Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

A Real-World Model of Multidisciplinary Survivorship Care: Clinical Pathways, Patient-Reported Outcomes, and Implementation Challenges

Bruno Miguel Silva

bruno.m.silva@nms.unl.pt

Universidade Nova de Lisboa

Rosalyn Rodwin

Yale University School of Medicine

Johanna D'Addario

Yale Cancer Center

Mary Jane Minkin

Yale Cancer Center

Natalie Smith

Yale Cancer Center

Scott Capozza

Yale Cancer Center

Kristen Madrid

Yale Cancer Center

Melissa Gambaccini

Yale Cancer Center

Tara Sanft

Yale University School of Medicine

Research Article

Keywords: Cancer survivorship, Multidisciplinary care, Patient-reported outcomes, Network analysis, Quality of life

Posted Date: November 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9337258/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

A Real-World Model of Multidisciplinary Survivorship Care: Clinical Pathways, Patient-Reported Outcomes, and Implementation Challenges

ORIGINAL

Corresponding Author
Bruno Miguel Silva [bruno.m.silva@nms.unl.pt]
Unidade Local de Saúde de Loures-Odivelas - Departamento de Oncologia Médica
Av. Carlos Teixeira 3, 2674-514 Loures, Portugal
ORCID iD: 0000-0001-6154-8019

AUTHORS

Bruno Miguel Silva, MD
Medical Oncology Department - Unidade Local de Saúde de Loures-Odivelas; Loures, Portugal.
NOVA Medical School, Faculdade de Ciências Médicas, NMS, FCM, Universidade NOVA de Lisboa; Lisboa, Portugal

Rosalyn Rodwin, MD MHS
Yale School of Medicine, New Haven, CT, United States
Yale Cancer Center, New Haven, CT, United States

Johanna D'Addario, MHS, PA-C, DFAAPA
Yale Cancer Center, New Haven, CT, United States

Mary Jane Minkin, MD
Yale Cancer Center, New Haven, CT, United States

Natalie Smith, RDN, CSO
Yale Cancer Center, New Haven, CT, United States

Scott Capozza, PT, DPT, MS
Yale Cancer Center, New Haven, CT, United States

Kristen Madrid, LCSW
Yale Cancer Center, New Haven, CT, United States

Melissa Gambaccini, APRN, AOCNP, FNPC
Yale Cancer Center, New Haven, CT, United States

Tara Sanft, MD
Yale University School of Medicine, New Haven, CT, United States
Yale Cancer Center, New Haven, CT, United States

COMPETING INTERESTS: The authors declare that there are no competing interests regarding the publication of this paper.
FUNDING: This work has not received any grant or scholarship.

Abstract

PURPOSE: Cancer survivorship care is increasingly recognized as a core component of oncology, yet its real-world organization remains heterogeneous. This study aimed to characterize a multidisciplinary survivorship care model and examine the structure of patient-reported survivorship needs.

METHODS: We conducted a retrospective, practice-based evaluation at a tertiary academic cancer center. The analysis combined structured mapping of clinical services with quantitative assessment of routinely collected patient-reported outcomes. Survivorship concerns were assessed using the National Comprehensive Cancer Network (NCCN) Problem List, and psychological distress was measured before and after clinic visits using the NCCN Distress Thermometer. A network analysis based on smoothed tetrachoric correlations and EBICglasso was used to examine conditional associations among concerns.

RESULTS: Survivorship care was delivered through coordinated multidisciplinary clinics, individualized care planning, and an integrated network of specialized services. Most patients (91.9%) reported at least one concern, with a median of five concerns per visit, spanning physical, emotional, social, practical, and spiritual domains. Distress scores decreased significantly following the clinic visit (median 4 [IQR 2–6] vs 1 [IQR 0–3], $p < 0.001$). Network analysis revealed structured interrelationships among concerns, with emotional issues forming a central cluster linked to physical and functional domains. Highly connected nodes included self-management, work, loneliness, and perceived burden.

CONCLUSION: Survivorship care can be effectively operationalized in routine practice; however, patient needs are interconnected rather than isolated. Network-informed approaches may support more integrated and patient-centered survivorship care.

Keywords

Cancer survivorship, Multidisciplinary care, Patient-reported outcomes, Network analysis, Quality of life

Introduction

Cancer survivorship is a rapidly growing challenge in oncology, driven by rising cancer incidence, earlier detection, and more effective treatments [1,2]. As a result, an increasing number of individuals live for years or decades after a cancer diagnosis, often experiencing persistent physical, psychological, and social consequences of their disease and its treatment. Common survivorship issues include fatigue, pain, cognitive impairment, emotional distress, fertility concerns, and financial toxicity, all of which may substantially affect quality of life [3,4]. Addressing these long-term and late effects is now recognized as a core component of comprehensive cancer care, rather than an adjunct to oncologic treatment.

Cancer survivorship care is broadly defined as efforts to enhance survivors' health and well-being during and after treatment, including surveillance for recurrence, management of long-term effects, prevention of secondary cancers, and promotion of healthy behaviors [3,5,6]. Foundational frameworks, such as the 2006 Institute of Medicine (IOM) report 'From Cancer Patient to Cancer Survivor: Lost in Transition, established four key components of quality survivorship care: prevention, surveillance, intervention for late effects, and coordination between oncology and primary care [7]. Similarly, the National Comprehensive Cancer Network (NCCN) Survivorship Guidelines provide detailed, evidence-based recommendations to support the integration of survivorship care into routine clinical practice [6].

Despite these advances, the delivery of survivorship care remains highly heterogeneous across healthcare systems. In many settings, follow-up care continues to be primarily oncology-centered and focused on disease surveillance, with limited integration of supportive, psychosocial, and functional care [8]. While dedicated survivorship clinics and shared-care models involving primary care have been proposed and implemented in some institutions, their adoption remains inconsistent, and their real-world organization varies substantially [6,9]. This gap between conceptual frameworks and clinical practice

highlights the need to better understand how survivorship care is operationalized in routine settings.

Moreover, survivorship needs do not occur in isolation but often co-exist and interact across domains, forming complex patterns that are not fully captured by traditional descriptive approaches. A deeper understanding of how patient-reported concerns cluster and relate to one another may provide important insights into how survivorship care can be structured more effectively and efficiently.

In this context, empirical mapping of real-world survivorship programs, combined with analysis of patient-reported outcomes, offers an opportunity to move beyond descriptive models toward a more system-oriented understanding of survivorship care. Such approaches may help identify key domains of need, inform prioritization strategies, and support the design of integrated, multidisciplinary interventions.

Accordingly, this study aims to characterize the organization and delivery of survivorship care at Yale Cancer Center (New Haven, Connecticut, United States), while also examining the structure of patient-reported survivorship needs using network analysis. By integrating program-level description with patient-centered data, this work seeks to provide both a practical model of care and a conceptual framework for understanding survivorship as an interconnected system of needs.

Methods

Study design and setting

This study represents a practice-based evaluation of survivorship care delivery at Yale Cancer Center, a tertiary academic oncology center in the United States. The analysis integrates (1) a structured description of clinical services and care pathways with (2) quantitative evaluation of program-level activity and patient-reported outcomes, with the aim of characterizing how multidisciplinary survivorship care is operationalized in a real-world setting.

Survivorship care programs

The analysis included the Adult Cancer Survivorship Clinic, the Health, Education, Research & Outcomes for Survivors (HEROS) program for childhood cancer survivors, and a network of specialized survivorship services, including sexual health, cardio-oncology, psycho-oncology, integrative medicine, rehabilitation, genetics and prevention, and palliative care. Organizational structure, referral pathways, care processes, and multidisciplinary team composition were characterized using institutional clinical protocols, program documentation, and operational workflows.

Data sources and measures

To complement the structural description, routinely collected clinical and program-level data from January to December 2024 were analyzed. Patient concerns are assessed prior to each visit using the National Comprehensive Cancer Network (NCCN) Distress Thermometer and Problem List, which captures concerns across five domains: physical, emotional, social, practical, and spiritual/religious [6]. For each domain, the proportion of patients reporting at least one concern was calculated, and the total number of concerns selected per patient was summarized.

Psychological distress was measured using the NCCN Distress Thermometer, administered immediately before and after the survivorship clinic visit [6]. Scores range from 0 to 10, with higher values indicating greater distress.

Program activity indicators were analyzed to characterize service utilization and longitudinal engagement. For the HEROS program, longitudinal clinic activity data from 2014 to 2024 were included to contextualize program growth and sustainability.

Statistical analysis

Descriptive statistics were used to summarize patient-reported concerns and program activity. Categorical variables are presented as proportions, and continuous variables as medians with interquartile ranges (IQR).

Changes in distress scores before and after the survivorship clinic visit were assessed using the Wilcoxon signed-rank test for paired data. All statistical tests were two-sided, with a significance threshold of $p < 0.05$.

To examine the structure and interrelationships of survivorship concerns, we conducted a network analysis. Because concerns were recorded as binary variables (present vs absent), a tetrachoric correlation matrix was estimated to approximate associations between underlying latent variables. The matrix was smoothed to ensure positive definiteness and numerical stability prior to model estimation. A sparse regularized partial correlation network was then estimated using the graphical least absolute shrinkage and selection operator (glasso) with Extended Bayesian Information Criterion model selection (EBICglasso), using a tuning parameter of $\gamma = 0.7$ to favor a parsimonious and interpretable network structure [10,11]. In the resulting network, nodes represent individual survivorship concerns and edges represent regularized partial correlations between concerns, controlling for all other variables in the network. Edge thickness reflects the magnitude of the association, and edge color indicates direction (positive or negative). Node strength centrality, defined as the sum of absolute edge weights connected to each node, was calculated to identify the most interconnected concerns within the network. For visualization, nodes were color-coded according to the NCCN Problem List domains.

All analyses were conducted in R (version 4.5.3; R Foundation for Statistical Computing, Vienna, Austria) using the qgraph and bootnet packages.

Ethical considerations

This study was conducted as a retrospective service evaluation using de-identified, routinely collected clinical and program-level data. In accordance with institutional policies, formal ethical approval was not required.

Results

Overview of Yale's Cancer Survivorship Model

Cancer survivorship care at Yale Cancer Center is organized as a multidisciplinary model extending beyond the completion of active treatment and encompassing physical, psychological, social, and spiritual domains (Figure 1). Care is delivered through a coordinated framework integrating oncologists, advanced practice providers, dietitians, social workers, psychologists, physical therapists, and other specialists.

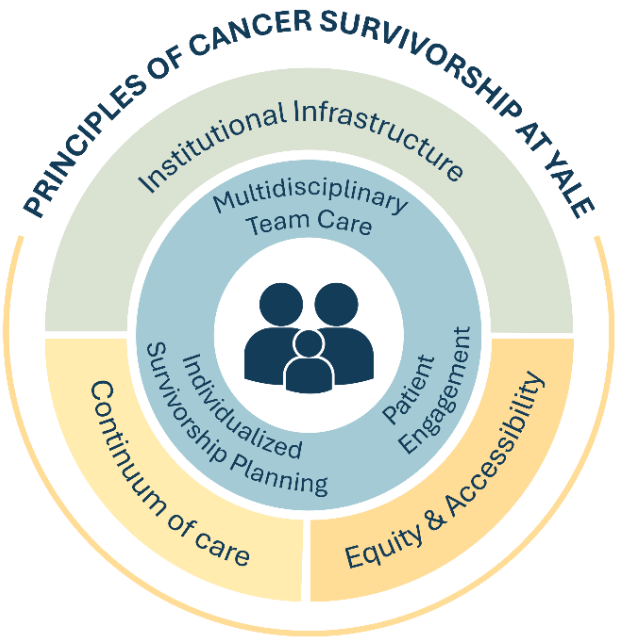


Figure 1. Principles of the Yale Survivorship Model. At the core of the model are the patients and their families. Surrounding them, the first orbit reflects the principles that shape individual-level care — multidisciplinary team care, individualized survivorship planning, and patient engagement. The outer orbit highlights system-level drivers — including institutional infrastructure, equity and accessibility, and the continuum of care — expanding survivorship impact beyond the clinic. Together, the dynamic interaction between these layers illustrates Yale's holistic, patient-centered, and academically driven approach to survivorship care.

This program emphasizes integration with primary care through a shared-care model. Structured communication between specialized services and PCPs, including facilitating PCP assignment for patients without one, supports continuity of care [12].

The model also prioritizes individualized survivorship care planning (SCP) by incorporating them into routine clinical practice to support coordination and follow-up based on treatment exposures, comorbidities, and patient preferences [13]. These documents are updated over time, integrating patient-reported outcomes, and enabling adaptive and responsive care.

Patient education and engagement are delivered through workshops, counseling, and structured educational materials as evidence shows that outcomes improve when survivors are informed and actively engaged in their care [14,15].

Yale's model extends across the lifespan, from childhood cancer survivors to older adults, reflecting that survivorship needs vary by developmental stage, life context, and comorbidity profile [16].

Adult Cancer Survivorship Clinic

The Yale Cancer Survivorship Clinic was established in 2006 as a dedicated multidisciplinary resource for cancer survivors in Connecticut, USA. The clinic functions as a central hub for survivorship care, integrating clinical services, patient education, and research activities.

Each clinic visit lasts approximately two hours and is coordinated by a multidisciplinary team including a nurse practitioner, a social worker, a registered dietitian, and a physical therapist. The clinic is overseen by a medical oncologist, who provides medical guidance and follow-up care. This structure allows time for in-depth discussions, assessments, and practical education.

During the visit, patients are evaluated by multiple providers in a coordinated format (Figure 2). The physical therapist assesses functional limitations and provides individualized exercise recommendations. The registered dietitian evaluates dietary patterns and provides nutritional counseling. The licensed clinical social worker addresses emotional, social, and practical concerns. The nurse practitioner integrates clinical history, patient-reported outcomes, and preventive care needs into an individualized survivorship care plan.

Prior to the visit, patient concerns are assessed using the National Comprehensive Cancer Network (NCCN) Survivorship Problem List, which captures issues across five domains: physical, emotional, social, practical, and spiritual/religious [6]. Psychological distress is measured using the NCCN Distress Thermometer before and after the visit [6]. A post-visit satisfaction survey is also administered.

Following the visit, patients receive individualized educational materials and a personalized survivorship care plan. Follow-up visits are scheduled as clinically indicated.

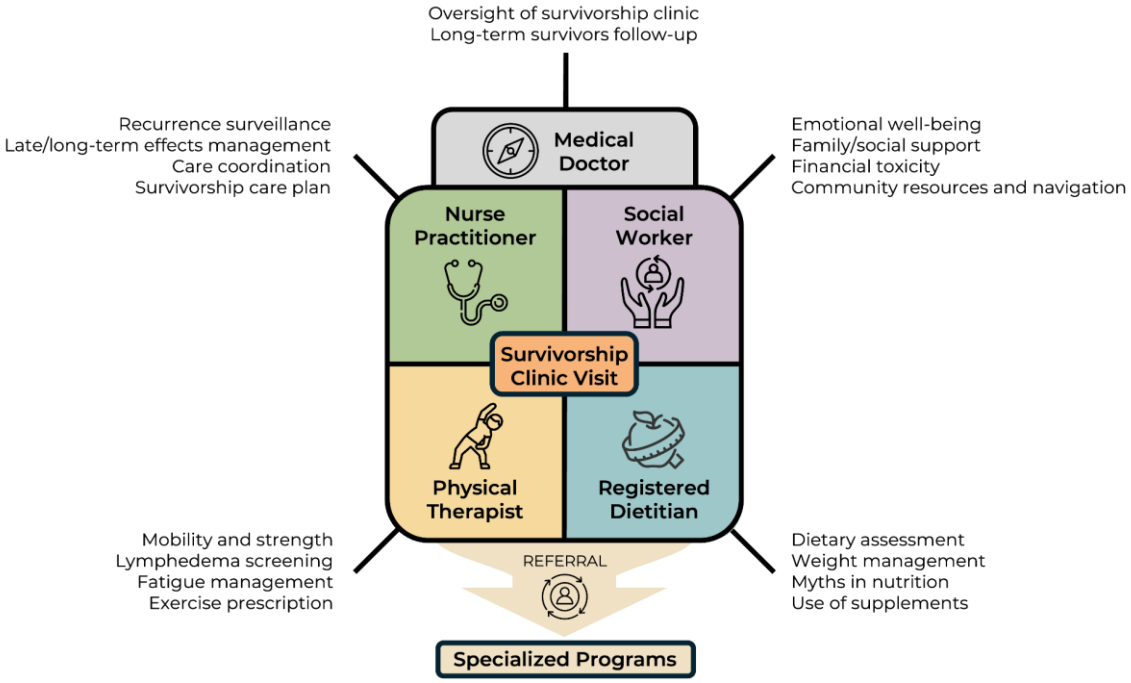


Figure 2. Structure of the Yale Cancer Survivorship Clinic visit. Patients participate in a 2-hour multidisciplinary clinic visit coordinated by a nurse practitioner, social worker, registered dietitian, and physical therapist. The clinic is overseen by a medical oncologist, who also conducts follow-up appointments for long-term survivors. When indicated, patients are referred to specialized programs for targeted management of late or complex effects

Patient Needs and Short-term Impact of the Adult Cancer Survivorship Clinic

Before the visit, 91.9% of patients (n = 125) reported at least one concern. Physical (83.9%) and emotional (82.5%) concerns were the most frequently reported domains, followed by practical (51.8%), social (43.1%), and spiritual or religious concerns (31.4%) (Figure 3A). Patients reported a median of five concerns per visit (range 0–34), indicating substantial variability in the number of concerns across individuals. The frequency and ranking of individual concerns are presented in Table 1.

Rank	Concern	Domain	n (%)
1	Worry or anxiety	Emotional	89 (65.4%)
2	Fatigue	Physical	72 (52.9%)
3	Sleep	Physical	69 (50.7%)
4	Pain	Physical	56 (41.2%)
5	Memory or concentration	Physical	49 (36.0%)
6	Sadness or depression	Emotional	44 (32.4%)
7	Changes in appearance	Emotional	38 (27.9%)
8	Fear	Emotional	37 (27.2%)
9	Finances	Practical	37 (27.2%)
10	Loss or change of physical abilities	Physical	33 (24.3%)
11	Taking care of myself	Practical	30 (22.1%)
12	Work	Practical	30 (22.1%)
13	Loneliness	Emotional	27 (19.9%)
14	Changes in eating	Physical	26 (19.1%)
15	Grief or loss	Emotional	25 (18.4%)
16	Loss of interest or enjoyment	Emotional	23 (16.9%)
17	Feelings of worthlessness or being a burden	Emotional	21 (15.4%)
18	Relationship with family members	Social	21 (15.4%)
19	Taking care of others	Practical	21 (15.4%)
20	Death, dying, or afterlife	Spiritual/Religious	21 (15.4%)
21	Relationship with friends or coworkers	Social	20 (14.7%)
22	Insurance	Practical	20 (14.7%)
23	Treatment decisions	Practical	20 (14.7%)
24	Sexual health	Physical	19 (14.0%)
25	Sense of meaning or purpose	Spiritual/Religious	19 (14.0%)

26	Relationship with spouse or partner	Social	18 (13.2%)
27	Anger	Emotional	18 (13.2%)
28	Housing/Utilities	Practical	17 (12.5%)
29	Communication with the health care team	Social	16 (11.8%)
30	Transportation	Practical	13 (9.6%)
31	Relationship with the sacred	Spiritual/Religious	12 (8.8%)
32	Relationship with children	Social	11 (8.1%)
33	Changes in faith or beliefs	Spiritual/Religious	11 (8.1%)
34	Safety	Practical	9 (6.6%)
35	Ritual or dietary needs	Spiritual/Religious	9 (6.6%)
36	Access to medicine	Practical	8 (5.9%)
37	Ability to have children	Social	6 (4.4%)
38	Prejudice or discrimination	Social	6 (4.4%)
39	Child care	Practical	6 (4.4%)
40	Having enough food	Practical	5 (3.7%)
41	Conflict between beliefs and cancer treatments	Spiritual/Religious	3 (2.2%)
42	School	Practical	3 (2.2%)
43	Tobacco use	Physical	1 (0.7%)
44	Substance use	Physical	0 (0.0%)

Table 1. Frequency and ranking of individual patient-reported concerns based on the NCCN Survivorship Problem List.

Network analysis revealed a structured pattern of associations among survivorship concerns, with predominantly positive relationships and only a small number of weak negative edges (Figure 4). The largest edge connected changes in eating and changes in appearance (weight = 0.410), followed by sexual health and work (0.384), sadness or depression and loneliness (0.324), sense of meaning or purpose and sleep (0.306), loss or change of physical abilities and loss of interest or enjoyment (0.289), and taking care of myself and taking care of others (0.285).

Emotional concerns formed a densely connected substructure, particularly sadness or depression, loneliness, anger, fear, and grief or loss. Within this cluster, sadness or depression was linked to loneliness (0.324) and anger (0.284), while fear was connected to

anger (0.248), death, dying, and afterlife (0.236), and grief or loss (0.212). Practical and functional concerns also showed internal coherence, particularly housing and finances (0.250), work and finances (0.238), and taking care of myself and taking care of others (0.285). Some cross-domain edges were also observed, including work and sexual health (0.384) and sleep and sense of meaning or purpose (0.306).

The most central nodes by strength were taking care of myself (1.447), loss of interest or enjoyment (1.314), changes in appearance (1.209), feelings of worthlessness or being a burden (1.162), loneliness (1.119), and work (1.109). Negative associations were rare and weak, limited to children and loss or change of physical abilities (-0.060), fear and sleep (-0.060), and death, dying, and afterlife and sexual health (-0.049).

Distress levels decreased significantly following the survivorship clinic visit (Figure 3B). Median Distress Thermometer scores declined from 4 (IQR 2–6) before the visit to 1 (IQR 0–3) after the visit ($p < 0.001$, Wilcoxon signed-rank test).

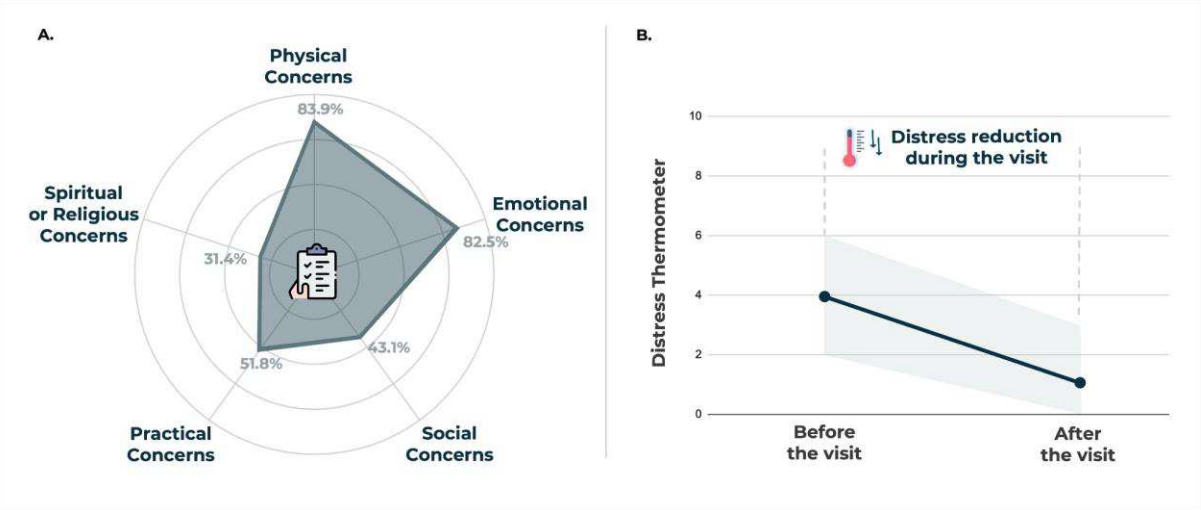


Figure 3. Profile of patient concerns and change in distress following the survivorship clinic visit, 2024 (n=136).

(A) Radar chart showing the proportion of patients reporting at least one problem in each category before the visit. Emotional and physical concerns were the most frequently reported domains. Patients selected a median of five specific issues per visit (range 0–34).

(B) Median Distress Thermometer scores before and after the visit, with the shaded area representing the interquartile range (IQR). Median distress decreased from 4 (IQR 2–6) to 1 (IQR 0–3); $p<0.001$ (Wilcoxon signed-rank test).

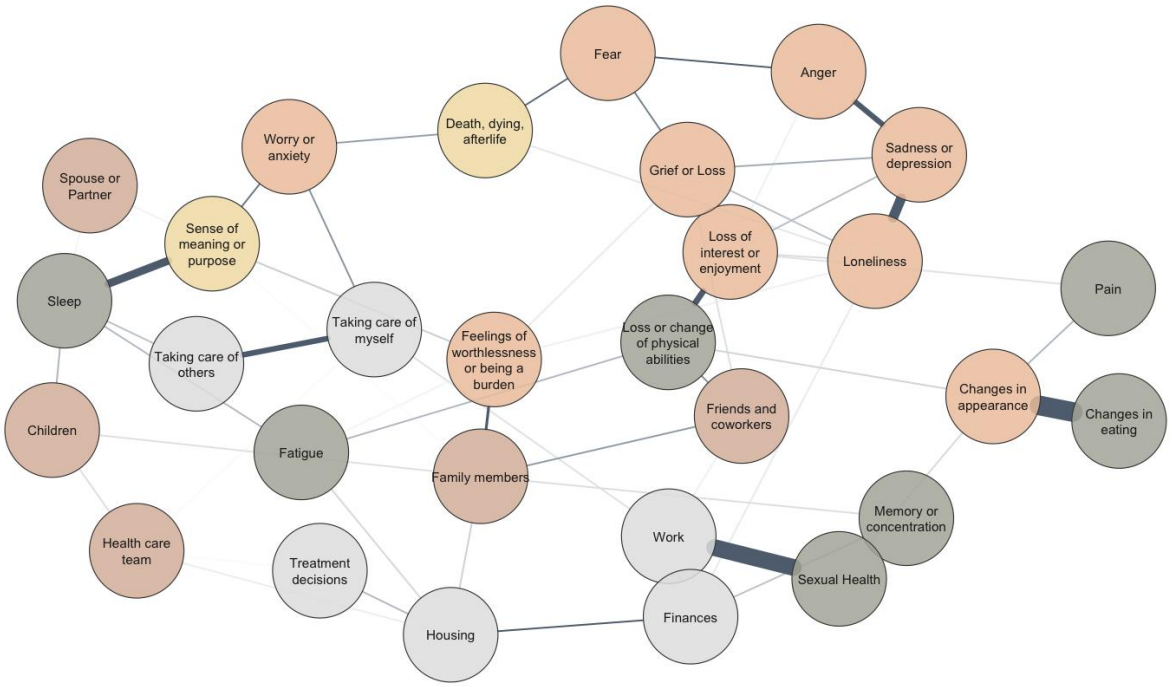


Figure 4. Network of survivorship concerns derived from the NCCN Distress Thermometer and Problem List. Nodes represent individual concerns and edges represent regularized partial correlations estimated using EBICglasso based on a smoothed tetrachoric correlation matrix. Edge thickness indicates the strength of the conditional association, and edge color indicates its sign. Nodes are color-coded according to NCCN domains.

HEROS: Program for Survivors of Childhood Cancer

The *Health, Education, Research & Outcomes for Survivors of Childhood Cancer* (HEROS) Program provides multidisciplinary care for pediatric and adult survivors of childhood cancer, supporting continuity across the lifespan.

Referrals originate from oncology teams, primary care providers, survivorship clinics, and self-referral. Each visit includes a multidisciplinary evaluation involving an oncologist or nurse practitioner, neuropsychologist, social worker, dietitian, physical therapist, and research staff. Clinical evaluation includes risk-based assessment of late effects according to the Children's Oncology Group Long-Term Follow-Up Guidelines, with additional investigations performed as indicated [17]. Psychological and functional assessments are conducted as part of routine care. Patients receive an annual individualized survivorship

care plan including a treatment summary, screening recommendations, and preventive guidance.

The HEROS program also maintains a longitudinal registry of patient outcomes, including patient-reported measures collected during routine visits. Between 2014 and 2024, the HEROS clinic recorded 1,433 visits, including 432 new patients (30.1%), 1,008 return visits (70.3%), and 63 telehealth visits (4.4%). The number of return visits increased over time, indicating sustained longitudinal engagement (Figure 5).

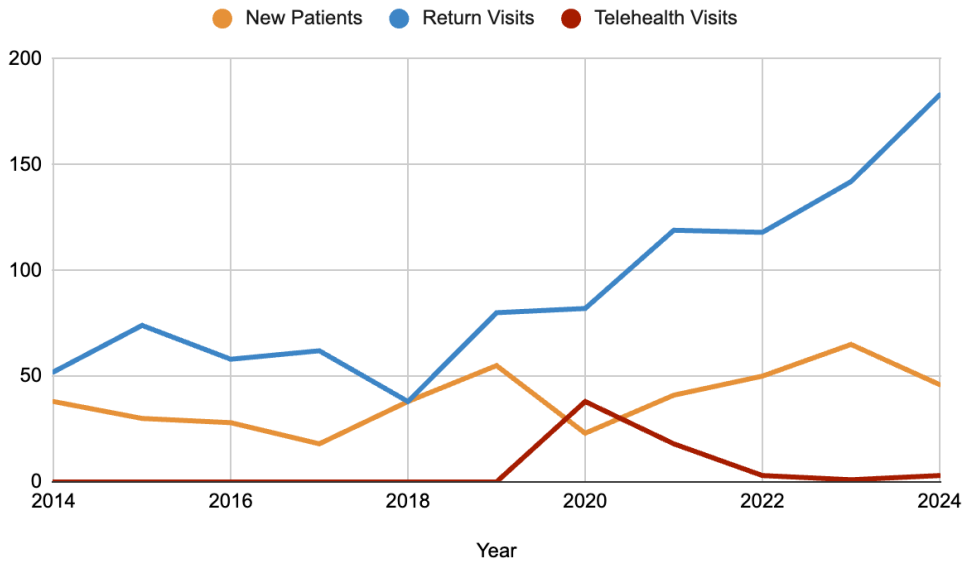


Figure 5. Longitudinal trends in HEROS clinic visits, 2014–2024. The graph depicts the number of new patients, return visits, and telehealth encounters over ten years. Return visits have shown a progressive increase, indicating program maturation and long-term survivor follow-up, while telehealth visits peaked in 2020, coinciding with the COVID-19 pandemic, primarily supporting return visits (88.9%).

Specialized Programs and Services

Yale Cancer Center maintains a network of specialized programs addressing survivorship-related clinical domains. These programs function as referral-based services supporting individualized care.

The Sexuality, Intimacy & Menopause Program provides multidisciplinary management of menopausal symptoms and cancer-related sexual dysfunction [18–23]. The Cardio-Oncology Program evaluates and manages cardiovascular risk and treatment-related cardiotoxicity [24]. The Psycho-Oncology Program provides psychological care, including

management of anxiety, depression, adjustment difficulties, and fear of recurrence, and includes a dedicated Cancer and Cognition Clinic.

The Early Onset Cancer Program provides coordinated care for patients diagnosed between 18 and 45 years of age, integrating oncology, genetics, reproductive counseling, and supportive services [25]. The Cancer Genetics and Prevention Program provides risk assessment, genetic testing, and surveillance strategies. The Integrative Medicine Program offers complementary approaches including mind-body interventions, acupuncture, nutrition counseling, and physical activity programs, while the Supplements Clinic provides structured evaluation of dietary supplement use [26]. The Palliative Care Program provides interdisciplinary management of complex symptoms and support for decision-making and advanced care planning.

Together, these programs operate within a coordinated referral network supporting multidisciplinary survivorship care.

Telehealth and Accessibility Tools

Survivorship care is delivered through a hybrid model combining in-person and telehealth visits. Telehealth is integrated into follow-up pathways and facilitates multidisciplinary coordination and communication with primary care providers.

Patient-facing digital tools include the MyChart patient portal, which provides access to survivorship care plans, visit summaries, and educational materials, and supports communication between patients and providers. Patient-reported outcomes are also collected through digital platforms. Language services are available 24/7, including spoken-language interpretation, written translation, and American Sign Language interpretation. Additional accessibility tools include assistive listening devices and visual aids.

Community Engagement

Community engagement is supported through partnerships with patients, families, and external organizations. The Patient and Family Advisory Committee includes patients and

caregivers who contribute to the development of clinical services, educational materials, and quality improvement initiatives. Collaborations with community oncology programs, patient advocacy groups, and public health organizations support survivorship education, outreach, and access to care through workshops, survivorship events, and peer support programs.

Discussion

This study provides a comprehensive, practice-based evaluation of a multidisciplinary survivorship care model within a large academic cancer center, integrating program-level description with patient-reported outcomes and network-based analysis of survivorship needs. The findings demonstrate that survivorship care can be operationalized through coordinated clinical pathways, structured assessment, and integrated referral networks, while also highlighting the complexity and multidimensional nature of patient needs in real-world practice.

Patient-reported data revealed a high burden of concerns across multiple domains, with most patients reporting at least one issue and a median of five concerns per visit. These findings are consistent with prior literature demonstrating that survivorship challenges extend beyond physical symptoms and encompass emotional, social, and practical dimensions. Importantly, the substantial variability in the number and type of concerns underscores the heterogeneity of survivorship experiences and supports the need for flexible, individualized models of care [4-8].

The network analysis further expands this understanding by demonstrating that survivorship concerns are not independent but are organized in interconnected patterns. Emotional concerns formed a densely connected core, closely linked to physical symptoms and functional limitations. In addition, concerns related to self-management, social roles, and daily functioning, particularly taking care of oneself, work, and feelings of being a burden, emerged as highly connected nodes within the network. These findings suggest that survivorship burden is structured not only around symptoms, but also around broader dimensions of autonomy, identity, and role reintegration.

From a clinical perspective, these results have important implications for care delivery. Traditional survivorship models often approach concerns as discrete problems to be addressed individually. In contrast, the network structure observed in this study suggests that targeting central or highly connected concerns may yield broader benefits across multiple domains. For example, interventions aimed at improving self-management

capacity, reducing emotional distress, or supporting return to work may have cascading effects on other aspects of survivorship. The relative absence of negative associations further indicates that concerns tend to accumulate rather than substitute for one another, reinforcing the need for integrated, rather than fragmented, care strategies.

The Yale survivorship model described in this study reflects several of these principles in practice. Multidisciplinary care, structured screening using patient-reported outcomes, and coordinated referral pathways enable the identification and management of diverse and co-occurring needs. Integration with primary care through a shared-care approach supports continuity beyond oncology, while specialized programs provide targeted expertise for specific domains such as cardio-oncology, psycho-oncology, and sexual health. Together, these components form a system capable of addressing the complexity of survivorship in routine clinical settings.

However, important challenges remain. Ensuring consistent referrals from oncology and primary care teams continues to be a barrier, as many eligible patients are not referred or do not engage with survivorship services. This reflects both gaps in provider awareness and variability in patient understanding of the role of survivorship care. Financial sustainability is another critical challenge, as current reimbursement models often do not capture the complexity of multidisciplinary care, limiting institutional incentives despite clear patient benefit. Equity considerations further complicate access, with underserved populations facing additional barriers related to insurance coverage, transportation, and cultural perceptions of survivorship services. Operational constraints, including fixed clinic schedules, may also limit accessibility for patients balancing competing responsibilities.

Looking forward, several opportunities exist to strengthen survivorship care. Improving coordination during the transition from active treatment to survivorship remains a priority, with potential to develop clearer referral pathways, shared-care frameworks, and communication strategies linking oncology, primary care, and supportive services. Expansion of specialized programs represents another area for development, particularly for populations with unmet needs, such as male survivors with sexual health concerns, individuals with hereditary cancer risk (“previvors”), and patients living long-term with

metastatic disease (“metavivors”) [27-30]. The development of structured cardio-rehabilitation programs tailored to cancer survivors is also an important emerging priority. Technological innovation offers additional opportunities to enhance care delivery. Digital tools may support automated referrals, longitudinal symptom monitoring, and integration of patient-reported outcomes into clinical workflows. Strengthening networks of specialized survivorship services and leveraging research collaborations will be essential to expanding capacity while maintaining high-quality, evidence-based care.

The findings of this study also have implications for the broader implementation of survivorship care models. The Yale experience highlights the importance of multidisciplinary collaboration, institutional support, and adaptability to local contexts. Successful replication in other settings may benefit from early engagement with experienced centers, development of core multidisciplinary teams, and phased implementation strategies that allow expertise to disseminate over time. Importantly, demonstrating both patient-centered outcomes and institutional value will be critical to sustaining these programs. Even when not directly financially profitable, survivorship services may contribute to improved patient satisfaction, long-term outcomes, and institutional reputation.

This study has several limitations. As a retrospective, single-center service evaluation, findings may not be generalizable to all healthcare settings. The absence of a control group limits causal inference regarding the observed reduction in distress scores. In addition, network analysis provides insight into associations between concerns but does not establish directionality or causality. Despite these limitations, the integration of real-world program data with patient-reported outcomes and network modeling provides a comprehensive perspective on survivorship care delivery.

Conclusion

This study demonstrates that multidisciplinary survivorship care can be effectively implemented within routine clinical practice through coordinated pathways, structured assessment, and integrated referral networks. The high prevalence and multidimensional nature of patient-reported concerns highlight the complexity of survivorship and the limitations of symptom-based approaches.

Network analysis further shows that survivorship needs are interconnected rather than isolated, with emotional, functional, and role-related concerns occupying central positions within the overall structure. These findings support a shift toward system-oriented models of care that prioritize highly connected domains and address multiple needs simultaneously.

Despite ongoing challenges related to referral pathways, accessibility, and financial sustainability, survivorship programs offer significant value by improving patient-centered outcomes and strengthening long-term care delivery. Future efforts should focus on scalable, data-informed approaches that align clinical organization with the interconnected nature of survivorship needs.

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74(3):229-63.
2. Miller KD, Nogueira L, Mariotto AB, Rowland JH, Yabroff KR, Alfano CM, et al. Cancer treatment and survivorship statistics, 2019. CA Cancer J Clin. 2019;69(5):363-85.
3. Alfano CM, Mayer DK, Bhatia S, Maher J, Scott JM, Nekhlyudov L, et al. Implementing personalized pathways for cancer follow-up care in the United States: Proceedings from an American Cancer Society-American Society of Clinical Oncology summit. CA Cancer J Clin. 2019;69(3):234-47.
4. Nekhlyudov L, Mollica MA, Jacobsen PB, Mayer DK, Shulman LN, Geiger AM. Developing a Quality of Cancer Survivorship Care Framework: Implications for Clinical Care, Research, and Policy. J Natl Cancer Inst. 2019;111(11):1120-30.
5. Partridge AH, Morgans A, Knelson LP, Recklitis C, Nekhlyudov L, Chi SN, et al. Cancer survivorship programs at the Dana-Farber Cancer Institute. J Cancer Surviv. 2024;18(1):34-41.
6. Sanft T, Day AT, Ansbaugh SM, Ariza-Heredia EJ, Armenian S, Baker KS, et al. NCCN Guidelines® Insights: Survivorship, Version 2.2025. J Natl Compr Canc Netw. 2025;23(6):208-17.
7. Medicine Io, Council NR. From Cancer Patient to Cancer Survivor: Lost in Transition. Hewitt M, Greenfield S, Stovall E, editors. Washington, DC: The National Academies Press; 2006. 534 p.
8. Halpern MT, Viswanathan M, Evans TS, Birken SA, Basch E, Mayer DK. Models of Cancer Survivorship Care: Overview and Summary of Current Evidence. J Oncol Pract. 2015;11(1):e19-27.
9. Salz T, Oeffinger KC, McCabe MS, Layne TM, Bach PB. Survivorship care plans in research and practice. CA Cancer J Clin. 2012;62(2):101-17.
10. Foygel R, Drton M. Extended Bayesian information criteria for Gaussian graphical models; 2010:604–612.
11. Epskamp, S., Cramer, A. O., Waldorp, L. J., Schmittmann, V. D., & Borsboom, D. (2012). qgraph: Network Visualizations of Relationships in Psychometric Data. Journal of Statistical Software, 48(4), 1–18. https://doi.org/10.18637/jss.v048.i04
12. Vos JAM, Stout NL, Nekhlyudov L. Implementing high-quality cancer survivorship care in primary care: future directions for policy and research. J Natl Cancer Inst. 2025.
13. Keesing S, McNamara B, Rosenwax L. Cancer survivors' experiences of using survivorship care plans: a systematic review of qualitative studies. J Cancer Surviv. 2015;9(2):260-8.
14. Hubbard G, Kidd L, Donaghy E. Preferences for involvement in treatment decision making of patients with cancer: a review of the literature. Eur J Oncol Nurs. 2008;12(4):299-318.
15. Barry MJ, Edgman-Levitan S. Shared decision making--pinnacle of patient-centered care. N Engl J Med. 2012;366(9):780-1.
16. Doose M, Mollica MA, Acevedo AM, Tesauro G, Gallicchio L, Reed C, et al. Advancing health equity in cancer survivorship research: National Institutes of Health 2017-2022 portfolio review. J Natl Cancer Inst. 2024;116(8):1238-45.
17. Children's Oncology Group Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers, version 6.0 (October 2023), available online at http://www.survivorshipguidelines.org/ (Accessed on January 26, 2026).
18. Schover LR. Sexual quality of life in men and women after cancer. Climacteric. 2019;22(6):553-7.
19. Agrawal LS, O'Riordan L, Natale C, Jenkins LC. Enhancing Sexual Health for Cancer Survivors. Am Soc Clin Oncol Educ Book. 2025;45(3):e472856.
20. Minkin MJ. Menopause: Hormones, Lifestyle, and Optimizing Aging. Obstet Gynecol Clin North Am. 2019;46(3):501-14.
21. Minkin MJ, Reiter S, Maamari R. Prevalence of postmenopausal symptoms in North America and Europe. Menopause. 2015;22(11):1231-8.

22. Alexandre M, Black J, Whicker M, Minkin MJ, Ratner E. The management of sexuality, intimacy, and menopause symptoms (SIMS) after prophylactic bilateral salpingo-oophorectomy: How to maintain sexual health in "previvors". Maturitas. 2017;105:46-51.
23. Li JY, D'Addario J, Tymon-Rosario J, Menderes G, Young MR, Johung K, et al. Benefits of a Multidisciplinary Women's Sexual Health Clinic in the Management of Sexual and Menopausal Symptoms After Pelvic Radiotherapy. Am J Clin Oncol. 2021;44(4):143-9.
24. Hull SC, Soufer A, Spatz ES, Baldassarre LA. Rationale and proposed framework for shared decision making in cardio-oncology. Cardiooncology. 2021;7(1):30.
25. Scott AR, Stoltzfus KC, Tchelebi LT, Trifiletti DM, Lehrer EJ, Rao P, et al. Trends in Cancer Incidence in US Adolescents and Young Adults, 1973-2015. JAMA Netw Open. 2020;3(12):e2027738.
26. Harrigan M, McGowan C, Hood A, Ferrucci LM, Nguyen T, Cartmel B, et al. Dietary Supplement Use and Interactions with Tamoxifen and Aromatase Inhibitors in Breast Cancer Survivors Enrolled in Lifestyle Interventions. Nutrients. 2021;13(11).
27. Uslu Y, Er S, Subaşı Sezgin D, Yeşilyurt A, Uras C. What Do Breast Cancer Previvors Tell Us About Their Stories? To Know or Not to Know? Semin Oncol Nurs. 2024 Oct;40(5):151714. doi: 10.1016/j.soncn.2024.151714.
28. Uslu Y, Er S, Subaşı Sezgin D, Yeşilyurt A, Uras C. What Do Breast Cancer Previvors Tell Us About Their Stories? To Know or Not to Know? Semin Oncol Nurs. 2024 Oct;40(5):151714. doi: 10.1016/j.soncn.2024.151714.
29. Finkelstein-Fox L, Bliss CC, Rasmussen AW, Hall DL, El-Jawahri A, Perez GK, Traeger LN, Comander AH, Peppercorn J, Anctil R, Noonan E, Park ER. Do cancer curvivors and metavivors have distinct needs for stress management intervention? Retrospective analysis of a mind-body survivorship program. Support Care Cancer. 2023 Oct 6;31(10):616. doi: 10.1007/s00520-023-08062-1.
30. Dean M, Davidson LG. Previvors' Uncertainty Management Strategies for Hereditary Breast and Ovarian Cancer. Health Commun. 2018 Feb;33(2):122-130. doi: 10.1080/10410236.2016.1250187.