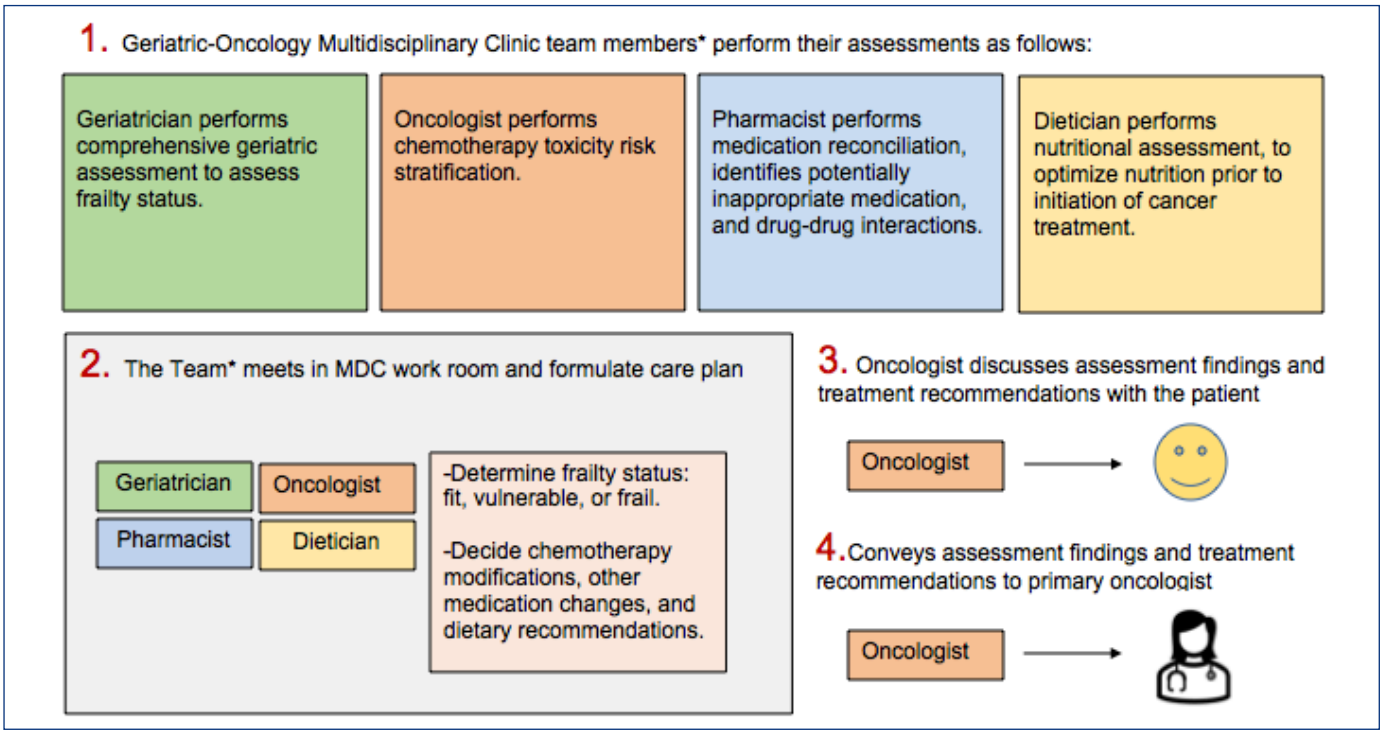
Using the clinical patient population of the GO-MDC, we performed a retrospective cohort analysis to determine these associations.

METHODS

Cohort

The retrospective cohort consists of patients seen between April 2017–March 2022 at the Lifespan Cancer Institute, affiliated with The Warren Alpert Medical School of Brown University. The members of the GO-MDC team include an oncologist, a geriatrician, a pharmacist, and a dietitian. This is a one-time consultative evaluation prior to initiation of chemotherapy in newly diagnosed or recurrent cancer patients, 65 years or older in age. The in-person assessment is ideally conducted within 7 days of referral made by the primary oncologist. This analysis was approved by the Lifespan IRB.

Figure 1.



Comprehensive Geriatric Assessment

The CGA was performed during the clinic visit and consisted of medical, oncologic, and social histories, cognitive and mood screening, polypharmacy, functional and nutritional assessment.

At the conclusion of the in-person visit, the team members met to review each case and formulated a comprehensive treatment plan based on the expertise from each discipline. A description of the contributions of each member of the inter-professional evaluation team is included in (**Figure 1**).

(CGA) Assessment Instruments

Specific tools in the CGA are detailed in **Table 1** and include Katz and Lawton Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) scale;[14,15] Timed Up & Go (TUG) test[16], the Mini-Cog assessment tool,[17] the PHQ-9[18], and Mini Nutrition Assessment (MNA).[19]

ECOG-PS

ECOG-PS indicates an increasing level of disability. A score of 0 indicating fully active, 1- restricted in strenuous activity, 2- restricted in work activity but ambulatory and capable of self-care, 3- capable of limited self-care, 4- completely disabled, and 5- dead.[10]

Chemotherapy Toxicity Risk

CARG-TT is a pre-chemotherapy assessment tool to predict moderate to severe chemotherapy toxicity. It is calculated from demographics, tumor and treatment variables, laboratory test results and CGA variables (function, comorbidity,

Table 1. Assessment tools used in Comprehensive Geriatrics Assessment

CGA Tools	Tool Description
Katz Index of Activities of Daily Living (ADL)	Includes self-reported measures of 6 basic self-care activities: feeding, dressing, bathing, transfer, continence, and toileting. One point is scored for independence in each activity. Score range is 0–6 with higher scores representing better function.
Lawton-Brody Instrumental Activities of Daily Living (I.A.D.L.)	Includes seven more complex activities: finances, medication management, driving, housekeeping, food preparation, shopping, laundry, and ability to use the telephone.1 point is scored for independence in each activity. Score ranges 0–8 with higher scores representing more independence
Patient Health Questionnaire – 9 (PHQ-9)	Assesses nine depressive emotional distress symptoms. Score range is 0–27. Normal mood: 1–4, Mild depression: 5-9, moderate depression: 10–14, moderately severe: 15–19, severe depression: 20–27
Mini Cog	It includes 3-word recall and a clock-draw test. Score ranges 0–5. 1 point for each correct word-recall and 2 points for a correctly drawn clock. A score of < 4 is considered abnormal.
Timed Up and Go Test (TUG)	Is used to assess risk for falls. The time it takes to walk 3 meters from a seated position and back without a break is measured. Increased risk of falls is associated with time >14s
Mini Nutritional Assessment tool (MNA)	Assesses nutritional status. It is scored from 0–14. Normal nutritional status is a score of 12–14, at risk of malnutrition is scored 8–11, and malnutrition has a score of 0–7

cognition, psychological state, social activity/support, and nutritional status). The CARG-TT score ranges from 0–19. Each risk category is associated with percentage likelihood of developing moderate to severe toxicity. Low risk is a score of 0–5 (<30%), intermediate risk, 6–9 (40–60%), and high risk, 10–19 (>70%).[20,21]

STATISTICAL ANALYSIS

All data was abstracted from the Electronic Medical Record (EMR) into a REDCap database,[22] a web-based chart review tool, and the analysis were conducted using SAS© software (Version 9.4, SAS Institute Inc., Cary, NC). The characteristics of the population are summarized with means (±SD) for continuous variables and number (%) for dichotomous variables. For the assessment instruments, we calculated literature-based cutoffs and present the number and percent. ECOG-PS was compared with CGA-based frailty and with CARG-TT moderate to severe chemotherapy risk using Chi-Square.

Table 2. Patient demographic and Clinical Data

Patient Characteristics/Demographics	Patients (n=66) (n%)
Age, years, range and mean	66–94 years, mean age:79 ± 6.9 years
Gender: Female	50 (76%)
Male	16 (24%)
Race: White	56 (85%)
Black	6 (9%)
Other/Mixed/Unknown	4 (6%)
Body Mass Index (BMI) range and mean	15–49, 29 ± 6.7
Carlson Comorbidity Index range and mean	3–20, 10.6 ± 4.3
Residence: Home	59 (89%)
Residence: ALF or Nursing home	7 (11%)
Cancer Risk Factors	
Family history of cancer	39 (59%)
History of smoking	34 (51%)
History of alcohol use	40 (61%)
New cancer diagnosis	55 (83%)
Recurrent Cancer	11 (17%)
Type of Cancer: Breast	20 (30%)
Gynecological	17 (26%)
Lung	14 (21%)
Other	15 (23%)
Stage of Cancer: Stage 1	14 (21%)
Stage 2	8 (12%)
Stage 3	17 (26%)
Stage 4	22 (33%)
Unknown	5 (8%)
Treatment received: 1st line	54 (82%)

RESULTS

The characteristics of the population (N=66) are described in **Table 2**. Consistent with the older population of Rhode Island, the cohort was older (mean age 79: range: 66-94 years), female (n=50; 76%), and racially heterogeneous (White n=56, 85%, Black n=6, 9%). Malignancies were varied with breast (n=20, 30%) gynecological (n=17, 26%) and lung (n=14, 21%) cancer represented. Most patients were newly diagnosed with cancer (83%) and had advanced cancer, stage 3 (n=17, 26%) or stage 4 (n=22, 33%).

The CGA findings are presented in **Table 2**. The population described functional limitations, with dependence in at least one ADL (n=28, 42%) and IADL (n=33, 50%). Cognitive deficits were detected on Mini Cog (n=32, 51%) and moderate to severe depressive symptoms were identified (n=26, 41%). Polypharmacy was documented in 60 patients (92%). On nutritional assessment, 26 patients (41%) were classified as at risk for malnutrition and 17 (26%) as malnourished.

The comparison of ECOG and CGA are presented in **Table 3**. CGA determined 23 patients to be fit (35%), 32 patients to be vulnerable (48%) and 11 patients to be frail (17%).

ECOG-PS was classified as non-fit (ECOG-PS ≥ 2) in 13 patients (20%) and fit (ECOG-PS: 0-1) in 53 patients (80%).

Table 3. Findings of Comprehensive Geriatric Assessment Domains and Aging Research Group (CARG) Chemo-Toxicity Classification

CGA Parameters	Patient population N= 66 (%)
Physical Function	
ADL dependence (requiring help in ≥ 1 ADL)	28 (42%)
IADL dependence (requiring help in ≥ 1 IADL)	33 (50%)
Normal TUG (time <14s)[a,b]	49 (74%)
Abnormal TUG (time ≥ 14s)	6 (9%)
Brain Function	
Mini Cog abnormal score of 0–3[c]	32 (51%)
PHQ 9 scale indicating moderate depression[d,e]	24 (38%)
PHQ 9 score indicating severe depression	2 (3%)
Other Assessments	
Polypharmacy (greater than 3 medication)	60(92%)
Nutrition: Normal	21
At risk for malnutrition	26 (41%)
Malnutrition	17 (26%)
CARG- TT[f]	
Low-risk toxicity	3 (5%)
Intermediate toxicity	36(54%)
High toxicity	27(41%)

a. Timed Up and Go test (TUG)
b. 9 patients did not participate in due to gait instability.
c. 2 patients unable to do Mini Cog due to cognitive decline.
d. PHQ-9 Patient Health Questionnaire-9
e. 3 patients were unable to participate in depression screen.
f. CARG-TT Cancer Aging and Research Group Toxicity Tool

Table 4. Comparison of ECOG-PS scores with CGA

ECOG score	CGA Assessment n=66 (n%)			
	Fit	Vulnerable	Frail	Total
0 to 1 (normal)	23 (35%)	26 (39%)	4 (6%)	53
>2 (restricted activity)	0	6 (9%)	7 (11%)	13
Total	23 (35%)	32 (48%)	11 (17%)	66

Table 5. Comparison of ECOG-PS with Cancer and Aging Research Group (CARG) Tool

ECOG score	Chemotoxicity risk calculated by CARG Tool (n)(%)		
	Low	Intermediate	High
0 –1 (normal)	3 (5%)	34 (52%)	16 (24%)
>2 (restricted activity)	0	2 (3%)	11 (17%)

Importantly, of ECOG-fit patients, CGA determined 30 (45%) to be vulnerable or frail. CARG-TT risk was intermediate in 34 patients (52%) and high in 16 patients (24%) of the patients who were classified as ECOG-fit (**Tables 4** and **5**).

CGA results correlated more closely with the chemotoxicity risk calculated by the CARG-TT, (p-value=0.0015). None of the patients who were deemed fit by CGA had a high chemotoxicity risk per CARG-TT. Treatment change to downgrade was recommended in 23 patients (37%). No treatment change was recommended in 44% of patients. Treatment modification recommendations, made by GO-MDC, were accepted by the primary oncologist in over 95% of the patients.

DISCUSSION

Older patients are a heterogeneous population and tailoring cancer treatment to the individual requires weighing risks against benefit in the context of frailty that is best assessed by CGA.[23,24] Past literature supports CGA to assist with prognostication in the scenario of adjuvant therapy[25] and risk stratification in the case of chemotherapy[26] or surgery.[27] By understanding the individualized risks and benefits, patients and oncologists can provide patient-centered treatment options.

Oncologists struggle with estimation of life expectancy, and without a reasonable estimate of life expectancy there is a risk for under- or over-treatment of patients.[28] Widely used validated prognostication tools that estimate life expectancy,[29,30,31] such as Walter-Covinsky Life tables, Lee Index and Schonberg's tool, require assessment of mobility, ADLS, IADLS, etc. These functional parameters are not routinely assessed in oncologic care but are known components of CGA. These tools estimate life expectancy independent of cancer. This becomes especially relevant in curative intent treatment, when an older patient may have a competing co-morbid condition that affects overall survival. For example, an 80-year-old woman in the top quartile of health would have a life expectancy of 13 years versus 4.6 years in the bottom quartile.[32]

For risk stratification, there are two validated tools that predict for moderate to severe chemotherapy toxicity: CARG-TT and CRASH score.[12,13,20] These tools are specifically designed and more accurate in predicting moderate to severe chemotherapy toxicity when compared to other oncologic measures of functional assessment like ECOG. The clear advantage of CARG-TT (that we utilized) over ECOG-PS was also evident. A total of 46 patients deemed fit by ECOG-PS were 'frail' based on CGA, highlighting a significant limitation of this tool. Our analysis showed that ECOG-PS can potentially miss frailty and may result in enhanced toxicity of cancer treatment.

The GO-MDC is built on literature-based models incorporating geriatric assessment into the management of older adults with cancer. CGA has a two-fold role in this clinic.

Firstly, CGA prior to cancer treatment allows for tailoring treatment based on patients' vulnerabilities, rather than at the time of occurrence of toxicity.[33] This results in better communication, patient-caregiver satisfaction, and advance care planning.

Secondly, CGA findings and subsequent use of CARG-TT leads to potential modification in treatment to minimize toxicity. This role of CGA has been well established in literature. A systematic review of 11 trials showed a change in initial treatment plan after CGA in 5–54% of patients (median 28%), mostly for less intensive therapy.[34] Similarly, the GO-MDC, change in treatment was recommended in 37% of patients also for less intensive treatment.

At GOMDC, our data analysis supports the established role of CGA as a more sensitive method for detecting frailty and CARG-TT as a better screener for unmasking chemotherapy toxicity risk. The high number of ECOG-PS 'fit' patients who subsequently scored as frail or having high chemotherapy toxicity risk highlights the importance of the more comprehensive CGA assessment.

A randomized control trial, comparing a cohort receiving CGA with one receiving ECOG evaluation-only would be a reliable means of further establishing the sensitivity of CGA and CART-TT in detecting frailty and chemotherapy toxicity risk in older cancer patients.

Additionally, CGA-based assessment also gives guidance on non-oncologic interventions that have direct impact on patients' quality of life and cancer treatment tolerance.[35,36,37] They fall into seven main categories: medication, co-morbidity optimization, mobility/fall risk assessment, cognitive screen, psychologic screen, nutritional, and social interventions.

At the GO-MDC, we identified notable cognitive, psychological, and nutritional deficits that are not routinely assessed in oncologic evaluation. None of these geriatric syndromes were uncovered by ECOG assessment.

There is limited data in literature looking at allocation of

chemotherapy based on CGA in randomized fashion. There is only one randomized control trial, in lung cancer, showing better quality of life, less toxicity, and similar survival, even though more patients had best supportive care in the CGA-based allocation of cancer treatment.[38]

Limitations

This study is a descriptive analysis and definitive conclusions regarding benefits of CGA cannot be drawn from our data analysis. Also, being a retrospective analysis, this study has an inherent patient-selection bias. The referral system to GO-MDC is entirely dependent upon the discretion of the primary oncologist. This directly impacts the diversity of patients, in terms of ethnicity, race, and cancer-type. Consequently, the referrals sent to GO-MDC were primarily breast and gynecological cancer patients.

Additionally, the primary oncologists, making triaging decisions for referrals, can potentially miss patients who otherwise may benefit from the GO-MDC evaluation.

Since the GO-MDC requires an additional clinic visit, patients may choose to forgo it, despite the referral.

GO-MDC is a one-time consultative evaluation and subsequent follow-ups are with the primary oncologist. By design, the clinic is limited in assessing the influence on treatment tolerability, patients' quality of life, and cancer outcomes.

CONCLUSION

GO-MDC provides a platform for CGA-based assessment of cancer patients and the information obtained from CGA was able to identify frailty status and chemotherapy toxicity risk. These findings are supported by the literature demonstrating that GO-MDC is able to identify frailty status for cancer treatment and implementation of CGA in routine oncology practice remains challenging.

References

1. Age and Cancer Risk. National Cancer Institute .March 5 2021[February 18, 2023]
2. DeSantis CE, Miller KD, Dale W, Mohile SG, Cohen HJ, Leach CR, Goding Sauer A, Jemal A, Siegel RL. Cancer statistics for adults aged 85 years and older, 2019. CA Cancer J Clin. 2019 Nov;69(6):452-467.doi:10.3322/caac.21577. Epub 2019 Aug 7. PMID: 31390062.
3. N. Howlader, A. Noone, M. Krapcho SEER Cancer Statistics Review,1975-2012. April 2015 National Cancer Institute, Bethesda, MD.
4. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, Znaor A, Soerjomataram I, Bray F. Global cancer observatory: cancer today. Lyon, France: international agency for research on cancer. 2018 Nov 5;3(20):2019.
5. Berger NA, Savvides P, Koroukian SM, Kahana EF, Deimling GT, Rose JH, Bowman KF, Miller RH. Cancer in the elderly. Trans Am Clin Climatol Assoc. 2006;117:147-55; discussion 155-6. PMID: 18528470; PMCID: PMC1500929.
6. Singh H, Kanapuru B, Smith C, Fashoyin-Aje LA, Myers A, Kim G, Pazdur R. FDA analysis of enrollment of older adults in clinical trials for cancer drug registration: a 10-year experience by the US Food and Drug Administration.(2017): 10009-10009.
7. Sedrak MS, Freedman RA, Cohen HJ, Muss HB, Jatoi A, Klepin HD, Wildes TM, Le-Rademacher JG, Kimmick GG, Tew WP, George K, Padam S, Liu J, Wong AR, Lynch A, Djulbegovic B, Mohile SG, Dale W; Cancer and Aging Research Group (CARG). Older adult participation in cancer clinical trials: A systematic review of barriers and interventions. CA Cancer J Clin. 2021 Jan;71(1):78-92. doi: 10.3322/caac.21638. Epub 2020 Oct 1. PMID: 33002206; PMCID: PMC7854940.
8. VanderWalde N, Jagsi R, Dotan E, Baumgartner J, Browner IS, Burhenn P, Cohen HJ, Edil BH, Edwards B, Extermann M, Ganti AK, Gross C, Hubbard J, Keating NL, Korc-Grodzicki B, McKoy JM, Medeiros BC, Mrozek E, O'Connor T, Rugo HS, Rupper RW, Shepard D, Silliman RA, Stirewalt DL, Tew WP, Walter LC, Wildes T, Bergman MA, Sundar H, Hurria A. NCCN Guidelines Insights: Older Adult Oncology, Version 2.2016. J Natl Compr Canc Netw. 2016 Nov;14(11):1357-1370. doi: 10.6004/jnccn.2016.0146. PMID: 27799507.
9. Extermann M, Aapro M, Bernabei R, Cohen HJ, Droz JP, Lichtman S, Mor V, Monfardini S, Repetto L, Sørbye L, Topinkova E; Task Force on CGA of the International Society of Geriatric Oncology. Use of comprehensive geriatric assessment in older cancer patients: recommendations from the task force on CGA of the International Society of Geriatric Oncology (SIOG). Crit Rev Oncol Hematol. 2005 Sep;55(3):241-52. doi: 10.1016/j.critrevonc.2005.06.003. PMID: 16084735.
10. Oken MM, Creech RH, Tormey DC, Horton J, Davis TE, McFadden ET, Carbone PP. Toxicity and response criteria of the Eastern Cooperative Oncology Group. Am J Clin Oncol. 1982 Dec;5(6):649-55. PMID: 7165009.
11. Schag CC, Heinrich RL, Ganz PA. Karnofsky performance status revisited: reliability, validity, and guidelines. J Clin Oncol. 1984 Mar;2(3):187-93. doi: 10.1200/JCO.1984.2.3.187. PMID: 6699671.
12. Hurria A, Togawa K, Mohile SG, Owusu C, Klepin HD, Gross CP, Lichtman SM, Gajra A, Bhatia S, Katheria V, Klapper S, Hansen K, Ramani R, Lachs M, Wong FL, Tew WP. Predicting chemotherapy toxicity in older adults with cancer: a prospective multicenter study. J Clin Oncol. 2011 Sep 1;29(25):3457-65. doi: 10.1200/JCO.2011.34.7625. Epub 2011 Aug 1. PMID: 21810685; PMCID: PMC3624700.
13. Extermann M, Boler I, Reich RR, Lyman GH, Brown RH, DeFelice J, Levine RM, Lubiner ET, Reyes P, Schreiber FJ 3rd, Balducci L. Predicting the risk of chemotherapy toxicity in older patients: the Chemotherapy Risk Assessment Scale for High-Age Patients (CRASH) score. Cancer. 2012 Jul 1;118(13):3377-86. doi: 10.1002/cncr.26646. Epub 2011 Nov 9. PMID: 22072065.
14. Katz S, Downs TD, Cash HR, Grotz RC. Progress in development of the index of ADL. Gerontologist. 1970 Spring;10(1):20-30. doi:10.1093/geront/10.1_part_1.20. PMID: 5420677.
15. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist. 1969 Autumn;9(3):179-86. PMID: 5349366.
16. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc. 1991 Feb;39(2):142-8. doi: 10.1111/j.1532-5415.1991.tb01616.x. PMID: 1991946.
17. Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-Cog as a screen for dementia: validation in a population-based sample. J Am Geriatr Soc. 2003 Oct;51(10):1451-4. doi: 10.1046/j.1532-5415.2003.51465.x. PMID: 14511167.
18. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001 Sep;16(9):606-13. doi: 10.1046/j.1525-1497.2001.016009606.x. PMID: 11556941; PMCID: PMC1495268.
19. Rubenstein LZ, Harker JO, Salvà A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci. 2001 Jun;56(6):M366-72. doi: 10.1093/gerona/56.6.m366. PMID: 11382797.
20. Hurria A, Mohile S, Gajra A, Klepin H, Muss H, Chapman A, Feng T, Smith D, Sun CL, De Glas N, Cohen HJ, Katheria V, Doan C, Zavala L, Levi A, Akiba C, Tew WP. Validation of a Prediction Tool for Chemotherapy Toxicity in Older Adults With Cancer. J Clin Oncol. 2016 Jul 10;34(20):2366-71. Doi: 10.1200/JCO.2015.65.4327. Epub 2016 May 16. PMID: 27185838; PMCID: PMC5321104.
21. Caillet P, Laurent M, Bastuji-Garin S, Liuu E, Culine S, Lagrange JL, Canoui-Poitrine F, Paillaud E. Optimal management of elderly cancer patients: usefulness of the Comprehensive Geriatric Assessment. Clin Interv Aging. 2014 Sep 29;9:1645-60. doi: 10.2147/CIA.S57849. PMID: 25302022; PMCID: PMC4189720.

22. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009 Apr;42(2):377-81. doi: 10.1016/j.jbi.2008.08.010. Epub 2008 Sep 30. PMID: 18929686; PMCID: PMC2700030.
23. Mazya AL, Garvin P, Ekdahl AW. Outpatient comprehensive geriatric assessment: effects on frailty and mortality in old people with multimorbidity and high health care utilization. Aging Clin Exp Res. 2019 Apr;31(4):519-525. doi: 10.1007/s40520-018-1004-z. Epub 2018 Jul 23. PMID: 30039453; PMCID: PMC6439176.
24. Bréchemier D, Sourdet S, Girard P, Steinmeyer Z, Mourey L, Gérard S, Balardy L. Use of comprehensive geriatric assessment (CGA) to define frailty in geriatric oncology: Searching for the best threshold. Cross-sectional study of 418 old patients with cancer evaluated in the Geriatric Frailty Clinic (G.F.C.) of Toulouse (France). J Geriatr Oncol. 2019 Nov;10(6):944-950. doi: 10.1016/j.jgo.2019.03.011. Epub 2019 Apr 4. PMID: 30956134.
25. Bang HJ, Shim HJ, Kim GR, Hwang JE, Bae WK, Chung IJ, Cho SH. Geriatric functional assessment for decision-making on adjuvant chemotherapy in older colon cancer patients. Korean J Intern Med. 2022 May;37(3):660-672. doi: 10.3904/kjim.2021.324. Epub 2022 Apr 15. PMID: 35421912; PMCID: PMC9082429.
26. Pierantoni F, Basso U, Maruzzo M, Lamberti E, Bimbatti D, Tierno G, Bergo E, Brunello A, Zagonel V. Comprehensive geriatric assessment is an independent prognostic factor in older patients with metastatic renal cell cancer treated with first-line Sunitinib or Pazopanib: a single center experience. J Geriatr Oncol. 2021 Mar;12(2):290-297. doi: 10.1016/j.jgo.2020.09.009. Epub 2020 Sep 21. PMID: 32972885.
27. Sentí S, Gené C, Troya J, Pacho C, Nuñez R, Parrales M, Jimenez I, Fernandez-Llamazares J, Julian JF, Parés D. Comprehensive geriatric assessment: Influence on clinical results after colorectal surgery in advanced age patients. Gastroenterol Hepatol. 2021 Aug-Sep;44(7):472-480. English, Spanish. doi: 10.1016/j.gastrohep.2020.08.014. Epub 2020 Oct 22. PMID: 33199132.
28. Krishnan M, Temel JS, Wright AA, Bernacki R, Selvaggi K, Balboni T. Predicting life expectancy in patients with advanced incurable cancer: a review. J Support Oncol. 2013 Jun;11(2):68-74. doi: 10.12788/j.suponc.0004. PMID: 23967494.
29. Lee SJ, Lindquist K, Segal MR, Covinsky KE. Development and validation of a prognostic index for 4-year mortality in older adults. JAMA. 2006 Feb 15;295(7):801-8. doi: 10.1001/jama.295.7.801. Erratum in: JAMA. 2006 Apr 26;295(16):1900. PMID: 16478903.
30. Suemoto CK, Ueda P, Beltrán-Sánchez H, Lebrão ML, Duarte YA, Wong R, Danaei G. Development and Validation of a 10-Year Mortality Prediction Model: Meta-Analysis of Individual Participant Data From Five Cohorts of Older Adults in Developed and Developing Countries. J Gerontol A Biol Sci Med Sci. 2017 Mar 1;72(3):410-416. doi: 10.1093/gerona/glw166. Erratum in: J Gerontol A Biol Sci Med Sci. 2017 May 1;72(5):731. PMID: 27522061; PMCID: PMC6075520.
31. Schonberg MA, Davis RB, McCarthy EP, Marcantonio ER. External validation of an index to predict up to 9-year mortality of community-dwelling adults aged 65 and older. J Am Geriatr Soc. 2011 Aug;59(8):1444-51. doi: 10.1111/j.1532-5415.2011.03523.x. Epub 2011 Jul 28. PMID: 21797837; PMCID: PMC3158286.
32. Walter LC, Covinsky KE. Cancer screening in elderly patients: a framework for individualized decision making. JAMA. 2001 Jun 6;285(21):2750-6. doi: 10.1001/jama.285.21.2750. PMID: 11386931.
33. Mohile SG, Dale W, Somerfield MR, Schonberg MA, Boyd CM, Burhenn PS, Canin B, Cohen HJ, Holmes HM, Hopkins JO, Janelsins MC, Khorana AA, Klepin HD, Lichtman SM, Mustian KM, Tew WP, Hurria A. Practical Assessment and Management of Vulnerabilities in Older Patients Receiving Chemotherapy: ASCO Guideline for Geriatric Oncology. J Clin Oncol. 2018 Aug 1;36(22):2326-2347. doi: 10.1200/JCO.2018.78.8687. Epub 2018 May 21. PMID: 29782209; PMCID: PMC6063790.
34. Hamaker ME, Te Molder M, Thielen N, van Munster BC, Schiphorst AH, van Huis LH. The effect of a geriatric evaluation on treatment decisions and outcome for older cancer patients - A systematic review. J Geriatr Oncol. 2018 Sep;9(5):430-440. doi: 10.1016/j.jgo.2018.03.014. Epub 2018 Apr 7. PMID: 29631898.
35. Pamoukdjian F, Aparicio T, Zelek L, Boubaya M, Caillet P, François V, de Decker L, Lévy V, Sebbane G, Paillaud E. Impaired mobility, depressed mood, cognitive impairment and polypharmacy are independently associated with disability in older cancer outpatients: The prospective Physical Frailty in Elderly Cancer patients (PF-EC) cohort study. J Geriatr Oncol. 2017 May;8(3):190-195. doi: 10.1016/j.jgo.2017.02.003. Epub 2017 Feb 22. PMID: 28236586.
36. Soo WK, King M, Pope A, Parente P, Darzins P, Davis ID. Integrated geriatric assessment and treatment (INTEGERATE) in older people with cancer planned for systemic anticancer therapy.(2020): 12011-12011.
37. Choi JY, Kim KI. Assessing frailty using comprehensive geriatric assessment in older patients with hematologic malignancy. Blood Res. 2022 Apr 30;57(S1):1-5. doi: 10.5045/br.2022.2021218. PMID: 35483918; PMCID: PMC9057660.
38. Corre R, Greillier L, Le Caër H, Audigier-Valette C, Baize N, Bérard H, Falchero L, Monnet I, Dansin E, Vergnenègre A, Marcq M, Decroisette C, Auliac JB, Bota S, Lamy R, Massuti B, Dujon C, Pérol M, Daurès JP, Descourt R, Léna H, Plassot C, Chouaïd C. Use of a Comprehensive Geriatric Assessment for the Management of Elderly Patients With Advanced Non-Small-Cell Lung Cancer: The Phase III Randomized ESOGIA-GFPC-GECP 08-02 Study. J Clin Oncol. 2016 May 1;34(13):1476-83. doi: 10.1200/JCO.2015.63.5839. Epub 2016 Feb 16. PMID: 26884557.

Authors

Sakeena Raza, MD, Warren Alpert Medical School of Brown University, Division of Geriatrics and Palliative Medicine, Brown Medicine, Providence, RI.

James L. Rudolph, MD, SM, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University and Center of Gerontology and Health Services Research, Brown University School of Public Health, Providence, RI.

Nadia Mujahid, MD, Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School, Brown University, Providence RI.

Emily Zhou, MD, Warren Alpert Medical School of Brown University; Internal Medicine Residency Program, Division of General Internal Medicine, Brown Medicine, Providence, RI.

Iva Neupane, MD, Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School, Brown University, Providence, RI.

Joao Filipe G. Monteiro, PhD, Department of Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

Mriganka Singh, MD, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

Humera Khurshid, MD, Warren Alpert Medical School of Brown University; Division of Hematology and Oncology, Lifespan Cancer Institute, Rhode Island Hospital, Providence, RI.

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Correspondence

Sakeena Raza, MD
Division of Geriatrics and Palliative Medicine
593 Eddy Street, Providence, RI, 02903
sakeena_raza@brown.edu

Impact of Geriatric Trauma Co-Management on 1-Year Mortality in Older Adults with Multiple Rib Fractures

IVA NEUPANE, MD; MITCHELL WICE, MD; JOAO FILIPE G. MONTEIRO, PhD; STEPHANIE LUECKEL, MD; TAREQ KHEIRBEK, MD; LYNN McNICOLL, MD; MRIGANKA SINGH, MD; NADIA MUJAHID, MD

ABSTRACT

BACKGROUND: Rib fractures in older adults are associated with higher morbidity and mortality. Geriatric trauma co-management programs have looked at in-hospital mortality but not long-term outcomes.

METHODS: A retrospective study of multiple rib fracture patients 65 years and older (n=357), admitted from September 2012 to November 2014 comparing Geriatric trauma co-management (GTC) vs Usual Care by trauma surgery (UC). The primary outcome was 1-year mortality.

RESULTS: 38.9% (139) were cared for by GTC. Compared to the UC, GTC patients were older (81.6±8.6 years vs 79±8.5) and had more comorbidities (Charlson 2.8±1.6 vs 2.2±1.6). GTC patients had 46% less chance of dying in 1-year compared to UC (HR 0.54, 95% CI [0.33-0.86]).

CONCLUSIONS: GTC showed a significant reduction in 1-year mortality even though patients were overall older and more comorbid. This shows multidisciplinary teams are crucial to patient outcomes and should continue to be further explored.

KEYWORDS: ribs fracture; multiple trauma; geriatric assessments; frail older adults

INTRODUCTION

The United States (US) population continues to age rapidly and live longer than ever before. The population over 65 years grew by over a third during the past decade,[1] with older adults making up 17.7% of Rhode Island's population.[2] Eighty million adults will be over 65 by 2040 and they will account for one in five adults by 2050.[3] Advanced age predisposes to increased medical complexity. Most commonly, cardiovascular disease, impaired stress response, multi-morbidity, frailty, poor physiologic reserve and geriatric syndromes like falls, gait imbalance, osteoporosis, sarcopenia, polypharmacy, cognitive deficits.[4,5,6] With increased life expectancy and availability of healthcare services, we expect a significant increase in the number of patients admitted for trauma. Blunt force chest trauma makes up 10–15% of trauma admissions.[7] Rib fractures account for 10% of trauma patients, with older adults having an incidence as high as 60 per 100,000 person years.[4,8] In comparison, the US has a hip fracture incidence rate of 195/100,000 person years with other countries ranging from 2–574/100,000.[9] The two most common causes of rib fractures are falls and motor vehicle accidents (MVA).[10, 11] Osteoporosis, common in older adults predisposes to fractures in low impact, less severe and lower velocity trauma in comparison to younger patients.[12]

Multiple rib fractures in older adults result in increased morbidity and mortality.[4] Complications like pneumonia or respiratory failure, which are rare in younger populations, are common in older adults.[5,13,14,15] These can lead to doubling of mortality from around 10% to 20% in the older adults.[5,8] Furthermore, older adults have increased risk for poor outcomes like prolonged hospitalization, intensive care unit (ICU) stays, long-term disability and inability to return to baseline.[8,16,17,18] In addition, for each subsequent rib fractured, mortality increases by 19% and pneumonia risk by 27%.[4,8,19]

Current trauma guidelines recommend patients 65 years and older with two or more rib fractures get directly admitted to a unit with ICU level staffing.[17] In our institution, these patients get initial management in the Trauma Intensive Care Unit (TICU). The Usual Care (UC) typically involves the critical care trauma surgery team providing pain management and respiratory rehabilitation. The TICU team manages hemodynamic instability, intervenes surgically: for example, chest tube insertion or in rare cases rib stabilization. They coordinate care with other surgical specialties like orthopedic surgery, neurosurgery or interventional radiology on a case-by-case manner. They follow these patients closely until they are stable enough to be transferred to the regular surgical floor.

Medical literature shows that geriatric surgical co-management results in better outcomes in surgical patients[20] and in those with hip fracture.[21] Geriatric trauma co-management (GTC) was developed at our institution to provide an additional layer of care to adults 65 years and older with multiple rib fractures. A dedicated geriatrician helped manage acute medical issues, chronic comorbidities, and geriatric syndromes while the TICU team addressed the critical care needs and surgical management of these vulnerable adults.

We hypothesized that patients 65 years and older with multiple rib fractures, admitted to TICU, with GTC will have a lower 1-year mortality in comparison to the UC.

METHODS

Study design and setting

This was a retrospective cohort study conducted in Rhode Island at the state's only academic, tertiary care, level 1 trauma center. Trauma patients 65 years and older with two or more rib fractures from September 1, 2012 to November 30, 2014 were included in this study. Patients were initially managed in an 11-bed closed TICU, followed by transfer to intermediate level of care or a regular surgical floor per trauma protocol. This study was approved with waived consent by the institutional review board of Lifespan, Inc./ Rhode Island Hospital (RIH).

Patient selection

Eligible patients were placed in the GTC program at the discretion of the primary TICU team. Patients were seen with and without other injuries such as sternal fracture, retroperitoneal hematoma, or long bone fractures. We excluded patients who were not initially admitted to the TICU from the emergency department or had emergent surgery prior to arrival to TICU. Patients whose information could not be confirmed deceased with our electronic medical record and Social Security Death Index (SSDI) were excluded from analysis.

Intervention

GTC at our institution is an interdisciplinary team that started in September 2012. Patients under GTC receive an initial comprehensive geriatric assessment and daily follow-up until the day of discharge Comprehensive geriatric assessment includes prevention and management of geriatric syndromes and medical comorbidities. In addition, regular communications were maintained with the patient's health care proxy, nurses, physical therapist, occupational therapist, case manager, and social worker. The geriatrician attended daily TICU rounds and conducted informal educational sessions with the TICU team members as well as formal didactics for surgical residents. These sessions focused on core geriatric topics such as delirium, falls, cognition assessment, or polypharmacy.

Data collection

Data was collected from the Lifespan electronic medical record (Epic, Veona, WI). Baseline demographic information included age, gender, race, Charlson Comorbidity Index (CCI) and at-risk medications. We measured injury mechanism, number of injuries, Injury Severity Score (ISS), Abbreviated Injury Scale (AIS) [both scoring systems for injury severity], advanced directives and whether patients were community dwelling.

Primary outcome

The primary outcome was 1-year mortality. We defined it as patients who died during the index admission and within a year of their initial discharge. This was irrespective of the location of death, or whether they were discharged to hospice during index hospitalization. For patients whose information could not be obtained in the institute's medical record, we checked the Social Security Death Index. This was done to confirm whether they were alive within one year of their initial discharge from the hospital or not.

Secondary outcome

The secondary outcomes were 30-day readmission from index admission; admission within 1 year of index admission; and number of ED visits during the year following index admission. The number of ED visits that did not result in an admission were recorded and indications for the first three ED visits after initial discharge were recorded (not shown). The causes for the ED visits were split into categories after data collection (infection, surgical issues, cardiac issues, falls, and nervous system issues). All admissions that occurred less than or equal to 30 days after the initial discharge were considered a readmission. All post-discharge admissions were recorded until a year after the initial discharge, and the first three dates and causes were recorded. The causes for admission were then split into the same categories as previously mentioned above.

STATISTICAL ANALYSIS

Statistical analysis was done using the software program SAS© software version 9.4. Univariate analysis was done to evaluate demographic and clinical variables, using t-Student, Fisher exact test and Chi-Square tests. The Kaplan-Meier and multivariate Cox-proportional hazard model was used for calculation of survival over time at 95% confidence level. The Kaplan-Meier curves were compared with the Wilcoxon and the log-rank tests of significance. The patients were followed until they died (are considered a case) or are censored, otherwise. The multivariate model with indicators of study group was conducted to compare 1-year mortality, among all patients. This was adjusted for age, gender, race and number of comorbidities. Comorbidities included: cancer, heart failure, diabetes, hypertension, respiratory disease. We looked at admission location, home or skilled nursing facility (SNF), 30-day readmissions, surgical revision, number of ED visits, and number of readmissions within one year after discharge.

The multivariate model to compare 1-year mortality among patients that were 65–70 years an older was adjusted by age, gender, respiratory comorbidity, 30-day readmission, and number of ED visits, number readmissions within 1 year after discharge. For patients that were 85 years and older the multivariable model included all of the above and, in addition, admission from SNF, 30-day readmission, and surgical revision and ISS score.

RESULTS

395 patients with two or more rib fractures were admitted to RIH during this 26-month period (**Table 1**). Of them, 131 were under GTC and 218 under usual care (UC) with 35 excluded due to unknown morality status and three excluded as they were identified as duplicate patients (**Figure 1**). The GTC on average were older (81.6±8.6 years vs 79±8.5; p<0.005), more likely to have hypertension, live in assisted living facility with higher comorbidities (Charlson 2.8±1.6 vs 2.2±1.6; p<0.001). The GTC group had a higher ISS (13.4±7.4 vs 12.4±6.6; p=0.188) and a higher percentage residing in a skilled nursing facility (SNF) (4.3% vs 3.2%; p=0.558) but they were not significant. The AIS Score (Chest 2.8±0.5 vs 2.8±0.6; p=0.884) and number of trauma diagnoses (3.2±2.3 vs 3.7±2.8; p=0.086) did not differ. The UC group had more patients admitted from home (93.6% vs 86.3%; p=0.021).

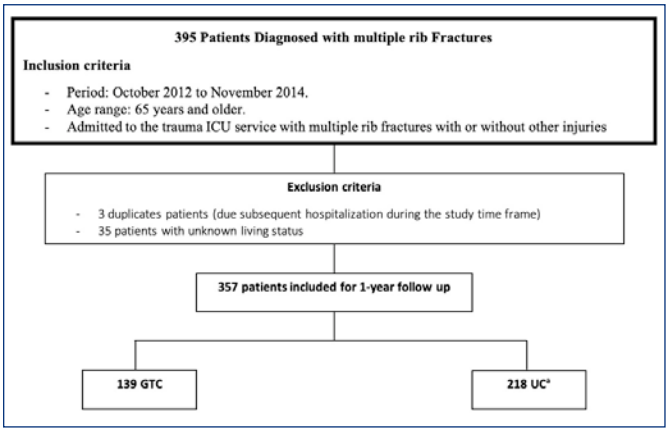
The primary outcome was 1-year mortality rate or discharge to hospice following the initial discharge (**Table 2**). When adjusted, there was a decrease in mortality by 46%; adjusted HR 0.54 [95% CI 0.33–0.86, p=0.011] in the GTC group compared to the UC. When stratified by age GTC had a reduction in hazard of mortality for ages 65–70 of 89% HR

Table 1. Baseline Characteristics of Analytical Study Sample

Patient Characteristics	Study group			
	GTC (n=139)	Usual Care[a] (n=218)	Full sample (n=357)	P-value
Age, mean (SD)	81.6 (8.6)	79.0 (8.5)	80.0 (8.6)	0.0053
Male, no. (%)	62 (44.6)	106 (48.6)	168 (47.1)	0.4581
White, no. (%)	129 (93.5)	202 (92.7)	331 (93.0)	0.7686
Injury mechanism, no. (%), Fall	106 (76.3)	148 (67.9)	254 (71.2)	0.0888
ISS Score, mean (SD)	13.4 (7.4)	12.4 (6.6)	13.0 (7.1)	0.1857
AIS Scores[b], mean (SD), Chest	2.8 (0.5)	2.8 (0.6)	2.8 (0.6)	0.8836
No. of Trauma Dx, mean (SD)	3.2 (2.3)	3.7 (2.8)	3.5 (2.6)	0.0860
No. of comorbidities, mean (SD)	2.8 (1.6)	2.2 (1.6)	2.4 (1.6)	0.0002
Admission Location				
Home, no. (%)	20 (86.3)	204 (93.6)	324 (90.8)	0.0212
ALF, no (%)	13 (9.4)	7 (3.2)	20 (5.2)	0.0139
SNF/Acute Rehab, no. (%)	6 (4.3)	7 (3.2)	13 (3.4)	0.5866

[a] care provided by the trauma team
[b] AIS scores Head, Face/Neck, Abdomen/Pelvis, Extremities, External all p>0.05
Abbreviations: AIS - Abbreviated injury scale ; ALF - Assisted living facility; CHF - Congestive heart failure ; Dx - diagnosis ; DNR/DNI - Do not resuscitate/Do not intubate; GTC - geriatric trauma co-management program; ISS - Injury Severity Score; SD - standard deviation; ALF - Assisted Living Facility; SNF - Skilled nursing facility.

Figure 1. Flow chart



[a]Care provided by the trauma team.
Abbreviations: GTC - geriatric trauma co-management program; UTI - Urinary tract infection; ICU - Intensive care Unit.

Table 2. 1-year mortality (patients who expired or were discharged to hospice) up to 1-year after post-discharge

	No. (%)	Unadjusted		Adjusted	
		HR (95% CI)	P-value	HR (95% CI)	P-value
Overall					
Usual care[a]	59 (29.5)	1 [Reference]		1 [Reference]	
GTC	34 (27.9)	0.60 (0.39–0.92)	0.0197	0.54 (0.33–0.86)	0.0105[a]
Age 65–70 years old					
Usual care[a]	10 (25.6)	1 [Reference]		1 [Reference]	
GTC	3 (15.8)	0.43 (0.12–1.59)	0.2033	0.11 (0.02–0.64)	0.0147[b]
Age more than 85 years old					
Usual care[a]	19 (34.6)	1 [Reference]		1 [Reference]	
GTC	12 (29.3)	0.56 (0.26–1.19)	0.1293	0.34 (0.13–0.91)	0.0317[d]

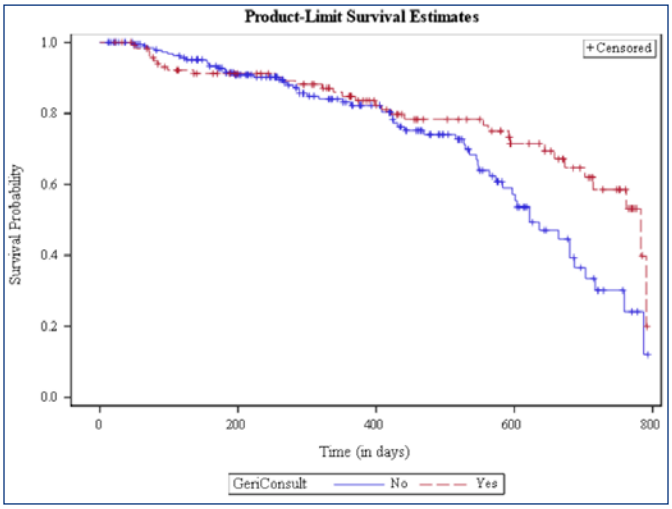
[a] Care provided by the trauma team.
[b] Results from Cox proportional hazard model with indicators of study group.
[a] controls for age, gender, race, number of comorbidities, comorbidities (cancer, CHF, diabetes, hypertension, respiratory), admitted from home or SNF, 30-day readmission, and surgical revision, number of ED visits, number readmissions within 1 year after discharge; [b] controls for age, gender, respiratory comorbidity, 30-day readmission, and number of ED visits, number readmissions within 1 year after discharge; [d] controls for age, gender, number of comorbidities, respiratory comorbidity, admitted from SNF, 30-day readmission, and surgical revision, number of ED visits, number readmissions within 1 year after discharge, ISS score
Abbreviations: CI - Confidence interval; ED - emergency department; GTC - geriatric trauma co-management program; HR - Hazard ratio; ISS - Injury Severity Score; SNF - Skilled nursing facility.

0.11 [95% CI 0.02-0.64, p=0.015] and age 85 years or older of 66% HR 0.34 [95% CI 0.13-0.91, p=0.032]. There were no difference in mortality rates in age groups 71 to 75 (23.5% [GTC] vs 22.9% [UC], p-value=1.000) and 76 to 80 (29.4% [GTC] vs 25.0% [UC], p-value=0.7458).

Figure 2 shows the Kaplan-Meier Survival curve with one-year survival with GTC significantly higher compared to UC (p=0.026), and shows that as time progresses the benefits of the GTC are even more advantageous on mortality with greater separation of the two groups.

There were no significant differences between the two groups for the secondary outcomes of 30-day readmission, admission within 1 year and number of ED visits during the year following index admission (**Table 3**). Sub analysis excluding patients that died in either group shows the same finding with higher mortality for the GTC group (5.7%) when compared with the UC (0.7%), p-value=0.0324. There was a non-significant increase in the GTC group for readmission and being seen in the emergency departments. **Table 4** shows the primary diagnosis of first three admissions within 1-year follow-up with p>0.05 between both groups for each diagnosis and admission (not shown).

Figure 2. Ribs fracture patients Kaplan-Meier survival curves, 1-year follow-up after discharge, for Geriatric Fracture Program patients compared to usual care.



Day 1 represents the first day after discharge for the first patient(s) enrolled in this study. The patients are followed until they die within a 1-year period follow-up (are considered a case) or are censored, otherwise. The Log-Rank test p-value was 0.0257. Abbreviations: ° – censured participants; GTC - geriatric trauma co-management program; UC - care provided by trauma team.

Month 1 represents the first month after one-year admission for the first patient(s) enrolled in this study. The patients are followed until they die (are considered a case) or are censored, otherwise. The Wilcoxon and the Log-Rank test p-values were 0.0049 and 0.0038, respectively.

Abbreviations: + - censured participants; GFP - geriatric fracture program.

Table 3. ED visits and readmissions within 1-year follow-up.

Outcomes	Study group			
	GTC (n=139)	Usual care[a] (n=218)	Full sample (n=357)	P-value
Number of ED visits, mean (SD)	0.9 (1.9)	0.7 (2.5)	0.8 (2.3)	0.2972
At least 1 ED visit, no. (%)	48 (34.5)	58 (26.6)	106 (29.7)	0.1100
30-day ED visit, no. (%)	16 (11.5)	17 (7.8)	33 (9.2)	0.2376
Number of readmissions, mean (SD)	0.6 (1.4)	0.4 (0.9)	0.5 (1.1)	0.1510
At least 1 readmission, no. (%)	38 (27.3)	52 (23.9)	90 (25.2)	0.4597
30-day readmissions, no. (%)	15 (10.8)	13 (6.0)	28 (7.4)	0.0980
Revision required for prior surgery, no. (%)	2 (1.5)	2 (1.0)	4 (1.2)	0.6489

[a] Care provided by the trauma team
[b] within the first 3 ED visits/admission
Abbreviations: GTC - geriatric trauma co-management program; ARF - Acute renal failure; PNA - Pneumonia; UTI - Urinary tract infection; ICU - Intensive care Unit; SD - standard deviation; SNF - Skilled nursing facility.

Table 4. Diagnosis for first 3 admissions within 1-year follow-up.

Diagnosis[a]
Heart failure
Pneumonia
UTI
Stroke
Sepsis
Infected Joint-Wound Infection
Prosthetic malfunction
Empyema
Pneumothorax
Hemothorax
Pleural effusion

[a] All diagnosis studied for first 3 admission within 1-year follow-up for GTC vs Usual Care p>0.05

DISCUSSION

Older patients with multiple rib fractures have mortality rates 2–5 times higher than younger adults despite equivalent ISS.[5, 22] Our results show that for patients with similar levels of rib-fracture severity, involvement of a geriatrician lowers mortality at one year, including those greater than 85 years of age. The involvement of a geriatrician can potentially prevent and address commonly encountered geriatric issues, including acute delirium, cognitive impairment and

or dementia with or without behavioral changes, urinary retention, falls, osteoporosis and medication management. Although literature in geriatric rib fracture co-management is limited, there is strong evidence of benefit with hip fracture patients[23, 24] and Acute Care for Elderly units.[22]

A previous study from our academic level-1 trauma center looked at in-hospital mortality for GTC and found a 40% reduction in-hospital mortality, or 9 fewer deaths.[4] This work revealed that overall in-hospital mortality can be reduced by as much as 22% in a geriatrician led co-management model of care. Recent literature has shown benefits of implementation of geriatric principles in trauma centers, though not specific to the co-managed model.[25,26]

Our analysis found a significant reduction in harm of 46% for one-year mortality or hospice referral post-discharge for older trauma patients with rib fractures followed by a geriatric trauma co-management group. In our small sample size this was more pronounced when stratified by age, especially for patients 65–70. Of note, the GTC patients were older, had more comorbidity and were less likely to be from the community. One would expect the GTC patients with worse pre-existing risk factors to have a higher mortality and hospice referral, but the inverse was seen. Sub-analysis by age was unable to identify specific trends in mortality. Our cohorts did not show any difference in trauma mechanism or severity between the two cohorts and we cannot assert how this plays a role in mortality.

We report long-term outcomes of older trauma patients with multiple rib fractures under GTC. This work adds to the literature on interventions to improve outcomes in the older population and potentially sets a foundation upon which other studies can be built. Our analysis demonstrates harm reduction in mortality and hospice referral up to one year out for all patients 65 and older, even in the more pre-morbid, frail patients.

Limitations

Our analysis was not without its limitations. The retrospective design creates potential bias as we cannot ascertain cause and effect but only associations.[4] Next, only 375 patients were able to be accounted for, thus limiting the power and generalizability of our conclusions. Also, as GTC was at the discretion of the trauma team, selection bias was most likely introduced when more frail patients were admitted. Furthermore, RIH is the only level-1 Trauma center/TICU in RI serving patients from all over the metropolitan area, regardless of the care system patient's normally use. This single center result cannot be generalized to other population demographics which likely differ from this state. We used the Lifespan chart system, the largest in RI, but were unable to access follow-up information from non-Lifespan hospitals and out-of-state residents, possibly missing key follow-up information. Additionally, we looked at post-hospital complications and did not control for prevalence of acute hospital complications such as delirium or ICU days that have a clear impact on mortality. We also did not look at patient's advance directives, family involvement regarding goals of care, or hospice.

CONCLUSION

Future studies that are larger and randomized controlled trials are needed to further understand the impact of geriatric co-management in older patients with multiple rib fractures and establish cause and effect. As the geriatric population continues to grow, further research is also needed to explore the effect of collaboration of a geriatrician with surgical subspecialties and the impact on patient outcomes. In our analysis, GTC intervention lowered 1-year mortality significantly. We need further studies while expanding access to the GTC model of care.

References

1. Rogers L, Wilder K. 65 and Older Population Grows Rapidly as Baby Boomers Age. US Census Bureau. 2020 Jun 25; Release Number CB20-99.
2. US Census Bureau. Quick Facts. Rhode Island. 2020 Jul; U.S. Census Bureau QuickFacts: Rhode Island
3. Hashmi A, Ibrahim-Zada I, Rhee P, Aziz H, Fain MJ, Friese RS, Joseph B. Predictors of mortality in geriatric trauma patients: a systematic review and meta-analysis. J Trauma Acute Care Surg. 2014 Mar;76(3):894-901. PMID: 24553567.
4. Singh M, Butterfield K, Monteiro JFG, George A, Heffernan DS, McNicoll L, et al. Improved Survival in Patients Older than 80 Years with Multiple Rib Fractures: Impact of Geriatric Trauma Co-Management. Gerontol Geriatr Res. 2016; 2(4): 1022.
5. Coary R, Skerritt C, Carey A, Rudd S, Shipway D. New horizons in rib fracture management in the older adult. Age Ageing. 2020 Feb 27;49(2):161-167. PMID: 31858117.
6. Mörs K, Wagner N, Sturm R, Störmann P, Vollrath JT, Marzi I, Relja B. Enhanced pro-inflammatory response and higher mortality rates in geriatric trauma patients. Eur J Trauma Emerg Surg. 2021 Aug;47(4):1065-1072. PMID: 31875239.
7. Ziegler DW, Agarwal NN. The morbidity and mortality of rib fractures. J Trauma. 1994 Dec;37(6):975-9. PMID: 7996614.
8. Bulger EM, Arneson MA, Mock CN, Jurkovich GJ. Rib fractures in the elderly. J Trauma. 2000 Jun;48(6):1040-6; discussion 1046-7. PMID: 10866248.
9. Kanis JA, Odén A, McCloskey EV, Johansson H, Wahl DA, Cooper C; IOF Working Group on Epidemiology and Quality of Life. A systematic review of hip fracture incidence and probability of fracture worldwide. Osteoporos Int. 2012 Sep;23(9):2239-56. PMID: 22419370.
10. Marini CP, Petrone P, Soto-Sánchez A, García-Santos E, Stoller C, Verde J. Predictors of mortality in patients with rib fractures. Eur J Trauma Emerg Surg. 2021 Oct;47(5):1527-1534. PMID: 31324938.
11. Sahr SM, Webb ML, Renner CH, Sokol RK, Swegle JR. Implementation of a rib fracture triage protocol in elderly trauma patients. J Trauma Nurs. 2013 Oct-Dec;20(4):172-5; quiz 176-7. PMID: 24305076.
12. Bergeron E, Lavoie A, Clas D, Moore L, Ratte S, Tetreault S, Lemaire J, Martin M. Elderly trauma patients with rib fractures are at greater risk of death and pneumonia. J Trauma. 2003 Mar;54(3):478-85. PMID: 12634526.

13. Christie DB 3rd, Nowack T, Drahos A, Ashley DW. Geriatric chest wall injury: is it time for a new sense of urgency? J Thorac Dis. 2019 May;11(Suppl 8):S1029-S1033. PMID: 31205759.
14. Birse F, Williams H, Shipway D, Carlton E. Blunt chest trauma in the elderly: an expert practice review. Emerg Med J. 2020 Feb;37(2):73-78. PMID: 31831589.
15. Duong W, Grigorian A, Nahmias J, Farzaneh C, Christian A, Dolich M, Lekawa M, Schubl S. An increasing trend in geriatric trauma patients undergoing surgical stabilization of rib fractures. Eur J Trauma Emerg Surg. 2022 Feb;48(1):205-210. PMID: 33095279.
16. Chen Zhu R, de Roulet A, Ogami T, Khariton K. Rib fixation in geriatric trauma: Mortality benefits for the most vulnerable patients. J Trauma Acute Care Surg. 2020 Jul;89(1):103-110. PMID: 32176172.
17. Brasel KJ, Moore EE, Albrecht RA, deMoya M, Schreiber M, Karmy-Jones R, Rowell S, Namias N, Cohen M, Shatz DV, Biffl WL. Western Trauma Association Critical Decisions in Trauma: Management of rib fractures. J Trauma Acute Care Surg. 2017 Jan;82(1):200-203. PMID: 27779590.
18. Schuster KM, Sanghvi M, O'Connor R, Becher R, Maung AA, Davis KA. Spirometry not pain level predicts outcomes in geriatric patients with isolated rib fractures. J Trauma Acute Care Surg. 2020 Nov;89(5):947-954. PMID: 32467465.
19. Pyke OJ Jr, Rubano JA, Vosswinkel JA, McCormack JE, Huang EC, Jawa RS. Admission of elderly blunt thoracic trauma patients directly to the intensive care unit improves outcomes. J Surg Res. 2017 Nov;219:334-340. PMID: 29078902.
20. Van Grootven B, Mendelson DA, Deschodt M. Impact of geriatric co-management programmes on outcomes in older surgical patients: update of recent evidence. Curr Opin Anaesthesiol. 2020 Feb;33(1):114-121. PMID: 31789902.
21. Grigoryan KV, Javedan H, Rudolph JL. Orthogeriatric care models and outcomes in hip fracture patients: a systematic review and meta-analysis. J Orthop Trauma. 2014 Mar;28(3):e49-55. PMID: 23912859.
22. Flood KL, Booth K, Vickers J, Simmons E, James DH, Biswal S, Deaver J, White ML, Bowman EH. Acute Care for Elders (ACE) Team Model of Care: A Clinical Overview. Geriatrics (Basel). 2018 Aug 6;3(3):50. PMID: 31011087.
23. Karlsson Å, Lindelöf N, Olofsson B, Berggren M, Gustafson Y, Nordström P, Stenvall M. Effects of Geriatric Interdisciplinary Home Rehabilitation on Independence in Activities of Daily Living in Older People With Hip Fracture: A Randomized Controlled Trial. Arch Phys Med Rehabil. 2020 Apr;101(4):571-578. PMID: 31935353.
24. Greenstein AS, Gorczyca JT. Orthopedic Surgery and the Geriatric Patient. Clin Geriatr Med. 2019 Feb;35(1):65-92. PMID: 30390985.
25. Halvachizadeh S, Gröbli L, Berk T, Jensen KO, Hierholzer C, Bischoff-Ferrari HA, Pfeifer R, Pape HC. The effect of geriatric comanagement (GC) in geriatric trauma patients treated in a level 1 trauma setting: A comparison of data before and after the implementation of a certified geriatric trauma center. PLoS One. 2021 Jan 11;16(1):e0244554. PMID: 33428650.
26. Laubach M, Gruchow LC, Hafner T, Migliorini F, Knobe M, Hildebrand F, Pishnamaz M. In-Hospital Clinical Outcomes in Patients with Fragility Fractures of the Lumbar Spine, Thoracic Spine, and Pelvic Ring: A Comparison of Data before and after Certification as a DGU® Geriatric Trauma Centre. Medicina (Kaunas). 2021 Nov 3;57(11):1197. PMID: 34833415.

Authors

Iva Neupane, MD, Division of Geriatrics & Palliative Care, Warren Alpert Medical School, Brown University, Providence, RI.

Mitchell Wice, MD, Division of Geriatrics & Palliative Care, Warren Alpert Medical School, Brown University, Providence, RI. Center of Innovation Long Term Services and Support, Providence Veterans Administration Medical Center, Providence, RI.

Joao Filipe G. Monteiro, PhD, Department of Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

Stephanie Lueckel, MD, Department of Surgery, Warren Alpert Medical School of Brown University, Providence, RI.

Tareq Kheirbek, MD, Department of Surgery, Warren Alpert Medical School of Brown University, Providence, RI.

Lynn McNicoll, MD, Division of Geriatrics & Palliative Care, Warren Alpert Medical School, Brown University, Providence RI.

Mriganka Singh, MD, Division of Geriatrics & Palliative Care, Warren Alpert Medical School, Brown University, Providence RI; Center of Innovation Long Term Services and Support, Providence Veterans Administration Medical Center, Providence, RI.

Nadia Mujahid, MD, Division of Geriatrics & Palliative Care, Warren Alpert Medical School, Brown University, Providence RI.

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Correspondence

Mitchell Wice, MD
593 Eddy Street, POB 438
Providence, RI, 02903
401-444-5248
Fax 401-444-3397
mwice@lifespan.org

Class II/III Obesity Prevalence in Residents of US Nursing Homes: Cross-sectional Study and Forecasting 2030 with COVID-19 Perspective

YASIN ABUL, MD; FRANK DEVONE, MS; MRIGANKA SINGH, MD; CHRISTOPHER HALLADAY, MS; THOMAS A. BAYER, MD; KEVIN W. McCONEGHY, PharmD, MS; STEFAN GRAVENSTEIN, MD, MPH; JAMES L. RUDOLPH, MD, SM

ABSTRACT

OBJECTIVES: This study aimed to better understand Class II/III obesity prevalence trends among older adults residing in nursing homes (NH) nationwide.

METHODS: Our retrospective cross-sectional study evaluated Class II/III obesity (BMI ≥35 kg/m^2) prevalence among NH residents in two independent national NH cohorts. We used databases from Veterans Administration NHs called Community Living Centers (CLCs) covering 7 years to 2022, and Rhode Island Medicare data covering 20 years ending in 2020. We also performed forecasting regression analysis of obesity trends.

RESULTS: While VA CLC resident obesity prevalence was less overall and dipped during the COVID-19 pandemic, obesity prevalence increased in NH residents in both cohorts over the last decade and is predicted to do so through 2030.

CONCLUSION: Obesity prevalence in NHs is on the rise. It will be important to understand clinical, functional, and financial implications for NHs, particularly if predictions on increases materialize.

KEYWORDS: obesity; nursing homes; COVID-19

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) reports that the US obesity prevalence was 41.5% among community-dwelling older adults. In 2019, obesity cost the US healthcare system nearly $173 billion.[1] Obesity has been associated with increased mortality rates for those hospitalized with COVID-19[2] and in older adults causes functional decline.[3,4] While obesity contributes to cardiovascular disease, type 2 diabetes mellitus, hyperlipidemia, metabolic syndrome, and cancer [5-8], it has an inverse association with mortality in patients with heart failure and chronic obstructive lung diseases.[9-11]

This paradox is relevant for older nursing home (NH) residents, who have a lower mortality rate if they are overweight and obese.[12] The COVID-19 pandemic further confounded the paradox with dramatic changes in NH care processes such as therapeutic activity, isolation, and assistance with eating. On face value, these changes could have mixed effects on diet and activity which affect those with obesity.[13,14] We undertook this cross-sectional observational study to better understand the trends of Class II/III obesity prevalence among older adults residing in NHs before and during the COVID-19 pandemic. We used two data sources to identify the national trends ,and secondarily, the trends in Rhode Island NHs. We hypothesized that Class II/III obesity prevalence would reflect the community and that the COVID-19 period would have limited effect on the trend.

METHODS

Study design

We performed a retrospective cross-sectional study using two data sources from a) Veterans Administration-managed nursing homes called Community Living Centers (CLC) and b) publicly available Medicare data from LTCFocus. We used two large datasets to demonstrate representativeness and generalizability of obesity prevalence in the nursing home population. LTCFocus data set was only available till April 2020. We included available VA dataset of 2021 and 2022 to represent COVID-19 period more precisely. We used a linear regression model to forecast future obesity prevalence rates by using past data trends. The secondary analysis of CLC data was approved by the Providence VAMC IRB and R&D committees.

DATA SOURCES

VA CLC data

Our VA CLC study population includes long-stay residents, defined as residents who resided in a community nursing home (CNH) or CLC at least 90 days over a specified year. We used data available through the VA's Clinical Data Warehouse (CDW) electronic medical records system from January 1, 2015 to October 20, 2022. The CDW contains sociodemographic characteristics and past medical history. Date cutoff for the "Pre-COVID" and "COVID" periods for CLC dataset was March 1, 2020.

Community nursing homes

For community nursing homes (CNH) we used data from the Medicare-administered Minimum Data Set which was

aggregated by LTCFocus. LTCFocus provides aggregated variables by year for all US nursing home residents from the 50 states and the District of Columbia (DC). We used LTCFocus to calculate nationwide Class II/III obesity trends from April 2015 to April 2020, with the latter being the most recent data. LTCFocus is sponsored by the National Institute on Aging (1P01AG027296) through a cooperative agreement with the Brown University School of Public Health.[15] We used the same dataset to calculate Class II/III obesity trends in Rhode Island from April, 2000 to April, 2020. Date cutoff for "Pre-COVID" and "During COVID" for the LTCFocus dataset was the April 2020 measurement.

OBESITY DEFINITION

From the VA CLC dataset, we included the closest available weight taken within ±365 days of a resident's first admission to a CLC and the Veteran's first height on the record, given the unlikely event of a significant change in height within ±365 days of their first CLC admission. After 365 days of the first index date admission, residents were eligible to be included in the subsequent year's cohort by the closest non-missing weight. We calculated BMI as weight divided by height in meters squared. We excluded residents with no data and extreme outlier values. Data was categorized according to the CDC obesity classification system. LTCFocus provides information for the proportion of residents with data on the first Thursday in April of the corresponding year who had a BMI of ≥ 35 kg/m^2 or higher. For consistency between the two datasets, we report CDC Class II/III (BMI ≥ 35 kg/m^2) in our comparisons, analyses, and forecasting.

STATISTICAL ANALYSIS

Between 2015 and 2022, yearly differences among VA CLC residents in association with BMI were analyzed using likelihood ratio tests. We also tested differences between pre- and during COVID-19 eras. Statistical analyses were conducted using R statistical software (Vienna, Austria Version 4.0.1) for CDW data and STATA 15.1 was used to perform all analyses on data collected from LTCFocus. As standardized mean difference values increase from 0, so does dissimilarity between the groups compared; we interpret values > 0.1 as potentially meaningful differences. We set significance at p values < 0.05. We applied a regression analysis model to evaluate the association between years and Class II/III obesity rate.

Forecasting

A linear regression model was used to predict future obesity prevalence rates, which assumes a linear trend in rates of obesity. Model was formalized as y=c + b*x (y= Class II/III obesity prevalence rate, c=constant, b=regression coefficient and x=year).

RESULTS

Table 1 describes selected characteristics of the two cohorts separated by the COVID-19 pandemic period. In general, VA CLC residents were younger and male with a higher prevalence of heart failure and hypertension and less dementia (See **Table 1**) relative to CNH residents. There was moderate positive correlation between Class II/III obesity rates in CNH and VA nursing homes in 2020 (r=0.39, p=0.0002) (**Figure 2**). Class II/III obesity was lower in the CLC residents relative to CNH residents.

The trend in Class II/III obesity for both cohorts is presented in **Figure 1** and detailed in **Table 2**. In both CLC and CNH residents, the prevalence of Class II/III obesity increased in long-term care residents since 2015, but the change was more pronounced in CNH (25.9% to 28.4%). In the COVID pandemic, there was a slight decrease in CLC resident Class II/III obesity, but the upward trend continued.

The forecasting analyses project significant increases in Class II/III obesity through 2030 in both cohorts with an approximate 10% increase in prevalence [VA CLC residents (R^2=0.83, F(1,14)=71.5, p<0.00001); and CNH residents (R^2=0.99, F(1,14)=29091 p<0.00001)]. Among RI CNH residents, Class II/III obesity prevalence rates more than doubled from 12.4% in 2000 to 28.6% in 2020 (**Figure 3**). The prevalence is projected to increase to 37.8% in 2030. (Forecasting regression model: Class II/III obesity prevalence rate = –1686.224 +0.8492857*year).

DISCUSSION

Using two available data sources, we observed upward trends in Class II/III obesity prevalence among nursing home residents within the last decade nationally, and also specifically in Rhode Island. Our analysis predicts that this trend will continue for the next decade. These trends add to the 2015 results of Zhang et al, for US nursing home residents from 2005 to 2015[17] and have important implications for clinicians, particularly those who care for nursing home residents.

Obesity rates in nursing homes mirror those in the general population. While Rhode Island ranked 41st among states in the US in 2021 with an adult obesity rate of 30.1%,[18] our study also shows that the population and NH prevalence are similar. However, a doubling in prevalence in RI over the past two decades [12.5% (2000) to 28.6% (2020)] and further increases forecast in RI and nationally, could generate added care burden in this healthcare sector, as older adults with obesity have a greater likelihood of eventually needing nursing home care.[19]

Rising obesity may increase the overall rate of functional disabilities in the population, producing greater needs for long-term services and supports.[20-22] More severe obesity (Class II/III) can impact functional dependence, increasing daily care needs.[19] For example, obese residents may require

Table 1. Baseline characteristics of residents before (CLC and community nursing homes) and during COVID-19.

	VA CLCs				Community Nursing Homes	
	Overall n (%)	Pre-COVID* n (%)	COVID* n (%)	RMD/ SMD	Pre-COVID* (%)	COVID* (%)
Residents (n)	208,780	168,783	39,997			
Age, years (SD)	71 (11.9)	70.8 (12)	72 (11.3)	0.10	79.1	78.1
Male	200,427 (96%)	162,225 (96.1)	38,202 (95.5)	0.03	39.8	37.0
BMI	27.6 (7.2)	27.6 (7.2)	27.7 (7.2)	0.01	NA	NA
Normal: BMI 18.5 to <25 kg/ m²	69,730 (33.4)	56,601 (33.5)	13,129 (32.8)	0.01	NA	NA
Overweight BMI 25 to <30 kg/m²	60,866 (29.1)	49,146 (29.1)	11,720 (29.3)	0.004	NA	NA
Class I Obesity BMI 30 to <35 kg/m²	35,801 (17.1)	28,816 (17.0)	6,985 (17.4)	0.01	NA	NA
Class II/III Obesity BMI ≥ 35 kg/m²	28,813 13.8	23,217 (13.7)	5,596 (13.9)	0.006	26.0	28.4
Race: White	149,381 (71.6%)	121,406 (71.9%)	27,975 (69.9%)	0.04	76.1	73.3
Long Stay >90 days	58,983 (28.3%)	4,519 (26.4%)	14,464 (36.2%)	0.21	NA	NA
Heart Failure	54,058 (25.9%)	42,529 (25.2%)	11,529 (28.8%)	0.08	20.1	22.3
Hyper-tension	172,820 (82.8%)	138,648 (82.2%)	34,172 (85.4%)	0.08	75.0	77.6
ADRD	70,164 (33.6%)	54,093 (32.1%)	16,071 (40.2%)	0.17	51.3	50.1
MACE	76,652 (36.7%)	60,242 (35.7%)	16,410 (41%)	0.10	NA	NA
Chronic pulmonary diseases	75,009 (35.9%	60,686 (36%)	14,323 (35.8%)	0.003	NA	NA

SMD: Standardized mean difference (values farther from 0 indicate dissimilar groups, and values >0.1 can be interpreted as potentially meaningful differences). NS: Non-significant; NA: Not available; ADRD: Alzheimer's disease-related dementias; MACE: Major adverse cardiac events. Class II/III obesity (BMI ≥ 35 kg/m²) *Date cutoff between "Pre-COVID" and "During COVID" for the CLC dataset was March 1st, 2020, and date cutoff between "Pre-COVID" and "During COVID" for the LTCFocus dataset was first Thursday in April of 2020.

Table 2. Overall obesity (BMI ≥ 30) and Class II/III (BMI ≥ 35) obesity prevalence in long-stay long-term care residents 2015–2022 nationally (n (%)).

	VA CLCs			Community Nursing Homes
Year	Total number CLC subjects	Obesity n (%)	Class II/III Obesity n (%)	Class II/III Obesity %
2015	35,266	10,758 (30.5)	4,760 (13.5)	25.9
2016	31,686	9,646 (30.4)	4,250 (13.4)	26.3
2017	31,571	9,741 (30.8)	4,389 (13.9)	26.8
2018	31,960	9,971 (31.2)	4,493 (14.1)	27.4
2019	32,378	10,115 (31.3)	4,528 (14.0)	28.1
2020	19,066	5,820 (30.5)	2,541 (13.3)	28.4
2021	18,290	5,787 (31.6)	2,619 (14.3)	N/A
2022	8,563	2,776 (32.4)	1,233 (14.4)	N/A

Obesity (BMI ≥ 30), Class II/III obesity (BMI ≥ 35)

Figure 1. Trends in Class II/III obesity prevalence rates in long-stay nationwide VA CLC residents and nationwide community NH residents from 2015 with forecasted Class II/III obesity prevalence rate to 2030 (dashed lines).

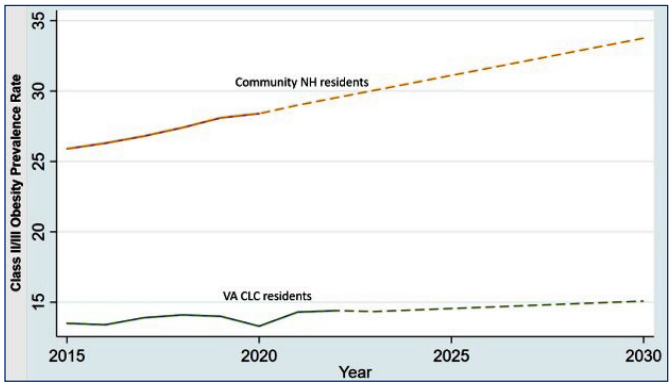


Figure 2. Correlation Plot of Community Living Center and Community Nursing Home Class II/ III Obesity Prevalence in 2020 (r=0.53, p=0.0002) (Rhode Island and Alaska do not have CLCs and are not included).

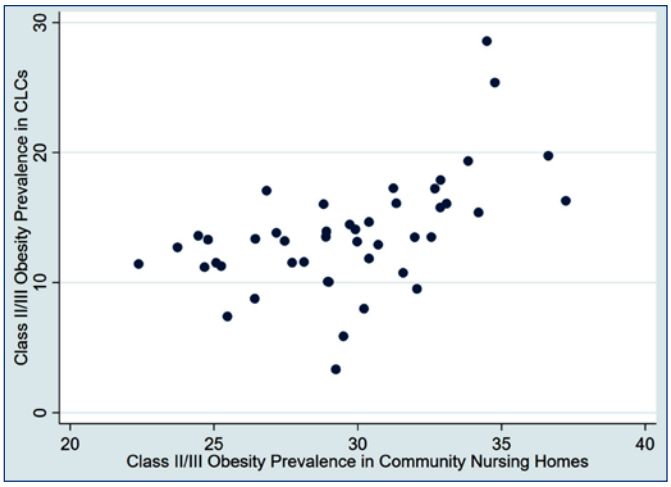
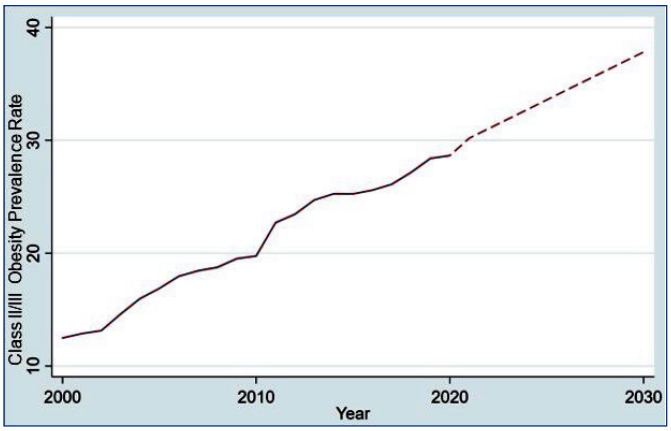


Figure 3. Trend in Class II/III obesity prevalence rate in RI community NH residents from 2000 to 2020, and forecasted obesity prevalence rate among same population to 2030 (dashed line).



more personal care assistance, often from two or more helpers. Residents with Class II/III obesity may need special equipment including enhanced designed wheelchairs, commodes, lifts, and basic diagnostic tools such as larger sphygmomanometer cuffs.[23] Obesity can potentially impact access to NHs, structural preparedness of NHs to respond to the needs of obese residents, and quality care of individuals admitted to NHs.

Obesity, as part of the metabolic syndrome, often presents with a constellation of glucose impairment, hypertension, and hyperlipidemia. The prevalence of metabolic syndrome increases to 42% by age 70.[24] This increase is mainly due to predisposing conditions including obesity, insulin resistance, inflammation, hypertension, which all increase with aging. [25] With aging, metabolic syndrome increasingly contributes to the risk for development of cardiovascular comorbidity, functional decline, and mortality. Major clinical implications of Class II/III obesity on older adults include increased risk of type-2 diabetes, high blood pressure, cardiovascular diseases and stroke.[7] These conditions help explain why NH residents with Class II/III obesity have higher mortality (OR 1.75; 95% CI, 1.10–2.80).[26] Unfortunately, the metabolic syndrome, obesity and related conditions remain understudied for nursing home residents.

A major strength of this study is the use of two national data sources from independent sample populations across the US, inferring highly generalizable findings. The CLC dataset allows for estimation of pre- and intra-pandemic obesity prevalence rates. The historical data permit linear regression-based forecasting for future obesity. More accurate and sensitive forecasting models are necessary to better understand and prepare for the impact of the worsening obesity epidemic in US NH residents.

Limitations

We note four significant limitations. First, LTCFocus does not report obesity according to the CDC obesity classification. We focused our analyses on Class II/III obesity for consistency across systems. Second, as one long-term resident may appear in several yearly cohorts means we cannot interpret changes in incidence as compared with prevalence. Third, height is collected less frequently than weight in these settings, and this may bias the ascertainment of BMI. Finally, our forecasting approach assumes a linear change in obesity rates and if rates change non-linearly may be biased, and forecasting would also benefit from inclusion of other predictors (such as case-mix, age, gender, etc.).

CONCLUSION

We found that there is an upward trend in the Class II/III obesity prevalence rate among VA CLC residents and nationwide CNH residents. We are forecasting that this trend will continue and expect it will impact the care and clinical health of NH residents, particularly the group with metabolic syndrome. Given structural, functional, and medical complexity, and the impact of obesity on NHs and NH residents, dynamic health policy changes and their implementation into the NH system are needed.

References

1. Centers for Disease Control and Prevention Report: Adult Obesity Facts. https://www.cdc.gov/obesity/data/adult.html#:~:text=The%20obesity%20prevalence%20was%2039.8,adults%20aged%2060%20and%20older, Accessed on 1/2/2023.
2. Anderson MR, Geleris J, Anderson DR, et al. Body Mass Index and Risk for Intubation or Death in SARS-CoV-2 Infection: A Retrospective Cohort Study. Ann Intern Med. 2020;173(10):782-790.
3. Harris T, Cook EF, Garrison R, Higgins M, Kannel W, Goldman L. Body mass index and mortality among nonsmoking older persons. The Framingham Heart Study. Jama. 1988;259(10):1520-1524.
4. Jensen GL, Friedmann JM. Obesity is associated with functional decline in community-dwelling rural older persons. J Am Geriatr Soc. 2002;50(5):918-923.
5. Khan SS, Ning H, Wilkins JT, et al. Association of Body Mass Index With Lifetime Risk of Cardiovascular Disease and Compression of Morbidity. JAMA Cardiol. 2018;3(4):280-287.
6. Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. Jama. 2003;289(1):76-79.
7. Han TS, Lean ME. A clinical perspective of obesity, metabolic syndrome and cardiovascular disease. JRSM Cardiovasc Dis. 2016;5:2048004016633371.
8. Wang J, Yang DL, Chen ZZ, Gou BF. Associations of body mass index with cancer incidence among populations, genders, and menopausal status: A systematic review and meta-analysis. Cancer Epidemiol. 2016;42:1-8.
9. Elagizi A, Kachur S, Lavie CJ, et al. An Overview and Update on Obesity and the Obesity Paradox in Cardiovascular Diseases. Prog Cardiovasc Dis. 2018;61(2):142-150.
10. Lavie CJ, De Schutter A, Parto P, et al. Obesity and Prevalence of Cardiovascular Diseases and Prognosis-The Obesity Paradox Updated. Prog Cardiovasc Dis. 2016;58(5):537-547.

11. Cao C, Wang R, Wang J, Bunjhoo H, Xu Y, Xiong W. Body mass index and mortality in chronic obstructive pulmonary disease: a meta-analysis. PLoS One. 2012;7(8):e43892.
12. Veronese N, Cereda E, Solmi M, et al. Inverse relationship between body mass index and mortality in older nursing home residents: a meta-analysis of 19,538 elderly subjects. Obes Rev. 2015;16(11):1001-1015.
13. Restrepo BJ. Obesity Prevalence Among U.S. Adults During the COVID-19 Pandemic. Am J Prev Med. 2022;63(1):102-106.
14. 1Robinson E, Boyland E, Chisholm A, et al. Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. Appetite. 2021;156:104853.
15. LTCFocus Public Use Data sponsored by the National Institute on Aging (P01 AG027296) through a cooperative agreement with the Brown University School of Public Health. Available at www.ltcfocus.org. https://doi.org/10.26300/h9a2-2c26.
16. CDC: Defining Adult Overweight & Obesity. https://www.cdc.gov/obesity/basics/adult-defining.html, Accessed on 12/24/2022.
17. Zhang N, Field T, Mazor KM, Zhou Y, Lapane KL, Gurwitz JH. The Increasing Prevalence of Obesity in Residents of U.S. Nursing Homes: 2005-2015. J Gerontol A Biol Sci Med Sci. 2019;74(12):1929-1936.
18. CDC:Adult Obesity Prevalence Maps. https://www.cdc.gov/obesity/data/prevalence-maps.html#overall, Accessed on 1/2/2023.
19. Harris JA, Castle NG. Obesity and Nursing Home Care in the United States: A Systematic Review. Gerontologist. 2019;59(3):e196-e206.
20. Samper-Ternent R, Al Snih S. Obesity in Older Adults: Epidemiology and Implications for Disability and Disease. Rev Clin Gerontol. 2012;22(1):10-34.
21. Elkins JS, Whitmer RA, Sidney S, Sorel M, Yaffe K, Johnston SC. Midlife obesity and long-term risk of nursing home admission. Obesity (Silver Spring). 2006;14(8):1472-1478.
22. Zizza C, Herring A, Domino M, Haines P, Stevens J, Popkin BM. The effect of weight change on nursing care facility admission in the NHANES I Epidemiologic Followup Survey. J Clin Epidemiol. 2003;56(9):906-913.
23. Lapane KL, Resnik L. Weighing the relevant issues: obesity in nursing homes. J Aging Soc Policy. 2006;18(2):1-9.
24. Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. Jama. 2002;287(3):356-359.
25. Bonomini F, Rodella LF, Rezzani R. Metabolic syndrome, aging and involvement of oxidative stress. Aging Dis. 2015 Mar 10;6(2):109-20. doi: 10.14336/AD.2014.0305. PMID: 25821639; PMCID: PMC4365955.
26. Grabowski DC, Campbell CM, Ellis JE. Obesity and mortality in elderly nursing home residents. J Gerontol A Biol Sci Med Sci. 2005;60(9):1184-1189.

Authors

Yasin Abul, MD, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence, RI; Brown University School of Public Health Center for Gerontology and Healthcare Research.

Frank DeVone, MS, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI.

Mriganka Singh, MD, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

Christopher Halladay, MS, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI.

Thomas A. Bayer, MD, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence, RI.

Kevin W. McConeghy, PharmD, MS, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI.

Stefan Gravenstein, MD, MPH, Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University; Brown University School of Public Health Center for Gerontology and Healthcare Research, Providence, RI.

James L. Rudolph, MD, SM, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University and Center of Gerontology and Health Services Research, Brown University School of Public Health, Providence, RI.

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Correspondence

Yasin Abul, MD
Captain John H. Harwood Research Center
at the VA Providence Health Care System
373 Niagara St., Providence, RI 02907
401-277-8900
Fax 401-649-4011
yasin_abul@brown.edu

Disparities in Utilization of Palliative Care in Patients Experiencing Homelessness

JANE M. SIMPSON, DO; JACOB RAMOS, MD; ANNIE LAURIE GULA, MD; MITCHELL WICE, MD; EDWARD MARTIN, MD; JAMES L. RUDOLPH, MD, SM

ABSTRACT

BACKGROUND: Patients experiencing homelessness have increased disease burden, increased severity of illness, and increased barriers to accessing care. The provision of high-quality palliative care is therefore essential for this population.

STATE OF HOMELESSNESS: 18 out of every 10,000 people in the US and 10 out of every 10,000 Rhode Islanders (down from 12 in 2010) experience homelessness.

CONCEPTUAL MODEL: High-quality palliative care for patients experiencing homelessness requires a foundation of patient-provider trust, well-trained interdisciplinary teams, coordinated transitions of care, community support, integrated healthcare systems, and comprehensive population and public health measures.

CONCLUSIONS: Improving access to palliative care for those experiencing homelessness requires an interdisciplinary approach at all levels from individual providers to broader public health policies. A conceptual model rooted in patient-provider trust has the potential to address high-quality palliative care access disparities for this vulnerable population.

KEYWORDS: homelessness; health services accessibility; end-of-life care; social determinants of health

BACKGROUND

During the depths of winter every year, a network organized by the US Department of Housing and Urban Development (HUD) seeks to obtain a census of people experiencing homelessness by performing a head count in shelters and community settings on a January night.[1] The figures are as bleak as the temperature – 580,466 people experiencing homelessness were counted in 2020.[1,2] The number represents 18 of every 10,000 people in the US and is increasing, while in Rhode Island 10 out of every 10,000 people were experiencing homelessness.[1-4]

Individuals experiencing homelessness have unique health needs that are intertwined with lack of housing. They experience higher rates of mental health issues, diabetes, substance use disorder, heart disease, HIV/AIDs, and overall mortality when compared to the general population.[5-8] People experiencing homelessness often present to healthcare later in their disease courses with more severe illness, unpredictable outcomes, and complex care needs.[9] Barriers to healthcare in populations experiencing homelessness are similar to barriers to other services including cost, not knowing locations to access care, decreased access to transportation, and lack of legal identification.[10-12] Illnesses leading to unemployment and higher healthcare costs additionally limit access to care.[5] Even for patients experiencing homelessness that had employment in the previous year, the ability to receive care was limited by access to health insurance. This is the result of multiple factors, including the priority of employment over insurance and Medicaid restrictions.[13] Due to increased disease prevalence, delayed access to care, increased mortality, and increased severity of illness, people experiencing homelessness may benefit from increased access to palliative care (PC), which is specialized medical care for people with serious or life-limiting illness which focuses on the needs of the patient by providing relief of symptoms, stress, and improving quality of life for patients using a interdisciplinary team of providers.[14]

PC provides high-quality, goal-concordant care to alleviate suffering by improving quality of life[15-18] and has been shown to decrease mortality in serious illnesses,[19] including cancer.[20] PC services can follow patients through the trajectory of serious illness, are often available in inpatient and outpatient contexts, and are comprised of interdisciplinary teams.[15-20] Providing equitable access to PC is a challenge in many populations, including those experiencing homelessness.[15-18] Barriers to PC services for this population include poor understanding of one's health, limited family support, competing medical priorities, and stigma associated with both PC and homelessness.[9,21,22] PC also depends on a stable home and social support model for care, posing additional barriers for those who are experiencing homelessness.[23] Improving utilization of high-quality PC could significantly impact the overall health and quality of life for those facing specific barriers to care[6,9,13] and increased disease prevalence and severity[5-8] due to homelessness. As stated prior, high-quality palliative care broaches not only medical care but also societal issues and thus is uniquely primed to improve the lives of those with homelessness. Thoughtful and intentional planning and actions are important when confronting an issue like homelessness on this scale, and so we believe a conceptual model of how to better provide PC to those experiencing homelessness is needed.

STATE OF HOMELESSNESS IN RI

The US Interagency Council on Homelessness reports that 1,104 people were experiencing homelessness in Rhode Island in 2020,[3,4] 10 out of every 10,000 people, compared to the national 18 per 10,000.[1,3,4] In surrounding states, Massachusetts had a prevalence of 26 per 10,000 people and Connecticut 8 per 10,000 people.[3,4] In 2010, 12 in 10,000 Rhode Islanders were experiencing homelessness.[24,25] During the 2020 census, Rhode Island was also shown to have a poverty rate of 10.6% and 4.8% of the population under 65 did not have health insurance.[4] We must continue to work towards the goal of eliminating homelessness and its effects on our neighbors and patients.

Prominent community organizations working to address homelessness include the Rhode Island Coalition to End Homelessness and Crossroads Rhode Island. There are also many community-based organizations that function on a regional level within the state and provide important services to those experiencing homelessness. The Rhode Island Coalition to End Homelessness estimates that as of March 31, 2022 there are 896 Rhode Islanders living in shelters, 277 living out of doors, and 141 families waiting for a shelter.[26] These community organizations work to identify those experiencing homelessness, connect people to shelters and social services, and raise awareness about the issue of homelessness.[27]

The Veterans Affairs Medical Center in Providence is involved in the identification and reduction of homelessness in the Veteran community. The VA system uses specific medical coding to identify those at risk for homelessness and those currently experiencing homelessness to facilitate interdisciplinary approaches to providing housing and increased access to care.[28] Because of these coordinated approaches, Veteran homelessness fell almost 50% from 2009 to 2020,[1] suggesting that identification and an interdisciplinary approach can be effective at reducing homelessness.

CONCEPTUAL MODEL FOR IMPROVING UTILIZATION OF PALLIATIVE CARE IN PATIENTS EXPERIENCING HOMELESSNESS

In this review, we propose a framework for communities seeking to address these disparities in access to high-quality palliative care. The authors performed a literature review looking at PC in the setting of homelessness both in the US and Canada. While much qualitative data, and some quantitative data, was available we recognized that a framework for how to approach the care of homeless people did not exist and could be created to help better serve this population with unique needs.

Palliative care as a foundation of patient-provider trust

This conceptual model is based on a strong foundation of patient-provider trust, which is a facilitator to compassionate and dignity-focused care.[12,29] Building trust between patients and providers is important to increase access to care, engender honest communication, and encourage repeat encounters. Construction and maintenance of this trust is hardly formulaic or specific to palliative care, but is key in the field of palliative care as it focuses on sensitive and very personal psychosocial issues on top of medical issues, and thus our model seeks to denote some of the most important elements required for success in building these relationships.

Multimodal training and education

Given the unique factors and societal stigma faced by people with housing instability, working with patients experiencing housing instability requires knowledge of and sensitivity to the specific stressors they face. Multimodal provider education – such as patient-first language, open-ended interviewing rooted in curiosity, and consideration of personal and professional biases (explicit and implicit) toward homeless individuals – can help foster mutual respect and identify patient-specific goals.[11,21] Special skills may be required for nuanced conversations about goal-concordant care with people experiencing homelessness, particularly when considering the increased barriers to care (i.e., financial stressors, food insecurity, inadequate medication storage options, etc.).

Interdisciplinary teams

Teams composed of members from several disciplines working together are an important foundation of all healthcare areas, but especially important in PC when trying to support patients in all facets of the illness process.[30] We likewise acknowledge that caring for patients with housing instability is beyond the scope of any single profession. Therefore, we cannot overstate the importance of interdisciplinary approaches in serving this population. Efforts to mitigate the impacts of homelessness can follow a collective impact model, which utilizes a centralized infrastructure, a dedicated staff, continuous communication, and a shared agenda.[30] In such a model, healthcare teams must partner with shelter staff, public works departments, and social services (among others) to provide appropriate support.[30] Just as delivering high-quality palliative care relies on an interdisciplinary disciplinary team (including physicians, nurses, nurse assistants, chaplains, social workers, and volunteers), cultivating patient trust is the responsibility of all clinical and non-clinical providers within any given system.

Continuity of care and coordinated transitions

Patients experiencing homelessness have high rates of acute care (inpatient hospitalization, emergency department) utilization, which may be exacerbated by poor transitions in care.[31] This is particularly important when considering a hospital discharge, as patients experiencing homelessness may have unique barriers to discharge. In 2021, Greysen et al demonstrated that 27% of people experiencing

homelessness were discharged at night (after shelters have closed) and 11% reported sleeping outside on the first night after discharge.[31] People experiencing homelessness face competing priorities and unique hardships, such as limited resources, living within inflexible structures (e.g., shelters), inconsistent living spaces, and the time-intensive task of seeking adequate nourishment and shelter.[21] Thus, distinct and familiar patterns of follow-up - paired with additional attention during points of transition - is key in sustaining trusting relationships.

PC treats and interacts with patients as they require and move between various levels of care including care based at home, in hospitals, and in nursing homes. In this way PC is uniquely positioned to improve transitions for those experiencing homelessness. Possible interventions include discussions about housing and transportation as health issues, and communication with shelters as collaborators in discharge planning.[31]

Community infrastructure and support

Beyond optimization of trust and safe transitions within the healthcare system, involvement of existing community-based infrastructures and support systems can bolster individual patient success. Key examples may include community-based programs focused on securing stable housing for vulnerable individuals, especially as patient environments can directly impact the delivery and continuity of health care services.[9,21] Furthermore, community health workers with lived experience of homelessness can provide vital insight into how to most effectively create support systems for a given community. As our model approaches a goal of increased access to high-quality palliative care, other systems working in parallel towards distinct goals may present opportunities to concert efforts towards the unified goal of increased population health. We believe it is important to identify these groups and resources in the community and have PC interdisciplinary teams partner with them to increase access to services and care in both directions.

Integration with healthcare systems

In line with interdisciplinary and community partnership, the WHO advocates for implementing an integrated care model, defined as "an approach to strengthen people-centered health systems through the promotion of the comprehensive delivery of quality services across the life-course, designed according to the multidimensional needs of the population and the individual and delivered by a coordinated multidisciplinary team of providers working across settings and levels of care. It should be effectively managed to ensure optimal outcomes and the appropriate use of resources based on the best available evidence, with feedback loops to continuously improve performance and to tackle upstream causes of ill health and to promote well-being through intersectoral and multisectoral actions."[32] Integrated care models strive to provide patients a single, coordinated plan of care, which can positively contribute to health related quality of life.[32] Additionally, integrating care can improve outcomes in healthcare delivery with increased timeliness and communication, cost savings, and overall patient satisfaction.[33] It is important to note that integrated care models are not sufficient to quell healthcare disparities, as "integration is likely to enhance already well-established systems rather than fundamentally changing the outcomes of care."[33] Furthermore, marginalized groups were often last to see these benefits with disparities in care well documented based on race or socioeconomic status – to name a few – where Caucasians or well-off individuals receive more frequent PC.[19,33]

Population and public-health measures

As above, interventions to improve access to PC for people experiencing homelessness must extend beyond the healthcare system. Since homelessness has such broad impacts, it should be managed as both a medical and a social issue.[34] Population- and public health-level interventions that can improve access include efforts to eliminate homelessness, ensure adequate insurance coverage, and eliminate institutional and structural racism. Rapid Re-housing[35] and Housing First initiatives[36] prioritize rent subsidies and expedited housing searches to help people obtain stable housing as soon as possible. These approaches have been shown to reduce homelessness, improve food insecurity, and improve overall well-being.[36] These interventions are also cost effective.[36] As a significant amount of palliative care, including hospice, is provided in the home, the lack of stable housing becomes a crucial barrier to appropriate PC, thus these efforts to provide housing become even more critical.

Furthermore, efforts to improve access to healthcare overall can improve PC access. Issues of access may include difficulties with transportation, prohibitive cost of care, and challenges with accessing, storing, and administering medications, including analgesics.[21] In fact, an aim of the United Nations' 2030 Agenda for Sustainable Development is to "achieve universal health coverage, including... access to quality, essential healthcare services."[37] Changes to the payor structure that acknowledge and accommodate for healthcare disparities, such as comprehensive universal health insurance, are both in line with global and local efforts to improve healthcare access.

It is also important to note that racial disparities to quality PC exist independent of insurance status.[16] This is especially concerning as non-Hispanic Black and Hispanic populations are vastly overrepresented in the population experiencing homelessness (lifetime incidence of 16.8% and 8.1%, respectively, compared with 4.8% for White people).[38] These race-based differences are perpetuated by lasting impacts of institutional racism, including historic redlining policies and current discriminatory lending practices, which increases risk for homelessness.[39] While it is beyond

the scope of this review to describe the impacts of structural racism on healthcare, it is clear that BIPOC (Black, Indigenous, and People of Color) experiencing homelessness represent a group with an even greater need for targeted advocacy and support. To truly address this healthcare disparity, we must address and eliminate structural racism.

CONCLUSIONS

Patients experiencing homelessness represent a population who could benefit from high- quality PC services to alleviate suffering and improve quality of life. While our review is not exhaustive or representative of the efforts at multiple levels that communities take to support their vulnerable populations, it is evident that there are many barriers to receiving PC for patients experiencing homelessness. Efforts should be made on an individual level to cultivate patient-provider trust, on an institutional level to minimize bias and improve interdisciplinary partnerships, on a community level to improve stability and support, and on a population level to implement public health interventions to minimize homelessness and its impacts. Comprehensive, holistic interventions could improve utilization of high-quality PC services for patients experiencing housing insecurity.

References

1. U.S. Department of Housing and Urban Development. HUD Releases 2020 Annual Homeless Assessment Report Part 1. March 18, 2021. Accessed April 5, 2022. https://www.hud.gov/press/press_releases_media_advisories/hud_no_21_041#:~:text=The%20report%20found%20that%20580%2C466,or%202.2%20percent%2C%20from%202019.
2. U.S. Department of Housing and Urban Development. HUD Releases 2021 Annual Homeless Assessment Report Part 1. February 4, 2022. Accessed April 5, 2022. https://www.hud.gov/press/press_releases_media_advisories/HUD_No_22_022
3. United States Interagency Council on Homelessness. Homelessness Statistics by State. 2020. Accessed April 5, 2022. https://www.usich.gov/tools-for-action/map/#fn[]=1300&fn[]=2900&fn[]=6400&fn[]=10200&fn[]=13400
4. United States Census Bureau. QuickFacts. 2021. Accessed April 5, 2022. https://www.census.gov/quickfacts/fact/table/CT,MA,RI/PST045221
5. National Health Care for the Homeless Council. Homelessness and Health: What's the Connection? 2019. Accessed April 5, 2022. https://nhchc.org/wp-content/uploads/2019/08/homelessness-and-health.pdf
6. Hwang S. Mental illness and mortality among homeless people. Acta Psychiatrica Scandinavica, 103: 81-82. Doi: 10.1034/j.1600-0447.2001.103002081
7. National Alliance to End Homelessness. Health. 2022. Accessed April 5, 2022. https://endhomelessness.org/homelessness-in-america/what-causes-homelessness/health/#:~:text=Health%20and%20Homelessness,-An%20acute%20physical&text=On%20a%20given%20night%20in,10%2C000%20people%20had%20HIV%2FAIDS
8. U.S. Department of Housing and Urban Development. The 2016 Annual Homeless Assessment Report (AHAR) to Congress Part 2. December 2017. Accessed April 5, 2022. https://www.huduser.gov/portal/sites/default/files/pdf/2016-AHAR-Part-2.pdf
9. de Veer AJE, Stringer B, van Meijel B, Verkaik R, Francke AL. Access to palliative care for homeless people: complex lives, complex care. BMC Palliat Care. 2018 Oct 24;17(1):119. doi: 10.1186/s12904-018-0368-3
10. National Coalition for the Homeless. Healthcare and Homelessness. 2009. Accessed April 5, 2022. https://www.nationalhomeless.org/factsheets/health.html#:~:text=Unfortunately%2C%20many%20homeless%20people%20who,identification%20(Whitbeck%2C%202009)
11. Klop HT, de Veer AJE, van Dongen SI, Francke AL, Rietjens JAC, Onwuteaka-Philipsen BD. Palliative care for homeless people: a systematic review of the concerns, care needs and preferences, and the barriers and facilitators for providing palliative care. BMC Palliat Care. 2018;17(1):67. Published 2018 Apr 24. doi:10.1186/s12904-018-0320-6
12. Purkey E, MacKenzie M. Experiences of Palliative Health Care for Homeless and Vulnerably Housed Individuals. J Am Board Fam Med. 2019;32(6):858-867. doi:10.3122/jabfm.2019.06.190093
13. Baggett TP, O'Connell JJ, Singer DE, Rigotti NA. The unmet health care needs of homeless adults: a national study. *Am J Public Health*. 2010;100(7):1326-1333. doi:10.2105/AJPH.2009.180109
14. Center to Advance Palliative Care. Palliative Care Definition: What Is Palliative Care. Accessed January 23, 2023. https://www.capc.org/about/palliative-care/
15. Gelfman LP, Barrón Y, Moore S, et al. Predictors of Hospice Enrollment for Patients With Advanced Heart Failure and Effects on Health Care Use. JACC Heart Fail. 2018;6(9):780-789. doi:10.1016/j.jchf.2018.04.009
16. Lewis JM, DiGiacomo M, Currow DC, Davidson PM. Dying in the margins: understanding palliative care and socioeconomic deprivation in the developed world. J Pain Symptom Manage. 2011;42(1):105-118. doi:10.1016/j.jpainsymman.2010.10.265
17. Walshe C, Todd C, Caress A, Chew-Graham C. Patterns of access to community palliative care services: a literature review. J Pain Symptom Manage. 2009;37(5):884-912. doi:10.1016/j.jpainsymman.2008.05.004
18. Xu Z, Chen L, Jin S, Yang B, Chen X, Wu Z. Effect of Palliative Care for Patients with Heart Failure. Int Heart J. 2018;59(3):503-509. doi:10.1536/ihj.17-289
19. Liu X, Dawod Y, Wonnaparhown A, Shafi A, Doo L, Yoo JW, Ko E, Choi YS. Effects of hospital palliative care on health, length of stay, and in-hospital mortality across intensive and non-intensive-care units: A systematic review and metaanalysis. Palliat Support Care. 2017 Dec;15(6):741-752. doi: 10.1017/S1478951516001164
20. Rocque GB, Cleary JF. Palliative care reduces morbidity and mortality in cancer. Nat Rev Clin Oncol. 2013 Feb;10(2):80-9. doi: 10.1038/nrclinonc.2012.211
21. Hudson BF, Flemming K, Shulman C, Candy B. Challenges to access and provision of palliative care for people who are homeless: a systematic review of qualitative research. BMC Palliat Care. 2016;15(1):96. Published 2016 Dec 3. doi:10.1186/s12904-016-0168-6
22. Huynh L, Henry B, Dosani N. Minding the gap: access to palliative care and the homeless. BMC Palliat Care. 2015;14:62. Published 2015 Nov 18. doi:10.1186/s12904-015-0059-2
23. Song J, Bartels DM, Ratner ER, Alderton L, Hudson B, Ahluwalia JS. Dying on the streets: homeless persons' concerns and desires about end of life care. J Gen Intern Med. 2007;22(4):435-441. doi:10.1007/s11606-006-0046-7
24. U.S. Department of Housing and Urban Development. 2010 Homeless Assessment Report. 2010. Accessed April 6, 2022. https://www.huduser.gov/portal/sites/default/files/pdf/2010HomelessAssessmentReport.pdf
25. United States Census Bureau. 2010 Census: Rhode Island Profile. 2010. Accessed April 6, 2022 https://www2.census.gov/geo/maps/dc10_thematic/2010_Profile/2010_Profile_Map_Rhode_Island.pdf

26. The Rhode Island Coalition to End Homelessness. Homeless Management Information System (HMIS). March 31, 2022. Accessed April 6, 2022 https://www.rihomeless.org/
27. Pixley CL, Henry FA, DeYoung SE, Settembrino MR. The role of homelessness in community-based organizations during COVID-19. *Journal of Community Psychology*, 1– 15. 2021. doi: 10.1002/jcop.22609
28. US Department of Veterans Affairs. 2021-2025 Homeless Programs Office Strategic Plan. 2019. Available from: https://www.va.gov/HOMELESS/strategic-plan.asp. Accessed April 4, 2022.
29. Ramsay N, Hossain R, Moore M, Milo M, Brown A. Health Care While Homeless: Barriers, Facilitators, and the Lived Experiences of Homeless Individuals Accessing Health Care in a Canadian Regional Municipality. Qual Health Res. 2019;29(13):1839-1849. doi:10.1177/1049732319829434
30. Abdel-Samad M, Calzo JP, Felner JK, et al. Conceptualizing an Interdisciplinary Collective Impact Approach to Examine and Intervene in the Chronic Cycle of Homelessness. Int J Environ Res Public Health. 2021;18(4):2020. Published 2021 Feb 19. doi:10.3390/ijerph18042020
31. Greysen SR, Allen R, Lucas GI, Wang EA, Rosenthal MS. Understanding transitions in care from hospital to homeless shelter: a mixed-methods, community-based participatory approach. J Gen Intern Med. 2012;27(11):1484-1491. doi:10.1007/s11606-012-2117-2
32. WHO. Strengthening people-centred health systems in the WHO European Region: Framework for action on integrated health services delivery WHO Regional Office for Europe; 2016. Available from: http://www.euro.who.int/__data/assets/pdf_file/0004/315787/66wd15e_FFA_IHSD_160535.pdf?ua=1
33. Lê G, Morgan R, Bestall J, Featherstone I, Veale T, Ensor T. Can service integration work for universal health coverage? Evidence from around the globe. Health Policy. 2016;120(4):406-419. doi:10.1016/j.healthpol.2016.02.007
34. Stafford A, Wood L. Tackling Health Disparities for People Who Are Homeless? Start with Social Determinants. Int J Environ Res Public Health. 2017;14(12):1535. Published 2017 Dec 8. doi:10.3390/ijerph14121535
35. Cunningham M.K., Batko S. Rapid Re-Housing's Role in Responding to Homelessness. Urban Institute; Washington, DC, USA: 2018.
36. Gubits D, Shinn M, Wood M, Brown SR, Dastrup SR, Bell SH. What Interventions Work Best for Families Who Experience Homelessness? Impact Estimates from the Family Options Study. J Policy Anal Manage. 2018;37(4):735-766.
37. Sustainable Development Goals. United Nations Department of Economic and Social Affairs. Accessed 6 June 2022. https://sustainabledevelopment.un.org/index.php?menu=1300
38. Fusaro VA, Levy HG, Shaefer HL. Racial and Ethnic Disparities in the Lifetime Prevalence of Homelessness in the United States. Demography. 2018;55(6):2119-2128. doi:10.1007/s13524-018-0717-0
39. Lynch EE, Malcoe LH, Laurent SE, Richardson J, Mitchell BC, Meier HCS. The legacy of structural racism: Associations between historic redlining, current mortgage lending, and health. SSM Popul Health. 2021;14:100793. Published 2021 Apr 20. doi:10.1016/j.ssmph.2021.100793

Authors

Jane M. Simpson, DO, Rhode Island Hospital and Lifespan Health System, Providence, RI.

Jacob Ramos, MD, Rhode Island Hospital and Lifespan Health System, Providence, RI.

Annie Laurie Gula, MD, Rhode Island Hospital and Lifespan Health System, Providence, RI.

Mitchell Wice, MD, The Warren Alpert Medical School of Brown University and the Providence VA Medical Center, Providence RI.

Edward Martin, MD, The Warren Alpert Medical School of Brown University, Providence, RI.

James L. Rudolph, MD, SM, Center of Innovation in Long Term Services and Supports, VA Providence Healthcare System, Providence, RI; Division of Geriatrics and Palliative Medicine, Warren Alpert Medical School of Brown University and Center of Gerontology and Health Services Research, Brown University School of Public Health, Providence, RI.

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Correspondence

Mitchell Wice, MD

Center of Innovation in Long Term Services and Supports

Providence VA Medical Center

830 Chalkstone Ave

Providence, RI 02093

mitchell.wice@va.gov

Feasibility of Light and Music Therapy in the Elderly for the Prevention of Hospital-Associated Delirium

SARAH KEENE, MD, PhD; ARVIND BALASUNDARAM, BA; LAUREN CAMERON-COMASCO, MD; RONNY OTERO, MD

ABSTRACT

Hospital-associated delirium is common in older adults, especially those with dementia, and is associated with high morbidity and mortality. We performed a feasibility study in the emergency department (ED) to examine the effect of light and/or music on the incidence of hospital-associated delirium.

Patients aged ≥ 65 who presented to the ED and tested positive for cognitive impairment were enrolled in the study (n = 133). Patients were randomized to one of four treatment arms: music, light, music and light, and usual care. They received the intervention during their ED stay. In the control group, 7/32 patients developed delirium, while in the music-only group, 2/33 patients developed delirium (RR 0.27, 95% CI 0.06–1.23), and in the light-only group (RR 0.41, 95% CI 0.12–1.46), 3/33 patients developed delirium. In the music + light group, 8/35 patients developed delirium (RR 1.04, 95% CI 0.42–-2.55).

Providing music therapy and bright light therapy to ED patients was shown to be feasible. Although this small pilot study did not reach statistical significance, there was a trend towards less delirium in the music-only and light-only groups. This study lays the groundwork for future investigation into the efficacy of these interventions.

KEYWORDS: emergency department; geriatrics; delirium; dementia; quality improvement

INTRODUCTION

Delirium is a significant cause of morbidity, resulting in functional decline among hospital patients, especially older adults with dementia.[1-5] Delirium in older adults is independently associated with longer hospital length of stay,[5,6] increased mortality,[4,6,7] and increased rates of cognitive decline.[8]

Two non-pharmacologic interventions that have been trialed in delirium prevention are music therapy and light therapy. These studies have shown mixed results, with a trend toward positive outcomes.[9-16] However, few studies have explicitly looked at preventing hospital-associated delirium through interventions in the ED, and none have examined music or light therapy in the ED setting. Here, we present a pilot study investigating whether music and/or full-spectrum light provided in the ED would reduce the incidence of delirium within the first 24 hours of hospital admission.

METHODS

Setting

This was a pilot randomized controlled trial from August 2021 through December 2021 in an academic ED, Beaumont Hospital, Royal Oak, Michigan.

Recruitment

Patients were eligible for inclusion if they were 65 or older, were assigned an Estimated Severity Index (ESI) of 2-5 at triage and could either consent or have a legally authorized representative available to consent for them. The hours of enrollment and intervention were 10 am to 6 pm, Monday through Friday. Patients were excluded from the study if they were on isolation precautions due to suspected SARS-CoV-2 infection, legally deaf, intoxicated, or presented with a psychiatric chief complaint. Although patients discharged from the ED were ultimately excluded from the study, expected disposition was not considered an enrollment criterion.

Patients who consented underwent a cognitive assessment with the Short Blessed Test[17] (SBT). Those who tested positive for potential cognitive impairment (SBT score >4) were enrolled in the trial. Enrolled patients were randomized to one of the four trial arms using the MinimPy software in a 1:1:1:1 allocation ratio.[18] The hospital's Institutional Review Board approved this study.

Intervention

Patients were enrolled in one of four groups: 1) music; 2) light; 3) music and light; 4) usual care. Upon enrollment, all enrolled patients were screened for delirium by the Confusion Assessment Method[19] (CAM) by the research assistant.

Music was provided with a wireless speaker that was placed on a table next to the patient's bed. Music was stored on a memory card compatible with the available wireless speaker. Two playlists were available: one containing classical music and one containing non-vocal jazz music. Patients were allowed to choose which playlist they were given; the classical playlist was chosen if they could not choose or expressed no preference. Playlists were chosen to

standardize the music intervention across participants. Each playlist was approximately 2 hours in length and repeated until turned off. The average length of time of the intervention was four hours. Similarly, Light therapy was provided by a full-spectrum lightbox set up on a table next to the patient's bed. Lightboxes were designed to mimic natural light with a color temperature of 6,500K. Brightness was set to 5,000 lux. All interventions were discontinued when the patient left the ED.

All patients received standard medical care provided by the ED physician and subsequent hospital staff after admission. Neither patients nor ED staff were blinded to the patient's treatment arm; however, hospital staff taking care of the patients on the inpatient floors after admission were blinded to the intervention. An additional CAM screen was performed by the inpatient nurse upon each patient's arrival to their inpatient floor.

Evaluation

The age, sex, presentation date and time, and ESI were collected prospectively for all patients screened for inclusion. For those who met inclusion criteria and consented, the following items were collected prospectively: their medical record number, the SBT result, the CAM result, and the start time of the intervention. Enrolled patients were subjected to a retrospective chart review to collect the following data: race, insurance payor, point of origin, past medical history, disposition, admission diagnosis, acute care unit to which the patient was admitted, and the level of care under which the patient was admitted. To determine the incidence of delirium, data was collected on the result of the initial inpatient CAM, as well as the use of medication, physical restraints, video or human monitoring, or activation of the hospital's Rapid Response Team (RRT) for reasons of "delirium", "agitation", "mental status change", or "encephalopathy".

Outcome

A multi-modal definition of delirium was employed to accurately capture all patients who experienced delirium within the first 24 hours of admission. A diagnosis of in-hospital delirium was made if the patient required benzodiazepine or antipsychotic use, physical restraints, video or human monitoring, or RRT activation for the reasons listed above within the first 24 hours, had a positive CAM upon arrival to the floor after a negative CAM in the ED, or had a diagnosis made of "delirium", "altered mental status", or "metabolic encephalopathy" added to their chart within the first 24 hours of admission. Patients were excluded from analysis if they were discharged from the ED or if they tested positive for delirium while in the ED based on the initial CAM obtained upon enrollment in the study.

STATISTICAL ANALYSIS

Descriptive statistics (mean, median, proportion, standard deviation) were calculated for all patient characteristics. The admission diagnosis category was determined by mapping the ICD-10 code used for the admission diagnosis to one of the delineated domains. Modified Charlson Comorbidity Index[20,21] (CCI) scores were calculated by assigning past medical history diagnoses as abstracted from the chart to each domain comprising the CCI. Estimated Severity Index (ESI) scores were assigned at ED triage.

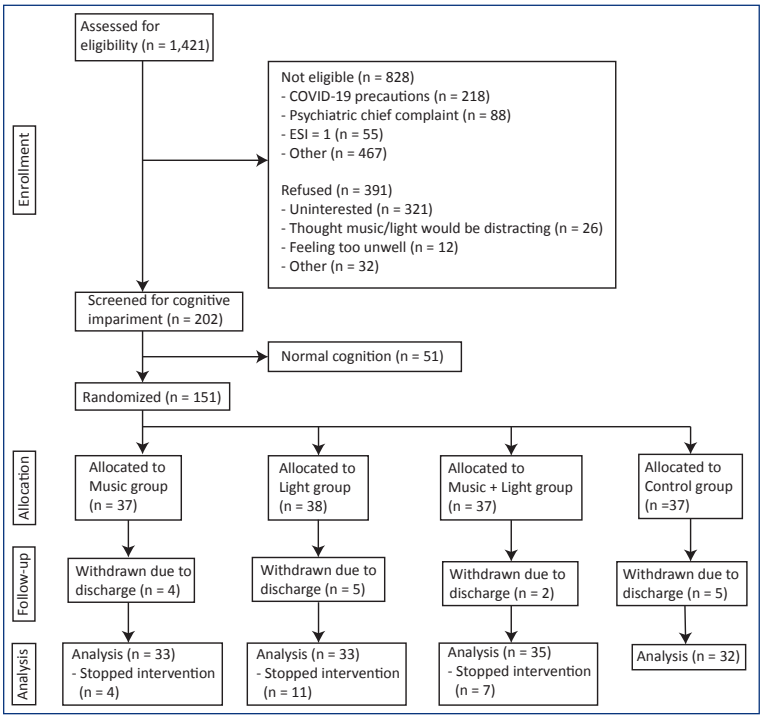
Medians were compared using the Kruskal-Wallis H test with Bonferroni adjustment for multiple groups. Differences in proportions among patient characteristics and differences in the incidence of delirium between groups were compared using Fisher's Exact Test. Significance was calculated as $\alpha = 0.05$. All statistical analyses were performed in STATA.[22]

RESULTS

Recruitment and patient characteristics

We screened 1,421 patients for study eligibility between August 2021 and December 2021. Of these, 593 were eligible to participate, and 202 consented to the study. Of those who consented, 51 patients demonstrated normal cognition by the Short Blessed Test (SBT) and were eliminated from the study. The remaining 151 patients were randomized to one of four treatment arms. Allocation and participant flow can be seen in the CONSORT diagram (See **Figure 1**).

Figure 1. CONSORT diagram showing patient flow through the study



ESI: estimated severity index

Table 1. Characteristics and Outcomes of Patients Enrolled in the Pilot Study

	Music (n=33)	Light (n=33)	Music + Light (n=35)	Control (n=32)	p value
Age, median (IQR)	84 (11)	83 (8)	83 (13)	84 (12)	0.96
Female, n (%)	17 (51.5)	20 (60.6)	23 (65.7)	22 (68.8)	0.52
Race					0.98
White	24 (72.7)	24 (72.8)	26 (74.3)	25 (78.1)	
Black	9 (27.3)	9 (27.3)	8 (22.8)	7 (21.9)	
Asian			1 (2.9)		
Charlson Comorbidity Index					0.75
≤4	18 (54.6)	17 (51.5)	20 (57.1)	14 (43.8)	
>4	15 (45.5)	16 (48.5)	15 (42.8)	18 (56.3)	
Estimated Severity Index					0.39
2	17 (51.5)	14 (42.4)	21 (60.0)	21 (65.6)	
3	15 (45.4)	16 (48.4)	13 (37.1)	11 (34.4)	
Point of Origin					>0.99
Extended Care Facility or Clinic	4 (12.1)	5 (15.2)	5 (14.3)	4 (12.5)	
Home	29 (87.9)	28 (84.9)	30 (85.7)	28 (87.5)	
Medicare Insurance	27 (81.82)	29 (87.9)	28 (80.0)	28 (87.5)	0.78
Admission Diagnosis Domain					0.037
Cardiac	10 (30.3)	3 (9.1)	5 (14.3)	4 (12.5)	
Gastrointestinal	3 (9.09)	2 (6.1)	3 (8.6)	1 (3.1)	
Respiratory	4 (12.1)	4 (12.2)	2 (5.7)	8 (25.0)	
Genitourinary	5 (15.2)	1 (3.0)	2 (5.7)	4 (12.5)	
Neurologic				2 (6.3)	
Other	11 (33.3)	23 (69.7)	23 (65.7)	13 (40).6	
Level of Care					0.13
General Medical	30 (90.9)	30 (90.9)	27 (77.1)	30 (93.8)	
Progressive Care	2 (6.1)	3 (9.1)	8 (22.9)	2 (6.2)	
Intensive Care	1 (3.1)				
Short Blessed Test Score, median (IQR)	13 (13)	12 (12)	8 (13)	13 (11)	0.41

IQR: interquartile range; n: number; %: percent.

Patient characteristics are shown in **Table 1**. Patients were predominantly female, White, and presented from home. Baseline health as measured by the Charlson Comorbidity Index was similar across groups.

Primary objective

We performed an intent-to-treat analysis on the incidence of delirium within 24 hours in each group. Two patients in the Music group became delirious within 24 hours; three became delirious in the Light group, eight in the Music + Light group, and seven in the Control group. These differences were not statistically significant (p=0.125). When patients who requested that the intervention be stopped were dropped from the study, the differences remained not significant (p=0.460).

Pairwise comparisons also did not show significance; however, the trend was toward a benefit from the intervention in the Music and Light groups. The relative risk of developing delirium in the Music group compared with the control group was 0.27 (95% CI 0.06–1.23), the relative risk for the Light group compared to the control group was 0.41 (95% CI 0.12–1.46), and the relative risk for the Music + Light group compared to the control group was 1.04 (95% CI 0.42–2.55).

Completion rates and participant adherence

A small number of patients who were randomized to receive music and/or light therapy requested that the intervention be stopped before leaving the Emergency Department. Four patients requested the intervention be discontinued in the Music group, 11 in the light group, and 7 in the Music + Light group. Of the latter, five patients requested that only the light be stopped, and two patients requested that both the light and the music be stopped. The patients' primary reason for requesting that the intervention be stopped is that the light therapy was too bright, followed by finding the light and/or music was distracting when they wished to do something else, like sleep or read. We found that if the room light was kept on when patients were receiving light therapy, they found the light treatment more tolerable. There were no incidences of ED providers requesting the intervention be discontinued. Using an intent-to-treat analysis that includes those patients who chose to discontinue the therapy, the mean duration of the intervention was 7.16 h and the median duration was 4.94 h.

DISCUSSION

Our data indicate that providing full-spectrum light and music therapy to older adult patients in the ED is feasible and can be incorporated into routine ED care. The intervention was received positively by ED staff and the majority of patients. Of those patients who did not qualify for the intervention, the most common reason was that the patient was on isolation precautions due to suspected SARS-CoV-2 infection. As the COVID-19 pandemic eases, this should cease to be a significant factor in adopting interventions such as these. Alternatively, a strict sanitation regime could be adopted that would allow equipment to be used for multiple patients sequentially without concern for their infectious status.

The primary difficulty we encountered was patients either declining enrollment or requesting that the intervention be stopped because they found the intervention to interfere

with how they wished to occupy themselves while waiting for their work up to be complete. Of these, the most common reasons were that they wanted to watch television and therefore were uninterested in music, or they found the light too bright, especially if they wished to sleep. We also found that the majority of the complaints about the brightness of the light were among those patients for whom the room lights were turned off. When room lights were left on, very few patients requested that the lights be turned off. The primary benefit of providing full-spectrum light is not providing light in general, but providing wavelengths of light that trigger an appropriate circadian response,[23,24] leaving the room light on is a simple way to improve compliance with the provided light therapy.

This small pilot study was designed to test feasibility rather than produce robust results. Consequently, it is unsurprising that none of the results reached statistical significance. However, there was a definite trend toward a positive impact in the Music and the Light arms. We plan to investigate further the potential of these interventions in a full-scale study in the future.

Limitations

Music therapy may be more challenging to implement in patient care areas divided by curtains or in a hallway, which can be mitigated by providing headphones. Additionally, our method of diagnosing hospital-associated delirium by retrospective chart review may have missed some cases of delirium, as the hypoactive subset of delirium does not usually prompt pharmacologic intervention or restraints.

CONCLUSION

We found that providing music players and lightboxes to older adults in the ED was feasible, and the reactions by patients and providers were generally positive. Although the results were not statistically significant, there was a trend towards a positive result in the Music and Light groups, indicating that these practical, low-cost interventions can have an outsized effect on lowering the burden of morbidity and mortality associated with delirium.

References

1. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med 1990;113(12):941-8. DOI: 10.7326/0003-4819-113-12-941.
2. Fong TG, Davis D, Growdon ME, Albuquerque A, Inouye SK. The interface between delirium and dementia in elderly adults. The Lancet Neurology 2015;14(8):823-832. DOI: 10.1016/s1474-4422(15)00101-5.
3. Voyer P, Cole MG, Mccusker J, Belzile É. Prevalence and Symptoms of Delirium Superimposed on Dementia. Clinical Nursing Research 2006;15(1):46-66. DOI: 10.1177/1054773805282299.
4. Kakuma R, Du Fort GG, Arsenault L, et al. Delirium in Older Emergency Department Patients Discharged Home: Effect on Survival. Journal of the American Geriatrics Society 2003;51(4):443-450. DOI: 10.1046/j.1532-5415.2003.51151.x.
5. Hsieh SJ, Madahar P, Hope AA, Zapata J, Gong MN. Clinical deterioration in older adults with delirium during early hospitalisation: a prospective cohort study. BMJ Open 2015;5(9):e007496. DOI: 10.1136/bmjopen-2014-007496.
6. Kennedy M, Enander RA, Tadiri SP, Wolfe RE, Shapiro NI, Marcantonio ER. Delirium Risk Prediction, Healthcare Use and Mortality of Elderly Adults in the Emergency Department. Journal of the American Geriatrics Society 2014;62(3):462-469. DOI: 10.1111/jgs.12692.
7. Han JH, Shintani A, Eden S, et al. Delirium in the emergency department: an independent predictor of death within 6 months. Ann Emerg Med 2010;56(3):244-252 e1. DOI: 10.1016/j.annemergmed.2010.03.003.
8. Girard TD, Jackson JC, Pandharipande PP, et al. Delirium as a predictor of long-term cognitive impairment in survivors of critical illness. Crit Care Med 2010;38(7):1513-20. DOI: 10.1097/CCM.0b013e3181e47be1.
9. Abraha I, Trotta F, Rimland JM, et al. Efficacy of Non-Pharmacological Interventions to Prevent and Treat Delirium in Older Patients: A Systematic Overview. The SENATOR project ONTOP Series. PLOS ONE 2015;10(6):e0123090. DOI: 10.1371/journal.pone.0123090.
10. Rivosecchi RM, Kane-Gill SL, Svec S, Campbell S, Smithburger PL. The implementation of a nonpharmacologic protocol to prevent intensive care delirium. J Crit Care 2016;31(1):206-11. DOI: 10.1016/j.jcrc.2015.09.031.
11. Cheong CY, Tan JAQ, Foong Y-L, et al. Creative Music Therapy in an Acute Care Setting for Older Patients with Delirium and Dementia. Dementia and Geriatric Cognitive Disorders Extra 2016;6(2):268-275. DOI: 10.1159/000445883.
12. Liang JH, Xu Y, Lin L, Jia RX, Zhang HB, Hang L. Comparison of multiple interventions for older adults with Alzheimer disease or mild cognitive impairment: A PRISMA-compliant network meta-analysis. Medicine (Baltimore) 2018;97(20):e10744. DOI: 10.1097/MD.0000000000010744.
13. Kverno KS, Black BS, Nolan MT, Rabins PV. Research on treating neuropsychiatric symptoms of advanced dementia with non-pharmacological strategies, 1998-2008: a systematic literature review. Int Psychogeriatr 2009;21(5):825-43. DOI: 10.1017/S1041610209990196.
14. Garcia Guerra G, Almeida L, Zorzela L, et al. Efficacy of music on sedation, analgesia and delirium in critically ill patients. A systematic review of randomized controlled trials. J Crit Care 2019;53:75-80. DOI: 10.1016/j.jcrc.2019.06.006.
15. Khan SH, Xu C, Purpura R, et al. Decreasing Delirium Through Music: A Randomized Pilot Trial. American Journal of Critical Care 2020;29(2):e31-e38. DOI: 10.4037/ajcc2020175.
16. Luther R, Mcleod A. The effect of chronotherapy on delirium in critical care - a systematic review. Nursing in Critical Care 2018;23(6):283-290. DOI: 10.1111/nicc.12300.
17. Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. Am J Psychiatry 1983;140(6):734-9. DOI: 10.1176/ajp.140.6.734.
18. Saghaei M, Saghaei S. Implementation of an open-source customizable minimization program for allocation of patients to parallel groups in clinical trials. Journal of Biomedical Science and Engineering 2011;04(11):734-739. DOI: 10.4236/jbise.2011.411090.
19. Han JH, Wilson A, Vasilevskis EE, et al. Diagnosing delirium in older emergency department patients: validity and reliability of the delirium triage screen and the brief confusion assessment method. Ann Emerg Med 2013;62(5):457-465. DOI: 10.1016/j.annemergmed.2013.05.003.

20. Quan H, Li B, Couris CM, et al. Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. Am J Epidemiol 2011;173(6):676-82. DOI: 10.1093/aje/kwq433.
21. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. J Clin Epidemiol 1994;47(11):1245-51. DOI: 10.1016/0895-4356(94)90129-5.
22. StataCorp. Stata Statistical Software: Release 17. College Station, TX2021.
23. Oldham MA, Lee HB, Desan PH. Circadian Rhythm Disruption in the Critically Ill: An Opportunity for Improving Outcomes. Crit Care Med 2016;44(1):207-17. DOI: 10.1097/CCM.0000000000001282.
24. Sack RL, Auckley D, Auger RR, et al. Circadian Rhythm Sleep Disorders: Part I, Basic Principles, Shift Work and Jet Lag Disorders. Sleep 2007;30(11):1460-1483. DOI: 10.1093/sleep/30.11.1460.

Authors

Sarah Keene, MD, PhD, Department of Emergency Medicine, Beaumont Health System, Royal Oak, MI; Department of Emergency Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Arvind Balasundaram, BA, Oakland University William Beaumont School of Medicine, Rochester, MI.

Lauren Cameron-Comasco, MD, Department of Emergency Medicine, Beaumont Health System, Royal Oak, MI; Oakland University William Beaumont School of Medicine, Rochester, MI.

Ronny Otero, MD, Department of Emergency Medicine, Beaumont Health System, Royal Oak, MI; Oakland University William Beaumont School of Medicine, Rochester, MI; Department of Emergency Medicine, Froedtert & Medical College Wisconsin, Milwaukee, WI.

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Correspondence

Sarah Keene, MD, PhD
Department of Emergency Medicine
The Alpert Medical School of Brown University
55 Claverick Street
Providence, RI 02903
734-395-9725
sarah.keene@brownphysicians.org