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# BEYOND BIOLOGY: SOCIAL DETERMINANTS OF BREAST CANCER MORBIDITY AND SURVIVAL AMONG WOMEN IN LOW- AND MIDDLE-INCOME COUNTRIES: A REVIEW

Jai Shree[1], Dr. Abhinandan[2]
[1] *Doctoral Research Scholar, Department of Sociology, Lovely Professional University, Punjab*
[2] *Lecturer in Sociology, Government Degree College Khour, Jammu.*

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***Corresponding Author:***
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***Abstract:***

The tumour biology of breast cancer is not the sole determinant of the outcomes of breast cancer in low- and middle-income countries; the social environment in which women live and those who do not access care also play a significant role. This assignment provides a review of evidence regarding the importance of social determinants to breast-cancer morbidity and survival: education, socioeconomic status, gender norms, health-system access, and cultural beliefs. In a scoping approach with focused systematic synthesis, determinant to outcome pathways is explored, such as delays in care, stage at diagnosis, treatment access, treatment adherence, and comorbidity. The epidemiological trends in LMICs indicate that there is an increase in incidence and a continuing high mortality rate because of late detection and discontinued treatment. Indian-specific evidence points to the presence of financial toxicity, rural-urban imbalances, and genders in decision-making as the key challenges. Insurance protection, community navigation, task-shifting and tele-oncology have the potential to be used but have not been evaluated to a large scale. The review finds that to boost survival and quality of life of women with breast cancer in resource-strained environments, it is necessary to integrate the biological progress with social and health-system reforms that are grounded on equity.

***Keywords:*** Breast cancer; social determinants of health; LMICs; India; stage at diagnosis; treatment adherence; health inequity; cancer survival; health systems; gender norms

## 1. Introduction

Breast cancer is a complicated condition whose clinical course represents not only tumour-biological characteristics (e.g., receptor status, proliferative index, lymph vascular invasion) but also the social structuring within which breast cancer patients reside (Obeagu & Obeagu, 2024). Coupling of the socioeconomic forces with biological processes in many low- and middle-income countries (LMICs) leads to later stage at presentation, increased comorbidity burden, disrupted treatment trajectory, and subsequent poor survival. The magnitude of global surveillance is estimated by the fact that recent estimates of the global cancer burden reveal the existence of millions of incidence cases of breast cancer and hundreds of thousands of deaths every year with a disproportionate burden attributed to the middle-income regions.

The assignment takes a broader perspective, that is, a beyond-biological perspective: it inquires how social determinants of health (SDOH) education, income, gender norms, health-system structure, geography, and cultural beliefs play the role of mediating the cascade between cellular pathology and population-level morbidity and survival. Concentrating on LMICs with an inherent country-level synthesis in the case of India, the review incorporates epidemiology, the theoretical framework, pathways of empirical delays, stage, access, adherence, comorbidity, as well as evidence on interventions and policy responses.

**Justification: the importance of beyond biology**

At the molecular level of analysis, breast cancers vary in terms of hormone receptor expression (ER/PR), HER2 amplification, genomic instability, and tumour microenvironment, which determine targeted treatment and prognosis (Hong & Xu, 2022). Nevertheless, these precise indicators cannot be applied to the benefit of the population unless there is prompt access to diagnostics (immunohistochemistry, imaging) and therapeutics (surgery, systemic therapy, radiotherapy). Social determinants operate both upstream and downstream of tumour biology: they both affect exposures that can change carcinogenesis (e.g. reproductive patterns, obesity, environmental carcinogens), define latency to diagnosis (symptom recognition and health-seeking) and integrity of treatment delivery (financial toxicity, distance to oncology centres). These non-biological drivers are critical to explaining the disparities in survival in LMIC contexts, as well as to develop fair cancer-controlling plans.

**Research questions and objectives**

**Primary objective**

To successfully synthesize evidence on the role of social determinants of health on breast cancer morbidity and survival in women living in LMICs, and specifically in India.

**Key research questions**

1. What social determinants are always related to diagnosis at a later stage, interruption in treatment and low survival in LMICs?
2. How do social determinants affect clinical outcomes (through which proximal pathways: delays in care or diagnosis, receipt of treatment or adherence, comorbidity) do they act?
3. How strong and reliable is the evidence of interventions to reduce disparities in LMICs due to social determinants?
4. What is the evidence on India that scales up to greater LMIC trends or not?

**Scope**

In this review, the focus on female breast cancer in LMICs is given more attention to population- and health-system researches focusing on social, economic, cultural, and structural determinants. The India country-level synthesis will capture the national registry data, regional studies and program evaluations. The last 10-15 years will be favourably incorporated into the temporal window to represent the latest diagnostic and treatment paradigms but also non-recent seminal earlier work will be included where applicable.

## 2. Conceptual framework

The review is guided by a conceptual model that is socio-ecological in nature: distal determinants (national policy, poverty, gender norms) are influencing intermediate contexts (education, employment, health-system financing, geography), which in turn are affecting proximal determinants (health literacy, symptom appraisal, transport, financial capacity). These proximal determinants influence the interactions that occur between the health system (screening uptake, diagnostic latency, treatment initiation), which influence tumour and host-level outcomes (stage at diagnosis, tumour burden, comorbidity interactions, immune competence), and eventually survival and quality of life (Bridger, 2023).

### Social determinants of health: cursory theoretic background

The SDOH literature has a conceptualization of health outcomes as emerging products of stratified effects: structural (macro-economic policies, social stratification), community (norms, social capital), interpersonal (household decision-making), and individual (knowledge, behaviours). Biologically, the chronic effects of poor SDOH may be in the form of allostatic load, immunosenescence, and metabolic dysregulation - physiologic conditions that may affect cancer progression, response to therapy and tolerance to cytotoxic regimens.

Pathways between social determinants and cancer morbidity and survival

The following are the empirically measured and theoretically conceivable routes in which SDOH mediate breast cancer outcomes in LMICs.

### Patient and health-system delay (delays in care)

The delays include symptom appraisal, initial access to healthcare, diagnostic period, and treatment onset. Delays that are prolonged are associated with the size of tumours, the spread of the nodules, and higher chances of metastasis which are biological conditions that are degrading in terms of survival probability (Batbayar et al., 2022). Several LMIC studies report median diagnostic delays in months and not weeks, and have definite correlations between delay and late presentation.

**Stage at diagnosis**

The most common prognostic factor is stage (TNM staging). Stage is affected through social determinants through screening uptake, symptom recognition and referral efficiency. Poor education levels and health literacy decrease engagement in screening and delay presentation, consequently increasing the rate of stage III-IV diagnosis.

**Treatment access**

There is inadequate oncology infrastructure, distance to healthcare systems, and inadequate diagnostic pathway are structural barriers to the provision of surgery, systemic therapy (chemotherapy, endocrine therapy, HER2-targeted agents), and radiotherapy. Financial obstacles (out-of-pocket payments) have biological implications in cases of poor control of the tumour because of poor or suboptimal regimens. Cohort studies performed in various LMICs show high percentages of treatment dropouts that are associated with disastrous spending.

**Adherence and abandonment**

The use of multi-agent chemotherapy or protracted endocrine therapy is socioeconomically unstable, dependent on side-effect control capacity, and social support (Lewis & Nagrial, 2023). Failure to comply boosts the risk of recurrence and deteriorates the disease-free survival; the act of giving up curative-intent therapy is directly proportional to the increase in mortality.

**Competing risks and comorbidity**

Comorbidities (e.g. uncontrolled diabetes, hypertension, chronic infections) may be untreated and affect both choices of therapy (e.g. contraindications to certain chemotherapies) and host resistance, which can change their tolerance to treatment and immunologic capability to deal with tumours.

**The suggested framework diagram (descriptive)**

A flow diagram will be obtained which will contain layers: (1) Structural determinants (policy, poverty) (2) Intermediate determinants (education, gender norms, health financing, geography) (3) Proximal determinants (health literacy, transport, finances, social support) (4) Health-system interactions (screening, referral, diagnostics, treatment initiation) (5) Clinical mediators (stage at diagnosis, comorbidity, adherence) (6) Outcomes (morbidity, survival, quality of life). Arrows will indicate two-way feedback (e.g. catastrophic spending exacerbating poverty).

## 3. Methods (overview)

### Review type

The task will indicate a scoping review with a complementary targeted systematic synthesis of quantitative associations wherein meta-analysis is possible. None better scoping approaches can be used to define the scope of SDOH research; a nested systematic part will evaluate the effect sizes on prevalent determinants (education, SES, health-system access).

### Search strategy and searched databases

The search in MEDLINE (PubMed), Embase, Scopus, Web of science, Cochrane Library, and regional databases (e.g., IndMED) will be conducted comprehensively (Asubiaro, 2023). The searches of grey literature will encompass the reports of GLOBOCAN and World Health Organization, the national cancer registry bulletins, and the evaluations of NGO programs. The search window will focus on 2010 and later but will have an earlier influential work. Limitations to language: English; where possible non-English articles with English abstracts would be taken into account.

### Inclusion criteia

Observational (cohort, case-control, cross-sectional) studies, population-based analytical study of registries, mixed-method and intervention studies that describe social determinants relative to stage, treatment, adherence, morbidity or survival of breast-cancer.

### Exclusion criteria

Those that are purely molecular/bench studies that do not have patient level social data, paediatric cohorts and case reports. They will be extracted into data (setting of the study, study design, population, tumour biology variables (histology, grade, ER/PR/HER2 status), SDOH variables (education, income quintile, insurance, rurality, caste/ethnicity where reported), time variables (patient and system delay), treatment variables (time-to-surgery, number of chemotherapy cycles received, endocrine therapy adherence), clinical moderators (stage, tumour size, nodal status, comorbidity index), and outcomes (disease-free survival, overall survival In the case of quantitative syntheses, random-effects meta-analyses of adjusted effect estimates (e.g. low vs high SES hazard ratio on mortality) will be reported where there are 3 or more sufficiently homogenous studies; a narrative synthesis stratified by region and study quality will be reported (Pandey et al., 2024). The Newcastle-Ottawa Scale of observational studies and Cochrane ROBINS-I tool of nonrandomized interventions will be used to evaluate the risk of bias.

## Overview of Epidemiology in the LMICs

There is heterogeneous incidence in LMICs but always higher rates of case-fatality than high-income nations. The lower productivity of some low-income settings in the age-standardized incidence may be a result of the reproductive patterns and under-ascertainment but the mortality rates are disproportionately high due to late stage at diagnosis, poor access to adjuvant therapies and service interruptions (Schwartz, 2024). Time series trends of middle-income areas reveal increasing incidence in line with urbanization, obesity, late exposure to childbearing and hormonal factors, and others low-income environments indicate no changes in incidence with time but increasing survival. Among the major metric difficulties are lack of full coverage of the registry, improper classification of cause of death, and the fluctuating data in staging -factors that both bias the survival estimates to the negative and make temporal inferences difficult.

## World-Wide Evidence of Selected Social Determinants

### Education and literacy

Poor educational achievement is strongly linked with poor screening (mammography/clinical breast exam) and late presentation. Mechanistically, education has an effect on health literacy and symptom appraisal which results in delayed diagnostic biopsy and an increase in the likelihood of an acquiring a clinically detectable tumour burden (larger diameter, nodal involvement) at the time of diagnosis.

### Socioeconomic standing (income/wealth)

SES regulates the access to diagnostics (pathology, imaging) and systemic treatment (taxane-based treatment, HER2-tumors trastuzumab (Herrmann & Führer, 2025). Treatment truncation is often triggered by disastrous out-of-pocket spending - a biologic phenomenon manifested as subtherapeutic cumulative dose intensity, lowering the probability of tumour cell kill and increasing the likelihood of microscopic disease and recurrence survival.

### Feminine and masculine norms and family dynamics

Patriarchal decision making may postpone care seeking especially when consent or finances of the family members are required. The social stigma of breast symptoms could enable an individual to conceal the symptoms which in turn can lead to locally advanced or metastatic disease- stages that are less responsive to curative therapies and more dependent on palliative chemotherapy that has low survival potential.

### Structural barriers and access to the health system

Geography and insufficient workforce in the field of oncology lead to delayed surgeries, long time-to-radiotherapy (with a risk of locoregional recurrence), and poor continuity of endocrine therapy (Ebrahim et al.,

2025). Finance models based on health financing that are not universal cover also expose patients to non-coverage between multi-cycle programs. Molecular subtyping is also restricted by infrastructure gaps, which have to make empiric endocrine or cytotoxic decisions, which can be out of step with tumour receptor biology.

**Cultural and psychosocial determinants**

Beliefs among alternative healers delay biomedical treatment; low social support deteriorates better adherence to long-term endocrine treatment (i.e., five-year tamoxifen), and chronic psychosocial stress adds to immunologic suppression and metabolic disturbance which may alter tumour progression and chemotherapy tolerance.

## 4. Results Associated with Social Determinants

**Social determinants impact the whole causal pathway**

Greater delay and reduced screening lead to greater percentage of stage III/IV at diagnosis which are less receptive to treatment leads to higher rates of treatment abandonment and non-adherence which in turn leads to greater rates of recurrence and mortality (Korvink et al., 2025). Conditions caused by SDOH (e.g. uncontrolled diabetes) raise the risk of peri-operative treatment and can prohibit aggressive systemic treatment, decreasing overall survival. Social support, access to analgesia and hospices are also restricted thus worsening the quality of life and palliative outcomes.

**India-country-specific synthesis Evidence**

There is evidence that India has the highest level of food security. India country-specific synthesis Evidence There is evidence that India has the highest level of food security (McKay et al., 2023). In response to SDOH-based disparities, India is an example of increased incidence in urban centres that have high inter-state heterogeneity as indicated by population-based registries. Low education, rural living and financial factors have been associated with late presentation and abandonment of treatment in the Indian research; qualitative research has identified gendered decision-making and stigma as the most prevalent factors. Program assessments (screening camps, nurse-led community education, expansions in the public insurance) demonstrate inconsistent results: higher awareness and the lack of the results on the distribution stage unless the diagnostic and referral pathways also get strengthened. Fragments in the Indian health-system and gaps in the registries are still significant data constraints that hinder the accurate quantification of the social-determinant impacts.

**LMIC Policy Responses and Interventions**

The prospective strategies are financial coverage (subsidies, insurance coverage of essential oncology drugs), decentralization and task-shifting (training primary-care teams on early detection and navigation), mobile health programs to track patients and remind them of their endocrine therapy, and hub-and-spoke models that connects

the peripheral clinics and tertiary oncology centres through tele-oncology (Barrios et al., 2023). It has been evident that integrated strategies such as demand-side (education, mobilization of communities) and supply-side (infrastructure, financing) are required to redistribute the stages of distribution and enhance survival. Nonetheless, strict randomised assessments and economic analyses in LMIC settings are limited.

**Limitation of the Literature Methodology**

Such weaknesses are common, and include cross-sectional designs, which limit causal inference, different measures of SDOH (income quintiles versus asset indices), unmeasured confounding (tumour biology differences such as triple-negative prevalence), survivor bias in facility-based cohort, and the lack of adjustment of treatment heterogeneity. The lack of completeness of the registry and the existence of inconsistent staging criteria further decrease the comparability. Such limitations require that pooled estimates should be interpreted with caution and that future investigations in the form of population-based, cohort studies, which combine tumour biology with finer social measures are necessary.

**Discussion**

The synthesis of the evidence has suggested that social determinants are strong modifiers of the clinical trajectory of breast-cancer in LMICs (Chanakira et al., 2024). They work both upstream (regulating exposures with impacts on carcinogenesis and tumour phenotype) and downstream (controlling access to biologically effective diagnostics and therapies). The feasible causal mechanism is between structural deprivation and decreased health literacy and late presentation to the increase in tumour bulk and the change in the immune/metabolic host milieu that restrict therapeutic options and dose-intensifying adherence and superior recurrence and mortality. The trend in India is similar to this framework, but with the further complication of strong subnational difference.

**Recommendations**

- To researchers: priority should be made on longitudinal population-based cohort of tumour molecular data correlated with standardised SDOH measures; implementation trials that combine financial protection with care-navigation to measure the survival endpoints.
- To policymakers and health systems: increase financial risk coverage around the necessary oncology testing and treatment, invest in decentralized diagnostic capacity (IHC, basic imaging), and put community health workers into an early detection channel.
- To program implementers and NGOs: Integrate culturally-sensitive education to decrease stigma with patient navigation and adherence support systems (SMS reminders, community groups) to decrease abandonment and enhance endocrine therapy persistence.

## 5. Conclusion

Biology is the determinant of what a tumour is social determinants the happenings to the individuals who are affected by the tumour. In LMICs and, in case with India, it is necessary to deal with education, gender norms, funding, and structural access to ensure that the gains in tumour biology are transferred to population survival. An equity-based, multi-sectoral approach that integrates molecularly informed care with effective social and systems interventions provides the most appropriate solution to the problem of survival disparities and provision of biologically effective therapy to all women, irrespective of their socioeconomic background.

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