

# INFECTION, PSYCHOLOGICAL DISTRESS, AND FINANCIAL BURDEN AMONG TRANSFUSION-DEPENDENT B-THALASSEMIA PATIENTS IN SOUTH PUNJAB, PAKISTAN: A CROSS-SECTIONAL STUDY

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## ABSTRACT

**Background:** TDT is a lifelong condition of blood transfusion and chelation therapy of Iron. However, patients still experience recurrent infections, psychological problems and financial difficulties. Generally, these dimensions are studied in isolation with limited integrated evidence from the context of Pakistan.

**Objective:** To compare various clinical, psychological and financial problems in patients with TDT in a tertiary care hospital in Dera Ghazi Khan, South Punjab, Pakistan.

**Methods:** A descriptive cross-sectional study was done in the Thalassemia Care Unit, Allama Iqbal Teaching Hospital for a period of four months. The participants were 120 children aged 5-30 years with  $\beta$ -thalassemia major who were on regular transfusion for at least 1 year were recruited purposively. Data were gathered by a structured questionnaire, clinical checklist, and observation sheet and analyzed in SPSS version 26. Descriptive statistics, Chi-square test, Independent t-test and ANOVA was performed and the p-value of  $\leq 0.05$  was considered statistically significant.

**Results:** 62% (n = 120) had at least 1 infection within the last year. Splenectomized patients were significantly more likely to become infected ( $p < 0.01$ ). 68% of patients experienced moderate to severe anxiety and 72% of families reported a considerable financial cost associated with treatment.

**Discussion:** There are interrelated clinical, psychological, and financial issues that arise in patients with TDT. To achieve better outcomes, a combination of infection prevention, mental health help and financial support, within an integrated, holistic and patient-centered approach to nursing care, is required with the support of health policy.

## Keywords:

Transfusion-dependent thalassemia; infection; psychological distress; financial burden; nursing; Pakistan

## INTRODUCTION

Thalassemia is a blood disease that is inherited, in which globin chain synthesis is impaired, causing ineffective red cell production, chronic hemolytic anemia and, in severe cases, lifelong blood transfusion dependency (Asim et al., 2023;

Mansory et al., 2025). The BetaThalassaemias are most prevalent in the Mediterranean, Indian subcontinent and Southeast Asia (Ansari et al., 2024). Pakistan has a high burden of this, with a registered carrier frequency of more than 5%, approximately 40,000 transfusion dependent

children and an estimated of 5,000-9,000 affected births annually (Ansari et al., 2024). Limited education and the inability to afford a diagnosis and treatment are important drivers, but consanguineous marriage is also a driver (Asim et al., 2023). In a study from Karachi, 81% of the families reported consanguinity, while 86.8% in a study from Hyderabad reported consanguinity (Asim et al., 2023; Ijaz, 2024). Patients suffering from transfusion dependent thalassemia (TDT) require regular transfusion of blood and chelation of iron but there is no proper quality of care in Pakistan and national policy is not available (Ansari et al., 2024).

Despite treatment, TDT gives overlapping and complex clinical, psychological and economic issues. One of the primary concerns is infection. Hepatitis C and hepatitis B and HIV are examples of transfusion transmitted infections which are common in Pakistan (Ansari et al., 2024). Infections are also considered the second leading cause of death in TDT, the risk of which is associated with anemia, iron chelation, transfusion-related infection and splenectomy (Mansory et al., 2025). Repeated transfusion is associated with iron overload which promotes bacterial growth and loss of the spleen which compromises defense against encapsulated bacteria (Mansory et al., 2025).

Morbidity related to psychosocial factors is also prevalent, with symptoms of anxiety, depression, and hostility, with a lasting need for psychological support (Ansari et al., 2024; Tarim & Oz, 2022). A pooled prevalence estimate of 42% of depression was obtained among 400 young patients in Karachi, with 44.2% scoring abnormal on a questionnaire for anxiety (Asim et al., 2023) and a meta-analysis of Iranian patients indicated a pooled prevalence of 42% of depression (Jaafari et al., 2022).

It costs a lot of money. The monthly treatment cost in Abbottabad at a public general hospital was estimated to be PKR 80,000 for non-entitled patients; and the families reported selling their livelihood assets or skimping on the education of their other children to meet the cost of their monthly treatments (Qamar & Shaikh, 2022). Although transfusion is subsidized, the patients

might have to pay for the pharmacy and laboratory costs, about two thirds of families in the sample from Karachi relied on charity funds (Asim et al., 2023).

Notwithstanding, Pakistan's evidence is still inconclusive. Primary studies typically present domains individually, for example, psychological outcomes in Karachi (Asim et al., 2023) or household expenditure in Abbottabad (Qamar & Shaikh, 2022), and combine domains primarily in reviews (Ansari et al., 2024). To the best of the authors' knowledge, few studies have evaluated infection, psychological distress and financial burden in the same patients and data from South Punjab is limited.

## 2. Literature Review

### 2.1 Infection risk

Infection continues to be a significant cause of morbidity in transfusion dependent thalassemia (TDT). Transfusion-transmissible infections (TTIs) are a major concern in Pakistan as repeated transfusion can transmit these infections, most importantly hepatitis C, hepatitis B and HIV, which impact health outcomes and quality of life. This is compounded by sub-optimal transfusion services and poor complication management (Ansari et al., 2024). There is also a risk of bacterial infection. In a recent Saudi retrospective study of 303 patients with thalassemia syndromes, 23.8% of patients had positive culture. Higher ferritin levels were related to infection, while chelation therapy was related to decreased odds (OR 0.18). This rate of mortality was significantly higher for infected patients (22% compared to 3%) (Mansory et al., 2025). In their model, Mansory et al., 2025, splenectomy, while not statistically significant, enhances bacterial growth because of iron overload and is a significant barrier to encapsulated bacteria. The evidence collected in Pakistan further supports the fact that many patients are not provided with proper chelation therapy (Ansari et al., 2024). The literature reinforces the need for strict transfusion screening, chelation adherence, and infection-prevention education.

## 2.2 Psychological issues

Psychological distress is one of the key components of the thalassemia burden. Common social and psychological ailments reported are anxiety, depressive symptoms and hostility which impact quality of life significantly, particularly in the social and psychological domains (Ansari et al., 2024; Tarim & Oz, 2022). In a sample of 400 children in Karachi, 44.2% of children were found with abnormal anxiety scores and 11% of children had severe depression. Higher rate of anxiety to be found in males, children who were not attending school, and children who were not satisfied with treatment (Asim et al., 2023). The prevalence of depression in Iranian patients was estimated in a meta-analysis to be 42% (Jaafari et al., 2022). Stigma and misinformation about the disease add to the burden (Ansari et al., 2024). As stated in both reviews and cohort studies, the psychological assessment should be done early and continuous counseling should be conducted (Asim et al., 2023; Ansari et al., 2024). However, in practice, most centers are transfusion-centric and the care (and management of complications) is one of the poorest (Ansari et al., 2024).

## 2.3 Financial burden

Families are paying a heavy price for treatment. For non-entitled families, the monthly treatment cost was PKR 80,000 in Abbottabad whereas the monthly treatment cost of an entitled family was PKR 5,000–10,000 in a public general hospital of Abbottabad. A total of 37 percent of families (with an average monthly income of PKR 25,000) sold some livelihood assets, 31 percent cut back on the education of their children and 23 percent decreased their health expenditure on other children (Qamar & Shaikh, 2022). In Quetta, 61% of the parents of malnourished thalassemia major patients reported monthly income of PKR 10,000 – 15,000, and all the parents who were asked about the need for a national low-cost treatment program responded in the affirmative (Umair et al., 2024). In Karachi, while some of the centers paid for transfusion, there were cases where patients had to pay for the pharmacists and the radiology and lab services. 64.5% utilized charity funds and 34.8% paid out of pocket (Asim

et al., 2023). A scoping review found that the lack of a national policy exacerbates these difficulties, and that the annual cost of treating a child may be higher than the average annual income (Ansari et al., 2024). Evidence on the three domains is thus available, but primarily as separate studies, thus supporting an integrated assessment in the same patients.

## 3. Methodology

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### 3.1 Study Design

The descriptive cross-sectional design was used, which was a single-time snapshot of the clinical, psychological and financial issues of a group of patients with transfusion dependent thalassemia (TDT). Various studies addressing a similar issue have been conducted in thalassemic centers of Pakistan, using cross-sectional designs (Asim et al., 2023; Qamar & Shaikh, 2022). The study was conducted in the Thalassemia Care Unit, Allama Iqbal Teaching Hospital at Dera Ghazi Khan in South Punjab, Pakistan, which is a tertiary care hospital. The unit is responsible for routine blood transfusion, iron chelation therapy and follow-up. The setting provided direct observation and interaction with patients and their caregivers in clinical postings.

#### 3.2.1 Study Duration and Sampling

Data were collected over four months [specify months and year] along with the routine clinical work. Purposive (non-probability) sampling was used for selecting participants. Patients with TDT were available at clinical posts, formed a specific, well-defined group and provided first-hand information about the study variables. 120 patients were included (how many were approached and how many refused was stated) There was no formal calculation for the sample size, and [explain how 120 was obtained]. The sample is sufficient to describe trends but it is not large enough for accurate estimation of the population size. The generalizability is also

restricted by single center, non-probability sampling as is also seen in similar convenience-sample based studies conducted in Karachi (Asim et al., 2023).

**Inclusion:** if the patient is diagnosed with  $\beta$ -thalassemia minor or has not been diagnosed with  $\beta$ -thalassemia major; not in regular transfusion for at least one year; not aged 5-30 years; or has not given informed consent (from caregiver in case of minors).

**Exclusion:** patients with thalassemia trait or intermedia; patients with other chronic comorbid illness; and patients in an unstable clinical condition.

### 3.4 Data collection instruments

The following methods were used: three instruments.

#### 1. Structured checklist.

It documented the history of infection, frequency of transfusion, splenectomy and complications. Indicate whether there was an infection history from hospital records, from patient report, or from both, as well as how an infection was defined.

#### 2. Observation sheet.

It documented the physical appearance, compliance with treatment, patients' behavior, and interactions with the family during clinical management. Describe how observations were taken or scores were given.

#### 3. Structured questionnaire.

It was composed of four parts:

- o **Demographic:** coded patient ID, age, gender, time since diagnosis, transfusions/month and splenectomy status.

- o **Clinical:** infections in last 12 months, type of infection, infection-related hospitalizations, chelation therapy (type, length and compliance), pre-transfusion hemoglobin and history of transfusion-transmitted infections (HBV, HCV).

- o **Psychological:** Concern or fear about transfusion, sadness, social isolation, and ability to focus and family support (1-5 scale). Name the scale used to determine the severity of anxiety and identify the reliability (such as Cronbach's  $\alpha$ ) and validation and/or pilot testing of the scale. If it was

a standard scale like the Hospital Anxiety and Depression Scale, mention the previous application of this scale in Pakistani TDT patients (Asim et al., 2023).

- o **Financial** – monthly medical costs (PKR), cost of chelation, cost of travel (per visit), loss of income or interruption to work and NGO/ Government support). Identify what constitutes a “significant financial burden.”

### 3.5 Data collection procedure

Patients were approached during their planned visit to the transfusion center. All adult patients and all caregivers of minors consented. Observations were done while working as part of the practice, and interviews were conducted in a private setting to maintain confidentiality. The data were recorded at once to minimize recall bias. Indicate the language in which the data was administered and who collected data; whether the children were interviewed or whether caregivers conducted the interviews.

### 3.6 Data analysis

SPSS 26 software was used for data analysis. Frequencies and percentages described categorical variables (gender, infection, psychological distress and level of financial burden). Continuous variables (age, transfusions/month and cost/month per treatment) were described using means and standard deviations. Inferential tests were conducted like what was done in other studies dealing with thalassemia (Asim et al., 2023; Mansory et al., 2025):

For categorical variables, the chi-square test was used to analyze association between the variables: infection status and splenectomy, psychological distress and gender, and financial burden and socioeconomic status.

The independent-samples t test was used to compare the means between two groups, e.g., psychological distress by age group (group A, group B).

ANOVA compared the means between more than two groups, e.g. financial burden between income groups

A p-value of 0.05 or lower was taken as statistically significant.

### 3.7 Ethical considerations

The study was conducted in accordance with the requirements of the Declaration of Helsinki regarding free consent, informed consent, and confidentiality of the participants (World Medical Association, 2025). The purpose of the study, voluntary participation, the ability to stop at any time, and that there was no financial or personal risk were all explained to the participants and caregivers. Patients and caregivers of minors were verbally informed and consented. Patients' data were protected; financial rewards were not

provided, and reactions to sensitive information were treated with sensitivity and respect.

## 4. Results

### 4.1 Clinical findings

Sixty-two percent of patients (74 of 120) had at least one infection in the preceding 12 months, and 46 patients (38%) had none (Table 2). Infection rates were significantly higher among splenectomized patients than among non-splenectomized patients ( $p < 0.01$ ). Hepatitis B or C was present in 18.3% of participants (about 22 of 120).

**Table 1. Infection occurrence in the past 12 months (n = 120).**

| Infection in the past 12 months | n (%)      |
|---------------------------------|------------|
| At least one infection          | 74 (62%)   |
| No Infection                    | 46 (38%)   |
| No                              | 120 (100%) |

### 4.2 Psychological findings

68% of patients (n = 82) had moderate to severe anxiety, which was defined as [scale name and cut-offs]. Report on the percentage of those who experience mild or no anxiety, and the mean anxiety score  $\pm$  SD. The categories described above are those of the Hospital Anxiety and Depression Scale, if your patient has been using it. The categories above are those of the Hospital Anxiety and Depression Scale, if your patient has been using it. The mean rating for family emotional support was  $[\_] \pm [\_]$  for the 1 - 5 scale.

An independent-samples t-test was used to compare psychological distress for the two age groups, [group A: mean  $\pm$  SD] vs [group B: mean  $\pm$  SD]

### 4.3 Financial findings

72% of families (n = 86) said that the financial burden was significant [split to moderate and severe; and definition used]. The average cost of treatment per month was Rs. The average value of the chelation cost was Rs. There was a mean travel cost of Rs. per visit.  $[\_]$ . [n (%)] said they had lost income or interrupted their job and [n (%)] received NGO or government support.

If significant, one-way ANOVA was used to compare financial burden among the income groups ( $F([\_], [\_]) = [\_]$ ,  $p = [\_]$ ) [indicate post hoc test if applicable]. [Add the chi-square result for financial burden by socioeconomic status:  $\chi^2 = \_, p = \_.$ ]

## 4.4 Summary of findings

**Table 2. Summary of principal findings (n = 120).**

| No | Variable                   | Finding                                                                        |
|----|----------------------------|--------------------------------------------------------------------------------|
| 1  | Infection (past 12 months) | 62% had at least one infection                                                 |
| 2  | Splenectomy and infection  | Significantly higher infection rates in splenectomized patients ( $p < 0.01$ ) |
| 3  | Anxiety                    | 68% had moderate to severe anxiety                                             |
| 4  | Financial burden           | 72% of families reported significant burden                                    |

## Discussion

Infection, anxiety and financial strain were all prevalent in this sample of 120 transfusion-dependent thalassaemic (TDT) patients from Dera Ghazi Khan. Sixty-two percent had an infection in the previous year, 68% had moderate to severe anxiety, and 72% of families reported a significant financial burden. Patients with splenectomy were significantly more likely to be infected ( $p < 0.01$ ) and 18.3% were found to have infection with hepatitis B virus or hepatitis C virus. The results are in line with the findings of TDT burdening patients with clinical decompensation, psychological distress, and economic hardship (Ansari et al., 2024) in Pakistan. The problems are presented cross-sectionally, so that the results indicate that these problems co-occur rather than one leads to the other.

The proportion infected (62%) should not be compared directly with other studies as there are different definitions. The measure that we used was infection in the past year, on a checklist (from hospital records / self-reported). In a study by Mansory et al., 2025, they investigated 303 cohort of thalassemic syndromes in Saudi patients and cultured them, obtaining a positive result in 23.8%. The strong correlation between splenectomy and infection is consistent with the spleen function as a barrier to infection by encapsulated bacteria (Mansory et al., 2025). The estimated splenectomy rate (OR 2.28) for that cohort was in the same direction but not significantly associated, thus indicating that this association does not exist in all samples. The difference may be due to differences in sample, definition or recall.

Our 18.3% hepatitis B and 0.9% hepatitis C positivity rates for patients who have been tested is above the 7.0% hepatitis C and 0.9% hepatitis B in the Saudi cohort (Mansory et al., 2025). That group was unique for the country, as well as the kind of thalassemia types that were represented. Our figure is like that of reviews which have noted transfusion-transmitted infection as a significant issue in Pakistan where the transfusion service is still suboptimal (Ansari et al., 2024). Ferritin was not measured, so iron overload is not a pathway that can be tested. In the Saudi cohort, an increase in ferritin levels was linked to infection, and a

decrease in ferritin level was associated with chelation therapy (OR 0.18) (Mansory et al., 2025). These indicate the need for safe blood screening, compliance with chelation therapy, activities on vaccination and awareness of infection prevention through education, and frequent assessment of blood banks (Ansari et al., 2024).

### 5.1 Psychological issues

68% of our patients have moderate to severe anxiety, which is higher than the 400 young patients in Karachi having abnormal anxiety (44.2%) (Asim et al., 2023). Studies have employed a variety of instruments and cut-off points and a range of age groups (8–18 years vs. 5–30 years), and therefore the difference should be interpreted with caution. Both demonstrate that anxiety is prevalent. This is consistent with reports about psychosocial morbidity in thalassemia (Ansari et al., 2024; Tarim & Oz, 2022) and the pooled depression prevalence in Iranian patients (42%) (Jaafari et al., 2022).

Possible factors suggested by the Karachi authors, who found high anxiety, include lifelong dependence on transfusion, physical and facial changes (due to chronic hemolysis) and social limitations (Asim et al., 2023). Additional distress is caused by stigma and misinformation about the disease (Ansari et al., 2024). For the Karachi cohort, anxiety was higher in boys, children who did not attend school and those who were not happy with treatment, and family support was high (Asim et al., 2023). [Compare with your own gender, age and family-support results.]

Early psychological assessment and continued counseling is recommended in reviews and cohort studies (Ansari et al., 2024; Asim et al., 2023). The study hospital is not assessed for the availability of counselling; therefore cannot conclude it is absent [add if known].

### 5.2 Financial burden

The finding of high out-of-pocket costs among the families (72%) is consistent with the Pakistani evidence. At Abbottabad, non-entitled families paid approximately PKR 80,000 per month; and 37% of the participants had resorted to selling

livelihood assets and 31% had sacrificed their children's education (Qamar & Shaikh, 2022). In Quetta, 61% of the patients' parents earned between PKR 10,000 and 15,000 a month, which is the poverty line (Umair et al., 2024).

Partial support is not considered to remove the strain. Transfusion was provided for free at centers in Karachi but the patients had to pay for the pharmacy, laboratory and radiological services and approximately two thirds of the patients received funds from the charity funds (Asim et al., 2023). Include the proportion of your patients getting NGO or government support, as to demonstrate that burden is also reported by supported families. Cost can also play a role in treatment. For the Karachi cohort, a minority did not receive iron chelators for clinical or financial reasons (Asim et al., 2023) and there was an association between chelation and reduced infection risk (Mansory et al., 2025). There is no data available to test this chain. A scoping review found that these problems are exacerbated by the lack of a national policy and confirmed that treatment cost exceeds average annual income (Ansari et al., 2024).

### 5.3 Integrated interpretation

Put all the results together, the result is a reinforcing cycle (Figure 1). Infections may result in additional hospital visits and added expenses. Financial difficulties may restrict follow-up and travel to care, as well as chelation. The risk of additional complications and infection is increased when there are gaps in care. With each episode, together with lifelong treatment and apparent disease changes, distress can increase and this can result in a reduction in engagement with care.

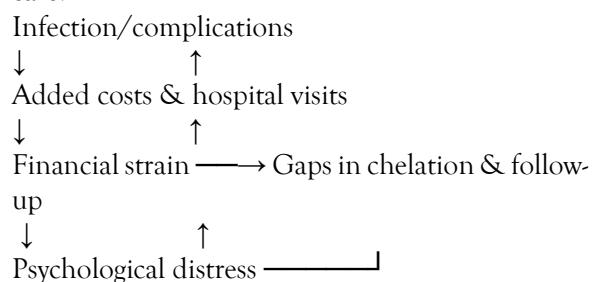


Figure 1. Proposed cycle linking infection, financial strain, treatment gaps and distress (hypothesis, not tested in this study).

Some sections of this cycle are supported by independent research, cost and chelation gap (Asim et al., 2023) and chelation and infection (Mansory et al., 2025). We have not measured the relationship between them, and there is a lack of causality since the design was cross-sectional, so they form a hypothesis for longitudinal studies. If it is true, a single intervention will not suffice and care should include support for infection prevention, psychological support, and financial support.

### 5.4 Compare other studies

Our results confirm those of other studies but the figures vary because the definitions, instruments and samples used vary. Sixty-two percent of patients had an infection compared to 23.8% of patients in the Saudi cohort with culture-positive infection (Mansory et al., 2025). Hepatitis B (18.3%) or C (0.9%) surpassed those groups' 7.0% and 0.9%, respectively. Moderate to severe anxiety (68%) was higher than the 44.2% abnormal anxiety in Karachi (Asim et al., 2023), which used a different scale and studied younger patients. The percentage of financial burden is 72%, which is in line with Abbottabad, where 37% of the families sold livelihood assets (Qamar & Shaikh, 2022). The results of a scoping review were consistent throughout Pakistan (Ansari et al., 2024).

### Limitations

Firstly, the data were collected from a single tertiary care hospital in Dera Ghazi Khan. The outcomes may not apply to other facilities, settings, or regions.

Second, a cross-sectional design only allows one time point to be observed. It does not show that infection and anxiety occur jointly, though it does not prove cause and effect; neither is it able to show how patients' conditions change over time. The hypothesis of the cycle proposed in the Discussion is therefore left unchanged.

Thirdly, a lot of the data has been self-reported via questionnaires. Participants may have recalled or failed to recall the number of infections, or psychological symptoms or financial impact, due to personal, social or recall issues, resulting in response bias. Initial data collection after each

interview was planned to help minimize recall bias but it does not eliminate it.

Fourth, the sample consisted of 120 patients who were selected by purposive, non-probability sampling, and no sample size calculation was done. This reduces the power of the study, the strength of associations found and generalizability of the results. Selection bias is also a possibility.

Fifth, only patients with transfusion-dependent  $\beta$ -thalassemia major (TDTMA) were studied. For other thalassemia types and hematological disorders, comparisons between groups were not possible due to the lack of other theses and the small sample size.

Lastly, although cultural influences and family support systems and long-term treatment adherence could influence patients' clinical, psychological and financial experiences, these were not subjected to detailed investigation. These gaps can be filled by larger, probability-based samples from multiple, longitudinal studies.

### Implications and Conclusion

The results indicate that beyond transfusion, attention needs to be paid to the patient with transfusion-dependent thalassemia (TDT) by the nurse. Given the high infection burden observed here and in other cohorts (Mansory et al., 2025), it becomes evident that strict infection-prevention measures are warranted, especially for splenectomized patients. Nurses can educate patients and their families on early signs and symptoms of infection, increase compliance with chelation therapy and vaccination programs, and monitor for complications associated with iron overload (Mansory et al., 2025). As the presence of anxiety is common, screening for anxiety at a transfusion visit and referral to mental health services are recommended (Ansari et al., 2024; Asim et al., 2023). Nurses have capability to promote their families by connecting them with NGO, charity and government help (Qamar & Shaikh, 2022).

Nursing administrators should implement uniform TDT care protocols and enhance infection control. This is consistent with the recommendations for a standard care protocol, safe transfusion practice and reliable access to

chelation therapy (Ansari et al., 2024). Blood safety and systematic screening for transfusion-transmitted infections should be ensured in hospitals, and blood banks should be evaluated regularly (Ansari, et al., 2024). Counselling should be integrated into the routine care of thalassemia right from the initial psychological evaluation (Asim et al., 2023). The out of pocket expenses are also significant; thus, management should design programmes that are linked to subsidies and charity, and a Health Safety Net supported by the government was proposed (Qamar & Shaikh, 2022). Regular training in chronic hematological care, infection prevention and psychosocial support should be provided for nursing staff. A common policy should be formulated at the national level (Ansari et al., 2024).

### Recommendations for future research

There is a need for longitudinal studies that observe patients over time to determine if infection can be reinforced by financial strain, treatment gaps and distress. Longitudinal designs are also needed to separate the effect of chelation from that of follow-up intensity (Mansory et al., 2025). Counselling programs, infection-prevention strategies and financial assistance models should be assessed in interventional studies. Generalizability would be enhanced by larger, probability-based samples in multi-center studies. In addition to genetic counseling, there is a need for studies of caregiver burden and quality of life, as well as carrier screening and prevention programs (Ansari et al., 2024).

### Conclusion

Patients with TDT in Dera Ghazi Khan had multiple clinical, psychological and financial problems. 62% had been infected during the previous year, more than 68% were moderately to severely anxious, and more than 72% of the families experienced a high level of financial burden. Thalassemia is thus not only a clinical disease. Care should include infection prevention and psychological and economic support, delivered through patient-centered nursing and supported by hospital management and policy. The results are associative and not causal; as the

study was cross-sectional, single center, and used purposive sampling, the conclusions must be verified in larger longitudinal studies.

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