



EPIDEMIOLOGICAL PROFILE, TREATMENT COMPLIANCE, AND ATTRITION FACTORS IN PAEDIATRIC CLUBFOOT MANAGEMENT IN NORTHERN TERTIARY HEALTH CARE CENTRE, INDIA

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ABSTRACT **Background:** Congenital Talipes Equinovarus (CTEV), or clubfoot, requires timely orthopaedic intervention and extended compliance to prevent permanent disability. This study evaluates patient demographics, clinical presentation, and attrition risks within a specialized rural clinic infrastructure. **Methods:** A retrospective analysis of 76 paediatric patients registered w.e.f 1st Jan 2021 to 31st Dec 2025 was performed. Demographic indicators, laterality, parental education, geographical distance, and follow-up outcomes were systematically assessed. **Results:** The cohort demonstrated a stark gender disparity, with 58 males (76.3%) and 18 females (23.7%). Bilateral involvement was present in 23 patients (30.3%), while right-sided and left-sided clubfoot occurred in 22 (28.9%) and 18 (23.7%) patients, respectively. The sample was completely localized to rural areas, with an average travel distance of 21.24 km to the clinic. The attrition rate was high, with 23 patients (30.3%) lost to follow-up (LTFU). The primary driver for clinical attrition was migration without access to an aligned club foot clinic (n=13, 56.5% of LTFU cases). **Conclusion:** While the clinical framework captures infants early (mean age ~2.89 months), geographic instability and socio-demographic migration represent significant systemic barriers to completing clubfoot care pathways.

KEYWORDS :

1. INTRODUCTION

Congenital Talipes Equinovarus (CTEV), or clubfoot, is a prevalent congenital orthopaedic deformity characterized by hindfoot equines, midfoot cavus, forefoot adduction, and hindfoot varus [1]. The global gold standard for conservative management relies on the Ponseti method, a systematic regimen consisting of progressive corrective serial casting, percutaneous Achilles tenotomy, and long-term foot abduction bracing [2]. Clinical progress throughout this treatment course is universally monitored and quantified using the structural parameters of the Pirani scoring index [3].

In developing nations and remote rural topographies, structural vulnerabilities present severe barriers to sustainable care. Factors such as vast geographical distance to specialized public facilities, lack of localized paediatric orthopaedic infrastructure, and familial economic migration severely threaten long-term treatment adherence [4,5]. Premature cessation of the bracing protocol leads to high recurrence rates, structural relapse, and permanent physical disability [5,6]. This paper evaluates the clinical patterns, structural demographics, and underlying etiologies of treatment default within a dedicated Club foot clinic DRKGMC Hamirpur HP data registry.

2. METHODOLOGY

2.1 Study Design and Setting

This study employed a hospital-based, retrospective descriptive design to evaluate the epidemiological attributes, compliance behaviors, and attrition factors within a pediatric clubfoot cohort. The study was conducted at the specialized Clubfoot Clinic operating under the Department of Orthopaedics at Dr. Radhakrishnan Government Medical College (DRKGMC), Hamirpur, and Himachal Pradesh, India. This tertiary care facility serves as a primary referral center for a predominantly rural and mountainous catchment area in northern India.

2.2 Study Population and Temporal Framework

The study population comprised all pediatric patients diagnosed with Congenital Talipes Equinovarus (CTEV), or clubfoot, who were registered and managed at the facility w.e.f 1st Jan 2021 to 31st Dec 2025.

Patients were managed using the standard Ponseti conservative method, which encompasses sequential corrective serial plaster casting, percutaneous Achilles tenotomy where indicated, and long-term maintenance via a foot abduction brace.

A total of 76 consecutive patient records met the inclusion criteria and were extracted from the physical baseline registries and digital clinical databases of the clinic for final analysis.

2.3 Data Collection and Covariates (Data Indicators)

A structured data extraction tool was developed to systematically pull variables from the institutional registry. More over attendants of Paediatrics patients were interviewed to gather the relevant information. The evaluated data indicators were broadly categorized into four primary domains:

- Demographic and Spatial Characteristics:** Chronological age at initial presentation (measured in months), gender presentation, absolute geographic classification, and the physical travel distance (measured in kilometres via road routes) from the patient's rural residence to the tertiary centre.
- Clinical and Anatomical Baselines:** Laterality presentation, categorized into bilateral involvement, unilateral right-sided clubfoot, or unilateral left-sided clubfoot.
- Socio-Behavioural Metrics:** Parental educational attainment levels, stratified independently for maternal and paternal guardians (ranging from illiterate/formal education deficit to graduate/higher degree holder).
- Compliance and Outcomes Profile:** Current treatment status (complete adherence vs. defaulted) and the explicit, documented aetiology behind patients classified as Lost to Follow-Up (LTFU).

3. Ethical Considerations

Ethical Clearance

The study was approved by the Institutional Ethics Committee (IEC) of Dr. Radhakrishnan Government Medical College (DRKGMC), Hamirpur, India. Because this was a retrospective analysis of existing clinical registries, a waiver of formal informed consent was granted. Consent of Patient's attendants were taken before interview.

Data Privacy & Confidentiality

Strict measures were enforced to protect patient privacy. All extracted clinical data were completely anonymised and assigned unique alphanumeric codes prior to analysis.

Scientific Integrity & Disclosures

The research was conducted in compliance with the Declaration of Helsinki and ICMR guidelines. The authors declare no conflicts of interest and received no specific funding for this study.

4. RESULTS

Demographics and Clinical Baseline

The study evaluated a total of 76 cases.

Table-1: The Clinical and Demographic Baseline Characteristics

Parameter	Metric Distribution / Value	Percentage (%)
Total Cohort Size	76 patients	100%

Gender	Male:58 Female: 18	76.3% 23.7%
Geographic Location	All patients belong to Rural area.	100%
Mean Age at Presentation	2.89 Months	—
Mean Distance to Clinic	21.24 Kilometers	—
Laterality Presentation	Bilateral (Both): 23 Unilateral Right: 22 Unilateral Left: 18 Not Recorded: 13	30.3% 28.9% 23.7% 17.1%

Table 2: Educational Stratification of Guardians within the Paediatric Cohort (N=76)

Educational Attainment Level	Maternal Status (n)	Maternal (%)	Paternal Status (n)	Paternal (%)
Graduate / Higher Degree	14	18.4%	20	26.3%
Higher Secondary (Grade 12)	35	46.1%	32	42.1%
Secondary Education (Grade 10)	14	18.4%	14	18.4%
Primary Education	12	15.8%	9	11.8%
Illiterate / Formal Education Deficit	1	1.3%	1	1.3%
Total Cohort Compliance Profile	76	100.0%	76	100.0%

3.3 Attrition and Loss to Follow-Up (LTFU) Analysis

A critical metric identified in the dataset was the default rate. While 53 patients (69.7%) maintained complete adherence to clinical care, 23 patients (30.3%) defaulted and were classified as lost to follow-up (LTFU).

The documented reasons for treatment default highlight clear socioeconomic and institutional vulnerabilities:

Reasons for Loss to Follow-Up (n=23)

Table 3: Institutional and Socioeconomic Etiologies of Treatment Default

Primary Attrition Factor	Case Count (\$n\$)	Relative Percentage (%)	Cumulative Percentage (%)
Socioeconomic Migration (Relocation to an area lacking a registered clinic)	13	56.5%	56.5%
Socio-behavioural Barriers (Guardian explicitly stated "Not Interested")	3	13.0%	69.5%
Concurrent Structural / Medical Issues (Overlapping domestic or healthcare issues)	3	13.0%	82.5%
Institutional Misdiagnosis (Initial structural diagnostic variance)	1	4.3%	86.8%
Institutional Care Transfer (Shifted to an alternative healthcare facility)	1	4.3%	91.1%
Paediatric Mortality (Patient death)	1	4.3%	95.4%
Unspecified (Data missing from physical baseline registry)	1	4.3%	100.0%
Total Stratified Attrition Cohort	23	100.0%	—

4. DISCUSSION

The findings demonstrate a profound male-to-female ratio (3.2:1), which tracks alongside or slightly exceeds known global epidemiological distributions for idiopathic clubfoot [1,6]. Encouragingly, the data demonstrates that infants are presenting early in life (mean age of ~2.89 months), providing an optimal physiological window for flexible ligamentous manipulation and successful cast correction [2].

However, the 30.3% attrition rate presents a severe clinical challenge. CTEV corrections require sustained corrective maintenance via abduction orthoses (bracing) for up to 4 or 5 years following serial casting phases [7,8]. Premature termination almost universally results

in severe clinical relapse [8]. Because 56.5% of the defaulted cases stemmed directly from family relocation/migration away from a Club foot clinic DRKGMC Hamirpur, it highlights a dire need for interconnected clinical network registries. When families migrate for seasonal economic reasons, the absence of a standardized, cloud-sharing referral network cuts off the child's care midway [4,9].

Furthermore, the average travel barrier of 21.24 km over rural terrains introduces substantial out-of-pocket transportation costs, long travel times, and severe logistical hurdles for families, compounding the risk of programmatic disinterest or transfer to local, unaligned practitioners [4,5].

5. Strategic Recommendations

To mitigate the high default rate observed in rural cohorts and bridge the gap between initial casting and long-term brace adherence, the following targeted institutional interventions are recommended:

- **Inter-Clinic Decentralization & Tele-Tracking:** Establish a unified, cloud-based patient tracking registry across neighbouring districts. When a family relocates for employment, an automated digital referral should seamlessly transition the child to the nearest regional Club foot clinic DRKGMC Hamirpur without interrupting strict serial casting or bracing timelines.
- **Geographical and Travel Subsidies:** Given the entirely rural presentation of the cohort and a high average travel distance (21.24 km), financial barriers significantly degrade long-term adherence. Implementing transportation voucher programs, fuel reimbursements, or decentralized mobile casting clinics would dramatically alleviate the financial strain on vulnerable households.
- **Targeted Parental Counselling and Navigation:** Dedicated healthcare navigators should proactively counsel families—especially those demonstrating structural vulnerabilities, lower literacy levels, or emerging "disinterest"—to thoroughly explain the necessity of the multi-year bracing maintenance phase to prevent structural relapse.
- **Quality Assurance and Diagnostic Audits:** To address instances of program exits due to "misdiagnosis" or alternative hospital transfers, routine clinical peer reviews and standardized Ponseti training updates must be mandated for frontline staff to preserve institutional trust.

6. CONCLUSION

While rural clubfoot programs succeed in securing the early presentation of paediatric patients, they remain highly vulnerable to socioeconomic headwinds. Addressing patient attrition requires moving beyond isolated clinical treatments toward an integrated, mobile-aware ecosystem of care that accommodates the realities of rural demographic migration [4,5].

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