



The role of physical arm function and demographic disparities in breast cancer survivors' ability to return to work

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Received: 29 April 2022 / Accepted: 31 October 2022

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Abstract

Purpose Ability to return to work (RTW) is an important aspect of breast cancer that is limited for many survivors. With 90% survivorship in the USA, it is imperative that focus shifts toward the improvement of physical arm function to improve survivors' ability to RTW. This narrative review discusses the role of physical arm function and demographic disparities in breast cancer survivor RTW.

Methods Literature on physical function, arm function, and demographic disparities following breast cancer treatment and their implications for RTW is discussed.

Results The ability to RTW is a key component of recovery for breast cancer survivors, but challenges and inequalities persist. Treatment effects can induce and prolong functional disability, affecting survivors' ability to RTW. These effects may be compounded for survivors whose occupation requires physical arm function. The RTW landscape, including the occupations survivors have, the physical function required for job tasks, and availability of workplace accommodations, is also unclear. Additional demographic disparities (e.g., income, live in rural area) exist, but the extent to which these factors influence RTW is not well understood. More work is needed to understand the compounded impact of treatment effects, demographic disparities, and occupational factors on RTW. Multidisciplinary rehabilitation that includes occupational counseling and exercise is a promising approach, but widespread adoption in the US healthcare model presents an ongoing challenge. Areas for further research are highlighted.

Conclusion There is an incomplete understanding of the effects of treatment on physical arm function and the role of demographic disparities on breast cancer survivor RTW.

Keywords Cancer survivors · Mastectomy · Breast reconstruction · Return to work · Treatment outcome · Physical endurance

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Introduction

Surveillance and treatment for female breast cancer have improved, leading to a 5-year survival rate of 90% in the USA [1]. With such good outcomes, the hierarchy of needs must now shift toward maintenance and improvement of factors influencing survivor quality of life (QoL). The ability to return to work (RTW) is an important aspect of cancer recovery, as it improves self-esteem and provides a sense of normalcy [2, 3]. A key component of recovery and maintenance of QoL for breast cancer survivors is the ability to return to daily activities and the job tasks associated with performing one's occupation. Often, RTW is needed to earn an income to support the survivors themselves and their family. Although up to 80% of breast cancer survivors in the USA are of working age (e.g., 20–64 years) RTW [3–5], almost half (46%) [6] do not RTW work full time, suggesting that treatment sequelae and side effects prolong functional disability. These deficits likely hinder RTW, as physical function is a universal driver of work ability and RTW [7]. The inability to fully RTW can compound the disease burden for survivors. This may be amplified for those with occupations in which physical function, including arm function, is vital to job performance, and survivors may not be able to return to the same level of productivity they had before breast cancer treatment. Demographic disparities, such as income, number of dependents in the household, and living in a rural location, may also impact recovery and RTW [8–10]. Disparities can compound treatment outcomes, and their consideration in the treatment pathway is needed to fully understand the RTW landscape for breast cancer survivors. It is also important to understand the consequences survivors face that extend beyond the immediate scope of treatment, including decreased occupational opportunities, reduced financial earnings, and the additional burden of disparities, as this can negatively impact outcomes, well-being, and QoL long after treatment concludes. The purpose of this narrative review is to discuss treatment-related factors and disparities that influence female breast cancer survivors' ability to achieve full recovery and the physical arm function needed to successfully RTW. This review will also emphasize knowledge gaps that represent opportunities for ongoing research. Identifying the complex, multifactorial implications of breast cancer treatment on RTW will help position the field to develop evidence-based interventions that can be included at various points in the cancer care continuum to offset challenges. Improving long-term physical arm function and ability to RTW is a critical component of the treatment pathway that will enable individuals to not simply survive cancer, but to thrive as a breast cancer survivor.

Extent of the return to work problem

Ability to RTW after cancer treatment is an important aspect of recovery and contributes to QoL [2, 3]. Improvements to cancer treatment have increased survival rates, in turn elevating the importance of RTW [11], including work ability and re-employment. However, it is not clear how many breast cancer survivors have a need or desire to RTW after treatment. Recent work has examined the complex factors influencing RTW decision-making, including treatment (e.g., surgery), side effects (e.g., fatigue), personal factors (e.g., familial support), and occupational factors (e.g., employer accommodations) [12–14]. While there is no formal consensus on a decision-making model for RTW, there is consistent recognition of the importance of considering factors beyond treatment effects, like earlier occupational therapy referral and including employer perspectives about RTW [13, 14]. These recommendations are similar for Western and Asian studies, although local cultural influences on patient expectations and priorities should also be considered [12]. In the USA, household finances are likely an important factor in RTW decision-making. Financial toxicity has been associated with a cancer diagnosis [15, 16], representing an obvious factor driving RTW after treatment. However, it is unclear how many survivors RTW out of financial need versus those who elect to abstain from RTW as a QoL choice. Data from the general population indicates that of those ≥ 18 years of age who are employed in the USA, 47.6% are women (out of 156,542 thousand employed [17]). In the USA in 2019, breast cancer accounted for 30.5% of new cancer diagnoses (863,830 total female cancer cases [18]). With 5-year survival of 90% [19], it is reasonable to expect a large proportion of women who receive a breast cancer diagnosis are likely to RTW after treatment. However, not all women RTW. Depending on their age at the time of diagnosis, some patients may elect to retire. Others may be from higher income households in which the reduced income from not re-engaging in the workforce is not detrimental to household finances, while others may have ongoing treatment requirements that are incompatible with work demands. While 12% of households in the USA are below the federal poverty line [20], those households that are above the poverty line may have more financial resources available to offset an individual's choice to not RTW. It is possible that household finances are a primary factor in RTW decision-making, but the extent to which RTW is a necessity versus a choice is not clear. It is also unclear the extent to which financial needs are balanced with other factors, like treatment effects, familial support, and workplace accommodations, to facilitate RTW. More research is needed to

better understand the motivations and needs driving RTW decisions for this population.

Description of return to work outcomes for survivors

The functional implications of breast cancer treatment on RTW are unclear, perpetuating survivor disease burden. Survival rate is an important outcome that indicates treatment efficacy, although there is a less clear understanding of the influence of treatment on occupational outcomes, including RTW timing, occupation, and availability of workplace accommodations. Survival rate and demographic disparities (e.g., race, income, zip code) in incidence and access to care have been described in great detail in cancer registries. The collection and broad dissemination of information through national (e.g., Surveillance, Epidemiology, and End Results (SEER) Program [21]) and state cancer registries have become powerful tools to improve understanding of general trends in diagnosis and treatment of cancer. However, these registries are void of information describing the well-known RTW challenges [7, 14, 16, 22] that exist for breast cancer survivors. Descriptions of post-treatment outcomes, including physical function, arm function, and psychosocial function, as they relate to occupational duties will enable identification of targets for enhancement of survivorship care. Expanding registries to include RTW and occupational information will allow the detection of emergent factors impacting RTW and how they may be associated with other disparities already recognized in cancer incidence and access to care. Data describing subjective and objective measures of function, such as validated patient-reported outcomes, physical and/or arm strength and mobility measures, and other measures of occupationally relevant physical function (e.g., FIT-HaNSA [23]), would enable examination of the baseline physical condition needed to RTW. Information describing survivors' occupation, categorization of physical job tasks, workplace accommodations, and compensation structure (e.g., hourly, salary) would also help define the RTW landscape. Determining the extent to which RTW is affected and how this may differ by demographics and pharmacologic and surgical treatments received is also needed. An opportunity exists to develop a database of information at the state or national level that provides clearer description of the multifactorial characteristics of breast cancer survivor RTW so targeted RTW interventions can be developed and integrated into the survivorship component of the cancer care continuum.

Demographic disparities in return to work

The inability to fully RTW can contribute to the financial toxicity that impacts half of all cancer patients [16], including breast cancer [15], and extends beyond the acute treatment period into survivorship [24]. Negative outcomes may be amplified for survivors in some demographic categories. For instance, survivors from low-income households may have a greater incentive to quickly RTW after treatment because workforce participation may be a necessary source of income. This is especially true in households that require multiple incomes to maintain financial stability or if the survivor was the primary or sole earner [15, 16]. This may lead to paradoxical outcomes long-term, as the financial need driving a quick RTW after treatment could limit the extent to which full functional recovery can be achieved. Limited recovery could lead to permanent functional limitations that negatively affect work ability and impact financial earnings long-term. Additional demographic factors can influence the RTW need and decision for survivors. For example, patients who have completed less education (e.g., less than a high school), have poorer health status before cancer diagnosis, are older age, or Black race have lower likelihood to RTW [22, 25]. The patient's household can also influence the RTW decision, as women who are married have been shown to RTW at lower rates than those who are unmarried, and those with ≥ 3 children are less likely to RTW than those with no children [10]. Survivors with greater social and family support are more likely to RTW [26]. Indeed, there are many demographic factors that can contribute to the likelihood of RTW, although more work is needed to determine the combined effect (e.g., race and income) of demographics on RTW.

Physical arm function affects return to work

The ability to RTW may depend on the patient's specific occupation, as many labor-intensive occupations require performance of physical arm tasks, such as overhead work, lifting, or load transfer. For example, an individual working in a warehouse for a delivery service provider would need arm strength and mobility to lift and transfer packages; similarly, a nurse in a hospital setting needs adequate arm function to perform patient care and transfer tasks. Regardless of the occupation, the ability to fully RTW requires adequate strength, mobility, and arm physical function, which may be severely impacted by breast cancer treatment [7, 14]. The need for functional restoration after breast cancer treatment to enable effective RTW

represents a clear gap that future work must address. This will require a multidisciplinary approach, as factors across multiple domains influence ability to RTW, such as treatments received, timing of RTW, availability of workplace accommodations, and type of occupation performed [14, 22, 25, 27–29]. Nevertheless, acknowledging that physical arm function is a universal driver of RTW and work ability [7], future studies should focus on identifying associations among these factors and developing strategies to address identified shortcomings.

The importance of restoring physical arm function is underscored by the need for women to return to the occupations available to them. Individuals living in rural areas may have fewer job opportunities compared to urban areas, while those in low-income households may work in jobs that are paid hourly with little schedule flexibility, for which they can be readily replaced [4, 27, 30, 31]. As only 33% of adults in the USA have a bachelor's degree [20], the greater density of the workforce in lower skilled, more labor-intensive work suggests that these are the jobs in which women, who represent approximately half of the US workforce [17], frequently participate. Available census data describing trends in the general population indicate that manual work is more prevalent than non-manual work in rural areas [32] and those living in rural areas have a higher participation in occupations requiring more labor-intensive tasks [33]. For example, occupations in the production sector are more prevalent in more non-metro (more rural) areas, representing 10.8% of employment versus 5.7% of employment in metro areas [34]. Occupational sectors requiring greater physical demand to perform, such as transportation and material moving; installation, maintenance, and repair; building and grounds cleaning and maintenance; and food preparation and serving related industries, are all more prevalent in more rural areas than urban areas [34]. While all individuals working within these industries do not perform physically demanding work (e.g., administrative personnel), in general, the available occupations in rural areas are more likely to be physically demanding than occupations in urban areas, which include management; business and financial operations; computer and mathematical; sales and related; and office and administrative support [34]. This suggests that breast cancer survivors in rural areas have a higher likelihood of seeking to RTW in manual jobs and thus must have the requisite physical arm function. The combination of demographic characteristics for individual patients (e.g., low income and living in a rural area) may further motivate the need and desire to RTW after treatment but may simultaneously present compounded challenges precluding successful RTW. More research is needed to identify the types of occupations breast cancer survivors seek to return to and the influence of demographics on perpetuating RTW inequalities. Understanding the specific ways individuals are

functionally and occupationally impacted by breast cancer treatment will expose targets for development of targeted strategies to improve occupationally relevant physical arm function and promote successful RTW.

Return to work challenges amplified by treatment

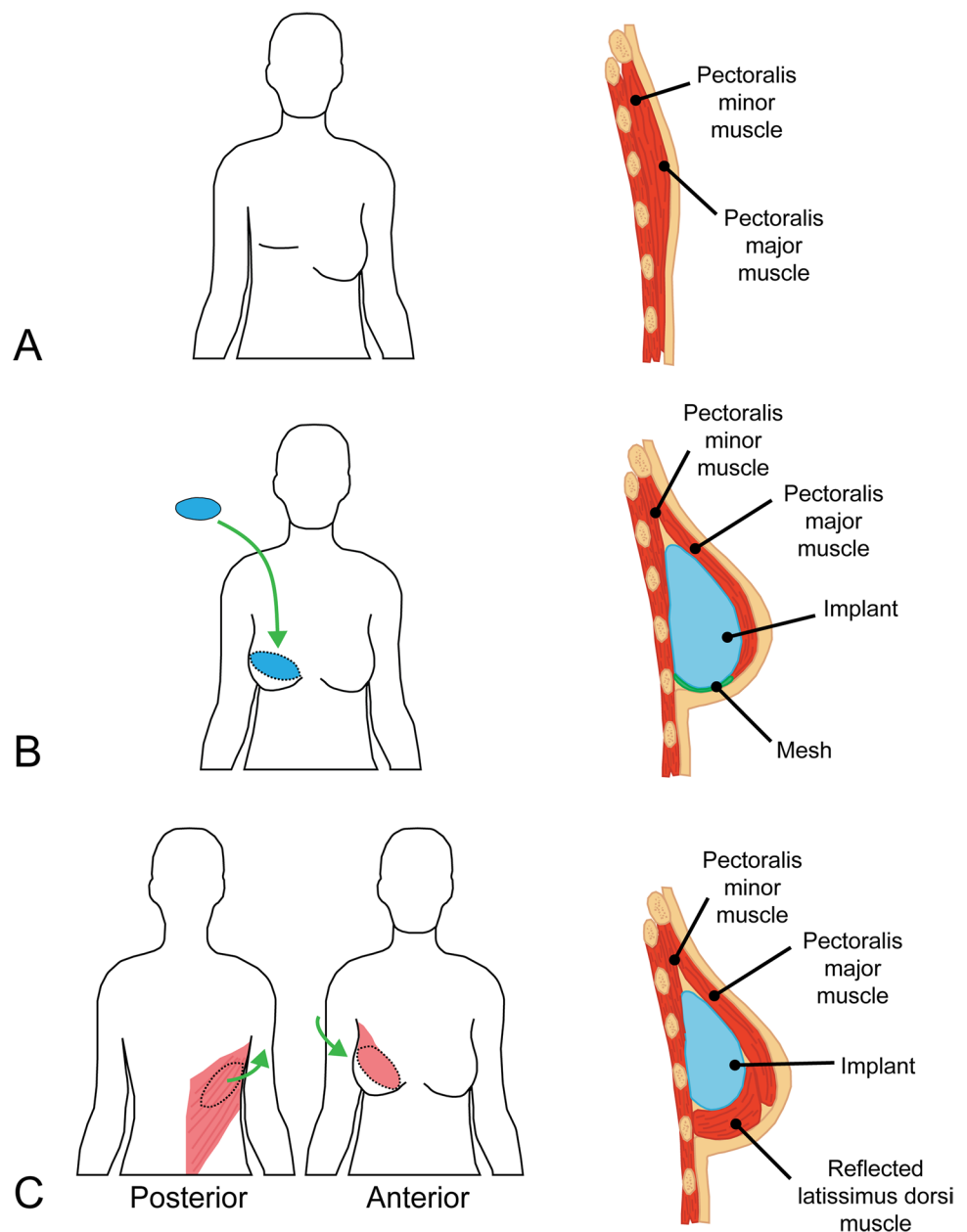
Breast cancer treatment often includes both pharmacologic and surgical components. Neo-adjuvant and adjuvant therapies, including chemotherapy, radiation therapy, and hormone replacement therapy, are commonly prescribed. Receipt of these therapies typically requires time away from work to receive treatment [35]. This may have an unequal impact on patients depending on their occupation, the amount of sick leave available, and employer accommodations. An interruption to full-time work can be expected for patients to undergo treatment [35], with some treatment regimens requiring greater time away from work. Receipt of chemotherapy is associated with reduced likelihood of RTW [8, 9, 35], likely due to the negative side effects, including fatigue and decreased cognitive function (e.g., “chemo brain”) [36, 37]. Additionally, some treatments, such as hormone replacement therapies, can be active for long periods of time [35], extending beyond typical allotments for sick leave and prolonging side effects. In combination with other therapies, surgery is the most common treatment for breast cancer in all disease stages, except metastatic disease [38], although these patients often undergo surgery in the surrounding region for chemotherapy infusion port placement. Common treatment sequelae include fatigue, muscular weakness, and depression [39, 40]. Women who undergo breast surgery also experience sequelae including pain, weakness, and reduced mobility [39], amplifying the negative functional effects of treatment. Mastectomy is an extensive surgical procedure to remove the affected breast tissue, which is increasingly performed in the USA [41]. Mastectomy is commonly performed in combination with lymph node removal, chemotherapy, and/or radiation therapy, which can further exacerbate functional disability. For example, mastectomy is associated with sequelae that negatively impact strength, mobility, and function [39, 40], while chemotherapy is associated with increased long-term fatigue [40]. These symptoms may further reduce a survivor's perceived or actual ability to RTW or ability to RTW at the same level of productivity. Post-mastectomy symptoms can reduce the functional capacity required to complete occupational tasks and rejoin the workforce [14, 22, 25, 27, 28]. This is reinforced by the decreased RTW rates reported for those who perform manual jobs compared to non-manual jobs [25], although the direct influence of mastectomy with

or without other treatments on work-related physical function and arm function is unknown.

It is likely that the specific arm function deficits following mastectomy are unique to both the surgical procedure and the occupation. Similar to mastectomy, the rates of post-mastectomy breast reconstruction are also increasing in the USA [42]. Breast reconstruction can be broadly categorized into reconstruction with either implants or autologous flaps [39], with each surgical approach requiring distinct methods that affect the anatomy in different ways (Fig. 1). For example, mastectomy without reconstruction can cause the development of scar tissue and muscle shortening, leading to protective posturing [43]. Reconstruction with implants most commonly requires pectoralis muscle dissection from

the chest wall, thereby relocating the muscle and altering its in vivo path and function in mobility and stability of the shoulder girdle [44]. Reconstruction with implants is commonly pursued due to the reduced surgical time and faster return to daily activities, although patients often present with reduced muscle strength, increased stiffness and instability of the shoulder, and long-term reductions in shoulder function [44]. Reconstruction with autologous flaps requires tissue harvest from other body regions, often the abdomen (e.g., transverse rectus abdominis (TRAM), or deep inferior epigastric perforator (DIEP)) or posterior shoulder (e.g., latissimus dorsi muscle (LAT)), to reconstruct the breast. While pre-pectoral placement of implants and autologous flap procedures may have the smallest influence on physical

Fig. 1 Mastectomy and breast reconstruction procedures affect the local anatomy differently. **A** After mastectomy, the affected breast tissue is removed, and the breast is not reconstructed. **B** Breast reconstruction with implants often requires dissection of the pectoralis major muscle from the chest wall to place the implant. This procedure can also include implantation of a mesh to provide inferior support to the implant. **C** Breast reconstruction with autologous flaps requires dissection of tissue from one body region to the breast. One example of autologous flap procedures includes the latissimus dorsi (LAT flap) procedure, where a portion of the muscle is dissected and reflected to aid in reconstruction of the breast. This procedure commonly includes the use of an implant in addition to the reflected muscle flap



arm function [45], there is increased risk of complications, such as infection, from the donor site, increased foreign body burden due to breast implants and biologic mesh, breast implant failure, need for surgical revision, and muscular fatigue in the abdomen and shoulder [46–48], affecting function and RTW. Despite the diversity of breast reconstruction approaches, a large knowledge gap remains about the specific ways physical arm function and RTW are affected by these procedures [39].

The number and type of breast cancer surgeries can also influence RTW, with previous work showing greater RTW challenges for those who undergo extensive surgical treatment, including mastectomy and breast reconstruction [39]. Compared to breast-conserving surgery, women who have bilateral mastectomy followed by breast reconstruction are 7.8× more likely to miss 1 + month of work and 3.1× more likely to stop work altogether [30]. Greater time off from work is often needed for more extensive surgery. However, prolonged absences from work negatively impact household finances and ability to RTW [30]. As the amount of time off work for illness increases, there is an increased probability of work-related disability [14]. The increased disability and surgically induced functional changes can affect occupational task performance upon RTW, particularly in occupations where lifting, load transfer, and other physical arm function are required. Workers in a variety of occupational sectors may encounter limitations precluding ability to fully RTW. For instance, warehouse workers must be able to lift and transfer weighted objects and complete tasks overhead. The strength and mobility needed for job-specific tasks may be limited because muscular strength and endurance, and shoulder range of motion, are significantly reduced [39, 43, 47, 49]. For example, in the healthcare industry, nurses must be able to lift and transfer loads up to human body weight to move and position patients; these workers must also have the mobility to reach for medical equipment and combined strength and mobility to properly apply the equipment to a patient. Nurses also work in shifts which can require long hours, necessitating physical endurance. Thus, common post-surgical sequelae associated with breast reconstruction, either alone or in combination with other treatment-related effects (e.g., chemotherapy-induced fatigue), may limit survivors' ability to quickly or fully RTW. While physical arm function is affected by breast cancer surgery, the skills and experience of workers are not lost during treatment, presenting an opportunity to engage with employers as stakeholders during treatment planning [39] to ensure maintenance of employment for the survivor and retention of a highly skilled worker for the employer. Opportunities exist to develop novel, multidisciplinary strategies that incorporate patient-centered (e.g., finances, physical arm function) and workplace-centered (e.g., occupational task requirements, workplace accommodation) approaches to facilitate

successful RTW (Fig. 2). Engaging both the patient and the workplace in aspects of the treatment pathway could remove barriers currently preventing full RTW.

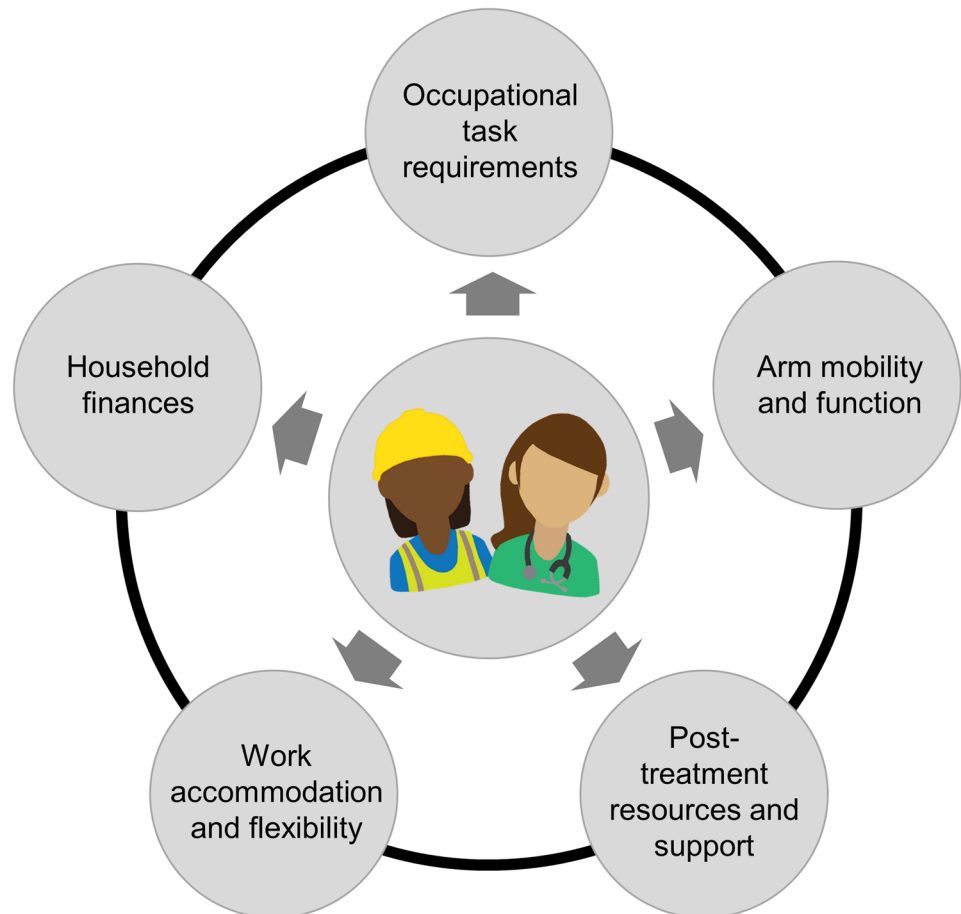
Opportunities for multidisciplinary rehabilitation

Identifying the specific ways physical arm function is affected by breast cancer treatment will expose targets around which to develop rehabilitation strategies to improve RTW outcomes. Multidisciplinary rehabilitation approaches that include occupational counseling and supervised exercise during chemotherapy have resulted in increased RTW rates, increased work ability, reduced fatigue, and improved QoL for a cancer cohort primarily comprised (84%; 78 out of 93) of breast cancer patients [50]. Identifying which functional deficits to target with rehabilitation will improve treatment and RTW outcomes [50]. The development of targeted interventions and resources (cf. Fig. 2) should also include metrics to address demographic factors that are known to contribute to ongoing inequalities, such as the patient's occupation, whether they live in a rural versus urban location, and whether they are from a low-income household. These factors may be best addressed through modifications to the healthcare model itself, although challenges persist. For example, individuals living in rural areas may not have easy access to appropriate facilities from which to receive their treatment. Reduced access to care for patients in rural areas poses a large burden for some patients (e.g., travel distance, transportation limitations) to receive adequate or ongoing care [51, 52]. Patients who are low income may have other challenges in pursuit of adequate and ongoing care. For instance, they may have little or no health insurance or additional household finances to cover necessary treatment or rehabilitation [30, 53]. These patients likely have little to no reserve funds to contribute toward costs of care not covered by insurance or to pursue additional care, such as physical therapy [54], to restore function and mobility to enable successful RTW.

The integration of rehabilitation in tandem with the treatment pathway could offset known disparities. Models exist that can be integrated into the care continuum to mitigate treatment-induced functional declines. Specifically, prehabilitation has been shown to be safe and effective for all cancer [55] and breast cancer patients [56], resulting in improved physical fitness before treatment that offsets negative treatment effects [57]. Prehabilitation is a flexible intervention that can be tailored to the specific needs of individual patients [58, 59], making this an attractive option to prospectively improve functional outcomes needed for successful RTW. Additionally, technology advances have enabled the development of interventions specifically designed

Fig. 2 The ability to return to work (RTW) is multifactorial and motivated by a diversity of factors, such as arm mobility and function, household finances, work accommodations and flexibility, occupational task requirements, and post-treatment resources and support. Directly addressing each of these contributing factors in the treatment pathway for breast cancer patients may improve their ability to RTW after treatment

Multifactorial aspects of return to work in breast cancer survivors



for at-home delivery, such as virtual exercise counseling sessions. Increased use of virtual technology, particularly during the COVID-19 pandemic, presents an opportunity to develop new strategies to enhance care delivery while simultaneously providing an accessible, cost-effective intervention option. Virtual interventions may be particularly appealing to those who must travel long distances to receive care or for those with limited financial means outside of insurance.

The benefits of exercise on improving cancer treatment outcomes are clear, but there are ongoing challenges in the USA with the integration of exercise programs into the treatment pathway in a consistent and effective way. Globally, exercise professionals have achieved success in integrating exercise into the cancer care continuum. For example, accredited exercise physiologists (AEPs) in Australia are university-trained allied health professionals that can be billed and are covered by health insurance. As a result, AEPs are commonly employed in hospitals and other health care settings, which increases patient accessibility to these services. The inclusion of AEPs as a billable service further increases patient access to care, regardless of their income status. In the USA, clinical exercise physiologists (CEPs)

[60] are comparable to Australian AEPs, although the US healthcare model does not currently cover CEPs under government or private insurance. This has resulted in many oncology professionals being unclear of their role in progressing patient continuity of care across the continuum [61]. An opportunity exists to develop a coverage mechanism for CEPs, providing a pathway for referral from clinical oncological providers to rehabilitation that is overseen by an exercise or rehabilitation professional. Ongoing work by the American College of Sports Medicine (ACSM) seeks to address discontinuities across healthcare providers through the ACSM Exercise is Medicine Initiative [61]. The goal of this initiative is to develop and implement a methodology to assess, advise, and refer patients to community-based and rehabilitation professional-supervised exercise programs that specifically target survivors' functional needs [61]. Developing a foundation for referral in combination with a large movement to incorporate exercise into the standard of care [60] would extend care beyond the acute treatment period into the cancer-free survivorship period, with the goal of improving physical function, arm function, and QoL that enable RTW and offset long-term disease burden.

Conclusion

Little work has attempted to link ongoing RTW challenges for breast cancer survivors to physical arm function and demographic disparities. More research is needed to identify the specific occupations in which breast cancer survivors participate, with emphasis on the compounded influence of treatment effects and disparities on RTW outcomes. Opportunities exist to improve understanding of the RTW landscape for breast cancer survivors, including identifying the most prevalent occupational sectors in which survivors participate, the physical function necessary to RTW, the effects of surgical treatment approach on physical arm function, and the influence of demographic factors on perpetuating inequalities. Additional work is needed to integrate exercise professionals into the treatment pathway to improve functional outcomes. Addressing the factors driving RTW for breast cancer survivors will lead to improved outcomes and offset long-term burdens of cancer.

Author contribution Authors Vidt, Heitzenrater, and Schmitz performed conceptualization, writing — original draft, and writing — reviewing and editing. Authors Dodge, Potochny, Widders, Paulishak, Ravnicek, Henry, Green, and Kass provided and performed writing — reviewing and editing.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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