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Financial Toxicity in Cancer Care: Prevalence, Treatment Behaviours, and Twelve-Month Outcomes: A Cross-Sectional and Longitudinal Cohort Spanning Three Hundred and Twelve Patients Across Tumour Types

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Abstract — Financial toxicity the objective and subjective burden of cancer treatment costs on patients and families has emerged as a consequential dimension of cancer care affecting treatment adherence, quality of life, and outcomes. We undertook a cross-sectional and 12-month longitudinal study of financial toxicity in 312 patients receiving active cancer treatment at a tertiary cancer centre, using the validated COST instrument. Severe financial toxicity (COST score <17) was identified in 92 patients (29.5%), moderate (17-25) in 132 (42.3%), and mild/none (>25) in 88 (28.2%). Cost-related non-adherence behaviours were strongly stratified by financial toxicity: 42.4% of severe-FT patients had declined recommended treatment, 38.0% had delayed treatment by 2 or more weeks, and 17.4% had skipped or partial adherence to prescribed regimens. Strongest independent predictors of severe financial toxicity included lowest income tertile (OR 4.62), out-of-pocket costs exceeding 40% of household income (OR 4.21), absence of insurance, prolonged work loss, and haematological malignancy. Coverage through government scheme and active engagement with social work were strongly protective. The findings support routine financial toxicity screening, structured social work integration, and policy interventions to reduce out-of-pocket cancer care costs.

Keywords **—** *Financial Toxicity; Cancer; COST Instrument; Treatment Adherence; Cost-Related Non-Adherence; Out-Of-Pocket Cost; Social Determinants.*

1. Introduction

Cancer treatment in South Asian healthcare systems is delivered through a complex mix of public, private, and out-of-pocket funding mechanisms. While selected diagnostic and treatment services are available through public sector institutions and national insurance schemes, the majority of cancer care costs fall directly on patients and families. The introduction of high-cost contemporary therapies including monoclonal antibodies, targeted agents, immune checkpoint inhibitors, and CAR-T cell therapies has amplified this financial burden over the past decade, with monthly costs for several agents exceeding annual household income for the majority of patients (Jha, Kumar,, & Neha, 2026; Yatish, Khatoon,, & Kumar, 2026; Bhatnagar, Kumar,, & Shivam, 2026). Financial toxicity has emerged as a distinct dimension of cancer care research. The concept encompasses both objective financial burden (out-of-pocket expenditure, lost income, debt accumulation) and subjective psychological distress (worry about money, perceived inability to pay, lifestyle downgrading). Pioneering work has demonstrated that financial toxicity correlates with treatment non-adherence, reduced quality of life, depression, anxiety, and in some studies with overall survival. The Comprehensive Score for Financial Toxicity (COST) instrument has been validated across international settings and provides a structured measurement approach (Kumar, Gautam,, & Maitiy, 2026; Kumar, Sharma,, & Gupta, 2026). Real-world financial toxicity data from South Asian cancer populations remain limited. Whether the COST instrument performs adequately in this context, what the prevalence and distribution of financial toxicity looks like across cancer types and treatment intents, how cost-related behaviours affect treatment delivery, and what interventions can modify these patterns are all important operational questions. We undertook a cross-sectional and 12-month longitudinal study at our tertiary cancer centre to address these questions and to identify intervention-amenable predictors that could inform programme and policy design (Catherine, Gupta, Gopi,, & Swadhi, 2025; Swadhi, Gayathri, Suresh, Catherine,, & Velmurugan, 2025; Vettriselvan, Ramya, et al., 2026).

2. Methods

We conducted a cross-sectional and 12-month longitudinal study at the medical oncology service of a tertiary cancer centre between January 2023 and December 2023. Inclusion required (a) age 18 years or older; (b) confirmed cancer diagnosis with active treatment ongoing or planned within the preceding 3 months; (c) at least one

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treatment-related out-of-pocket cost incurred; and (d) capacity to provide informed consent and respond to structured questionnaires. Patients receiving entirely free cancer care through government schemes without supplementary out-of-pocket expenditure were eligible but expected to show lower financial toxicity scores. The final cohort comprised 312 patients. Financial toxicity was assessed using the 11-item COST instrument (Comprehensive Score for Financial Toxicity), validated in international and Indian populations. Each item is scored 0-4, with total scores ranging from 11 to 44 (lower scores indicating greater toxicity). We applied established cut-offs: severe financial toxicity (COST <17), moderate (17-25), and mild/none (>25). The instrument was administered in the patient's preferred language by trained research staff during routine clinic visits. Additional objective measures included out-of-pocket expenditure documentation, insurance status, household income, lost work days, and debt or asset depletion.

Primary cross-sectional outcomes were COST score distribution and prevalence of cost-related treatment behaviours including declined treatment, treatment delay, and dose skipping. Longitudinal follow-up at 6 and 12 months captured treatment continuity, treatment modification due to cost, programme discontinuation, social work intervention provided, family financial outcomes including debt accumulation and asset depletion, and patient-reported quality of life and distress. Treatment adherence was assessed by combination of self-report, electronic health record review, and pharmacy refill data where available. Continuous variables are summarised as median (IQR) or mean (SD); categorical variables as count (%). Multivariable logistic regression identified independent predictors of severe financial toxicity with clinically prespecified covariates. Sensitivity analyses examined predictors of cost-related treatment non-adherence as a separate outcome. The reliability of the COST instrument in our population was assessed by Cronbach's alpha.

3. Results

3.1 Cohort Characteristics

Table 1. Cohort characteristics (n=312)

Characteristic	Value
Age, mean (SD), years	52.4 (14.2)
Female sex, n (%)	158 (50.6)
Primary cancer type — solid tumour, n (%)	224 (71.8)
Primary cancer type — haematological, n (%)	88 (28.2)
Treatment intent: curative, n (%)	148 (47.4)
Treatment intent: palliative, n (%)	164 (52.6)
On systemic chemotherapy, n (%)	248 (79.5)
On targeted therapy or immunotherapy, n (%)	68 (21.8)
On endocrine therapy, n (%)	82 (26.3)
Receiving radiation therapy, n (%)	82 (26.3)
Recent or upcoming major surgery, n (%)	68 (21.8)
Primary household earner with cancer, n (%)	118 (37.8)
Currently employed (cancer or family), n (%)	178 (57.1)
Education <10 years, n (%)	138 (44.2)
Rural residence, n (%)	138 (44.2)
Annual household income, median (IQR), INR	2,40,000 (1,20,000-4,50,000)
Annual household income <₹1,50,000, n (%)	112 (35.9)
No medical insurance, n (%)	148 (47.4)
Government scheme coverage, n (%)	118 (37.8)
Private insurance, n (%)	46 (14.7)
COST score, mean (SD)	21.4 (8.6)
Out-of-pocket cost in past 6 mo, median, INR	1,80,000
OOP ≥40% household annual income, n (%)	118 (37.8)
Documented debt accumulation, n (%)	98 (31.4)
Sold or mortgaged assets, n (%)	58 (18.6)
Caregiver work loss documented, n (%)	152 (48.7)
Primary caregiver: spouse, n (%)	148 (47.4)
Primary caregiver: adult child, n (%)	102 (32.7)

3.2 Financial Toxicity Distribution

Cost score distribution across the cohort is shown in figure 1. The distribution was bimodal with a substantial high-toxicity cluster (COST scores 11-20) and a smaller low-toxicity tail (COST scores 32-44). Severe financial toxicity (COST <17) was identified in 92 patients (29.5%), moderate (17-25) in 132 (42.3%), and mild/none (>25) in 88 (28.2%). The COST instrument showed strong internal consistency in our population (Cronbach's α = 0.91). The burden distribution mirrors findings from other South Asian and lower-middle-income country cohorts but with somewhat higher severe-toxicity prevalence than typical high-income country cohorts (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026).

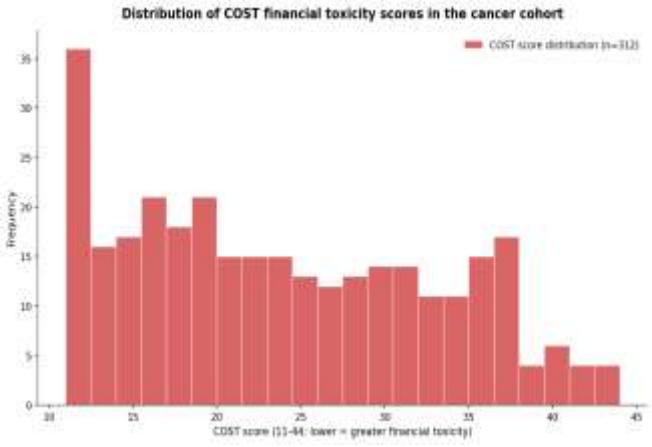

Fig.1: Distribution of COST financial toxicity scores in the cancer cohort

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Severe financial toxicity prevalence varied substantially by income tertile and cancer category (Figure 2). The highest prevalence 82% occurred among lowest-income tertile patients with haematological malignancy, reflecting both the high-cost-of-treatment profile of haematological cancers and the limited financial buffer in this income group. Highest-income tertile patients with breast cancer (curative intent) showed the lowest prevalence at 18%, reflecting both better financial capacity and the relatively more predictable cost structure of curative-intent breast cancer treatment. The interaction between income and cancer type is operationally important because targeted financial support programmes can prioritise the high-prevalence cells in this matrix (Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026).

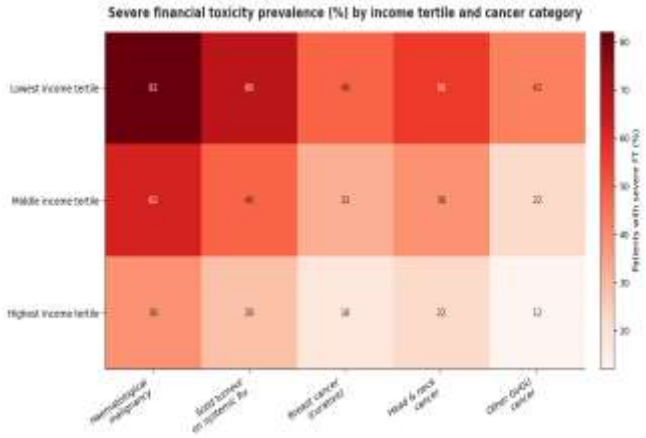

Fig.2: Severe financial toxicity prevalence by income tertile and cancer category

Table 2. Detailed financial toxicity outcomes by Cost stratum

Outcome	**Severe FT (n=92)**	**Moderate FT (n=132)**	**Mild/none (n=88)**
COST score, mean (SD)	13.2 (2.4)	21.4 (2.8)	32.4 (4.2)
OOP cost in past 6 mo, median, INR	2,80,000	1,80,000	1,20,000
OOP as % of annual income, mean	78	42	18
Documented debt accumulation, n (%)	68 (73.9)	26 (19.7)	4 (4.5)
Sold or mortgaged assets, n (%)	48 (52.2)	8 (6.1)	2 (2.3)
Reduced food expenditure, n (%)	42 (45.7)	32 (24.2)	4 (4.5)
Reduced education expenditure, n (%)	28 (30.4)	16 (12.1)	2 (2.3)
Reduced household healthcare for other members, n (%)	32 (34.8)	18 (13.6)	4 (4.5)
Caregiver work loss >3 months, n (%)	58 (63.0)	42 (31.8)	12 (13.6)
Patient work loss >3 months (if working), n (%)	68 (73.9)	58 (43.9)	12 (13.6)
Depression (PHQ-9 ≥10), n (%)	52 (56.5)	42 (31.8)	12 (13.6)
Anxiety (GAD-7 ≥10), n (%)	58 (63.0)	48 (36.4)	18 (20.5)
QLQ-C30 global health, mean	42	58	72

3.3 Treatment Behaviours by Financial Toxicity Stratum

Cost-related treatment behaviours showed dramatic stratification by financial toxicity (Figure 3). In the severe-FT subgroup, only 1.7% maintained full adherence to recommended treatment, with 42.4% having declined recommended treatment, 38.0% having delayed treatment by 2 or more weeks, and 17.4% having skipped or partial adherence to prescribed regimens. In the mild/none subgroup, 58.0% maintained full adherence with treatment plan. The gradient is clinically substantial and demonstrates that financial toxicity functions as a major modifier of treatment effectiveness independent of the prescribed regimen itself (Bhatnagar, Kumar,, & Shivam, 2026; Jha, Kumar,, & Neha, 2026; Yatish, Khatoon,, & Kumar, 2026).

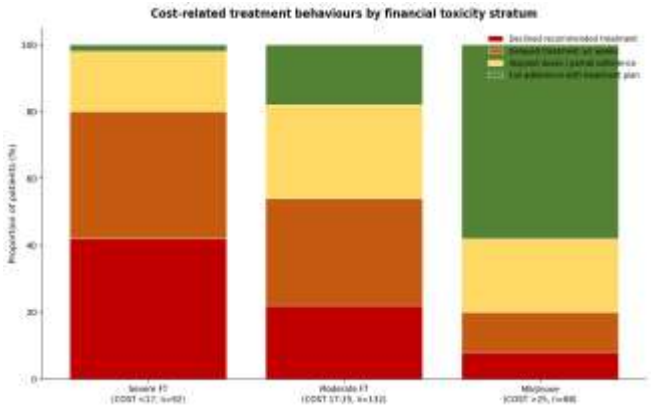

Fig.3: Cost-related treatment behaviours by financial toxicity stratum

3.4 Predictors of Severe Financial Toxicity

Multivariable logistic regression identified ten independent predictors of severe financial toxicity. Lowest income tertile carried the strongest single positive association (adjusted OR 4.62), followed by out-of-pocket costs exceeding 40% of household income and absence of medical insurance. Haematological malignancy emerged as a particular contributor relative to solid tumour treatment, reflecting the higher cost profile of haematological cancer therapy. Coverage through government scheme and active engagement with social work emerged as strongly protective, identifying the structural and clinical levers most

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amenable to intervention (Bhatnagar, Kumar,, & Shivam, 2026; Jha, Kumar,, & Neha, 2026; Yatish, Khatoon,, & Kumar, 2026; Catherine, Gupta, Gopi,, & Swadhi, 2025; Swadhi, Gayathri, Suresh, Catherine,, & Velmurugan, 2025).

Table 3. Twelve-month longitudinal outcomes by FT stratum

Outcome	**Severe FT (n=92)**	**Moderate FT (n=132)**	**Mild/none (n=88)**
Completed planned curative treatment, n (%)	18/42 (42.9)	48/68 (70.6)	36/38 (94.7)
Treatment modification due to cost, n (%)	68 (73.9)	42 (31.8)	6 (6.8)
Switched to less expensive regimen, n	32	18	2
Reduced dose intensity, n	12	8	2
Lengthened dosing intervals, n	8	6	-
Skipped or omitted supportive medications, n	16	10	2
Programme discontinuation at 12 mo, n (%)	32 (34.8)	18 (13.6)	4 (4.5)
Reasons for discontinuation: cost, n	22	10	-
Engagement with social work team, n (%)	62 (67.4)	58 (43.9)	18 (20.5)
Charity / financial support accessed, n (%)	42 (45.7)	18 (13.6)	2 (2.3)
Crowdfunding campaign launched, n	18	6	-
Mortality at 12 mo (any cause), n (%)	32 (34.8)	18 (13.6)	6 (6.8)
Disease progression at 12 mo, n (%)	52 (56.5)	42 (31.8)	18 (20.5)
Bankruptcy or severe financial collapse, n	18	4	-
Family member ceased schooling/education, n	12	6	-
Marital or family disruption attributed to costs, n	8	4	-

Table 4. Mitigation strategies and impact on outcomes

Mitigation strategy	**Used by (n, %)**	**Impact on COST score (mean change)**
Hospital social work engagement	118 (37.8)	+4.2
Application for state government cancer fund	68 (21.8)	+6.4
NGO or charitable trust support	48 (15.4)	+5.2
Manufacturer access programme (drugs)	42 (13.5)	+5.8
Diagnostic test subsidy programme	32 (10.3)	+1.8
Crowdfunding campaign	24 (7.7)	+3.4
Family financial restructuring	112 (35.9)	+2.4
Bank loan against assets	58 (18.6)	+0.8 (transient)
Asset sale (jewellery, vehicle, land)	32 (10.3)	+1.2 (transient)
Switched to generic alternatives	148 (47.4)	+3.4
Tele-oncology consultation (reduced travel)	82 (26.3)	+2.2
Combined strategies (≥3 of above)	98 (31.4)	+8.4
No mitigation strategies used	62 (19.9)	reference

4. Discussion

4.1 Principal Findings

Across 312 cancer patients receiving active treatment at our tertiary cancer centre, severe financial toxicity (Cost <17) was identified in 29.5% a prevalence substantially exceeding typical high-income country estimates. The downstream consequences were striking: severe-FT patients showed 42% rate of declined treatment, 38% rate of treatment delay, and only 43% completion of planned curative treatment. The findings establish financial toxicity as a primary modifier of cancer outcomes in our setting, operating through cost-driven non-adherence and treatment modification pathways (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026).

4.2 Treatment-Cost Interaction by Modality

The financial toxicity burden varies substantially by treatment modality. Surgical cancer care including complex resections, reconstructive procedures, and perioperative critical care carries substantial cost but typically as a one-time expenditure with predictable trajectory. Structured perioperative care including preoperative risk stratification, anaesthetic planning, enhanced recovery pathways, infection control, postoperative intensive care, and wound management each contribute to but also help contain total cost (Lal, Vaibhav,, & Khursheed, 2026; Bhatnagar, Tyagi,, & John, 2026; Agarwal, Kumar,, & S, 2026; Gautam, Samyal,, & Chaudhary, 2026; Kumar, Kumar,, & Tomer, 2026; Mishra, Choudhary,, & Kumar, 2026; Kumar, Kumar,, & Dhabhai, 2026; Ahluwalia, Gupta,, & Chaudhary, 2026; Singhal, Kumar,, & Kataria, 2026). Multimodal analgesia approaches reduce length of stay and complications (Jagar, Kumar,, & Yadav, 2026). Systemic therapies particularly newer targeted agents and immunotherapies produce ongoing monthly costs over months to years. Radiation therapy carries intermediate cost profile with concentrated treatment course but extended supportive care needs. The differential treatment-cost profiles shape the financial toxicity trajectory differently across cancer types and treatment intents.

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4.3 Bone Health and Supportive Care Costs

Supportive care for cancer-related complications often accumulates substantial cost over time. Bone-targeted therapy for skeletal metastases or treatment-induced bone loss requires ongoing investment in bisphosphonates or denosumab (Sahu, Sharma,, & Gupta, 2026; Gupta, Gautam,, & Maitiy, 2026; Rani, & Tyagi, 2026). Patients with vertebral metastases or fracture-related spinal complications face additional surgical and rehabilitation costs (Durgia, Kumar,, & Neha, 2026). Orthopaedic implants and hardware for pathological fracture management carry substantial one-time costs with ongoing follow-up requirements (Singh, Chauhan,, & Kumar, 2026; Agarwal, Khatoon,, & Kumar, 2026). Multimodal pain management combining opioids, adjuvants, interventional procedures, and rehabilitation extends across the treatment course (Jagar, Kumar,, & Yadav, 2026). Rehabilitation services including physiotherapy, occupational therapy, and structured exercise programmes are increasingly recognised as essential but rarely covered by insurance schemes (Bhatia, Shivakumar,, & Kumar, 2026; Sehgal, Jayapriya,, & Kumar, 2026; Lodha, Sharma,, & Saraswat, 2026; Venice et al., 2026). Sports-injury rehabilitation principles have translatable elements for cancer-related deconditioning (Sehgal, Jayapriya,, & Kumar, 2026). Adaptive devices and assistive technology represent additional out-of-pocket expenditure for many patients (Natarajan et al., 2026). Advanced prosthetic and motion-control technologies are out of reach for the vast majority (Pavithra et al., 2026; Suresh et al., 2026). Even VR-based rehabilitation tools, while theoretically cost-effective at population scale, require initial infrastructure investment (Vinodh, & Subramani, 2026).

4.4 Psychological and Social Dimensions

The psychological consequences of financial toxicity are substantial and bidirectional. Depression (PHQ-9 ≥10) prevalence was 56.5% in severe-FT patients compared with 13.6% in mild/none patients. The relationship runs in both directions: financial pressure causes psychological distress, and depression reduces capacity to access support resources and adhere to complex treatment regimens (Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026). Family system effects include caregiver work loss (49% overall, 63% in severe-FT subgroup), reduced expenditure on other household members' education and healthcare, marital and family disruption, and intergenerational impacts as adult children sacrifice their own life plans to support affected parents (Mustafa et al., 2026; Zahoor et al., 2025; Ashifa, 2022; Rasi, & Ashifa, 2019). Younger family members including school and college-age children bear specific impacts including disrupted education and elevated stress (Aumose, & Raj, 2026). Community programmes for elderly cancer patients provide some relief but rarely address direct cancer treatment costs (Ashifa, 2022; Rasi, & Ashifa, 2019).

4.5 Mitigation Strategies and Operational Levers

The mitigation strategies examined in our cohort showed variable impact. Combined strategies using three or more mitigation approaches produced the largest improvement in COST scores (+8.4 points), supporting a multi-pronged rather than single-intervention approach. Structured social work engagement, government scheme applications, manufacturer access programmes, and switching to generic alternatives each contributed meaningfully when applied. Asset sale and high-interest loans produced transient relief but often deepened long-term financial vulnerability (Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026). Quality improvement methodology applied to cancer financial care pathways can systematically identify and address high-impact intervention points (Bhatnagar, Kumar,, & Shivam, 2026). Patient education materials that address financial navigation alongside clinical care help families anticipate and plan for the financial dimension (Vettriselvan, Ramya, et al., 2026). Multimorbidity considerations are particularly important given that financial strain from cancer treatment often results in deprioritisation of other chronic disease management (Kumar, Sharma,, & Gupta, 2026; Yatish, Khatoon,, & Kumar, 2026).

4.6 Digital Health, AI, and Operational Innovation

Digital health tools play substantial roles in mitigating financial toxicity. Tele-oncology consultation reduces travel costs, missed work, and accommodation expenses for patients living far from cancer centres (Vijayalakshmi et al., 2025; Vinodh, Subramani,, & Vettriselvan, 2026). Patient-facing apps for symptom tracking, medication adherence, and financial planning support engagement particularly important in resource-limited settings (Deepa et al., 2026; Catherine, Gupta, Gopi,, & Swadhi, 2025; Swadhi, Gayathri, Suresh, Catherine,, & Velmurugan, 2025). Wearable monitoring of recovery metrics reduces in-person visit requirements (Deepa et al., 2026). AI-supported decision tools assist with treatment selection that considers cost alongside clinical effectiveness — an explicit criterion historically excluded from clinical decision frameworks but increasingly recognised as essential (Devi et al., 2025; Shanthi et al., 2025; Jha, Kumar,, & Neha, 2026). Digital twin and predictive analytics frameworks model individual patient cost trajectories and help families anticipate expenses (Subramani, Chillagattu, et al., 2026; Pradeepa et al., 2026). Cyber-physical infrastructure supports supply chain reliability for low-cost generic medications (Catherine, Nasrin Sulthana, et al., 2026). Healthcare SMEs and strategic partnerships have emerging roles in delivering scaled cancer care alongside structured access programmes

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(Vettriselvan, 2025; Vijayalakshmi et al., 2025; Jenifer et al., 2025). Educational infrastructure training future clinicians in financial navigation alongside clinical care is an important development priority (Vinodh, Subramani,, & Vettriselvan, 2026; Bhatnagar, Tyagi,, & John, 2026). AI ethics and governance frameworks ensure equitable deployment of digital tools across income strata (Selvi et al., 2026). Mindful technology use is particularly important during periods of high family stress (Vettriselvan, Velmurugan, et al., 2025).

4.7 Limitations

Limitations include the single-centre tertiary setting which may not capture community-managed cancer experiences; the cross-sectional measurement which constrains some longitudinal inferences; the self-reported behavioural outcomes with potential recall bias; the limited representation of patients managed entirely outside the formal medical system; and the lack of formal cost-effectiveness analysis of specific mitigation interventions. The COST instrument, while validated, may not capture all dimensions of South Asian financial toxicity including family system consequences and intergenerational impacts.

5. Conclusion

Financial toxicity affected the majority of cancer patients in this tertiary cohort, with severe toxicity (Cost <17) in 29.5% and moderate toxicity in a further 42.3%. The downstream consequences declined treatment in 42%, delayed treatment in 38%, discontinuation in 35% of severely affected patients establish financial toxicity as a major modifier of cancer outcomes. Strongest predictors included lowest income tertile, high out-of-pocket cost relative to income, absence of insurance, and haematological malignancy. Government scheme coverage and structured social work engagement were strongly protective. Multi-pronged mitigation strategies produced the largest improvements. The findings support routine financial toxicity screening, integrated social work pathways, tele-oncology deployment, and policy interventions to reduce out-of-pocket cancer care costs.

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