

# Distribution and Determinants of Scrub Typhus in a Tertiary Care Hospital, Chennai

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## ABSTRACT

**Background:** Scrub typhus is a re-emerging zoonotic infection in India with significant morbidity and mortality due to delayed diagnosis and complications.

**Methods:** An observational cross-sectional study was conducted over 18 months at Sree Balaji Medical College & Hospital, Chennai. Ninety-three adult patients with confirmed scrub typhus (IgM ELISA and/or eschar) were enrolled. Socio-demographic, clinical, and laboratory data were collected. Associations with complications and outcomes were analyzed using chi-square and t-tests.

**Results:** Most patients were male (71%) and from rural areas (78.5%). The predominant age groups were 20–29 (22.6%) and 40–49 (21.5%) years. Fever (100%), myalgia (76.3%), and headache (63.4%) were common. Eschar was seen in 20.4%. Complications occurred in 52.7%, mainly renal (14.0%), respiratory (11.8%), and neurological (5.4%). Multi-organ dysfunction syndrome (MODS) was present in 5.4% and was significantly associated with mortality ( $p < 0.01$ ). The overall case fatality rate was 6.5%. Risk factors included outdoor exposure (95.7%), rodent presence (93.5%), and vegetation exposure (86.0%).

**Conclusion:** Scrub typhus remains a major health challenge in endemic regions. Early recognition, timely treatment, and clinician awareness are crucial to prevent severe complications. MODS is a key predictor of mortality. Strengthening diagnostic capacity and vector control measures in rural communities is essential.

**Keywords:** Scrub typhus, *Orientia tsutsugamushi*, multi-organ dysfunction, febrile illness, mortality, Tamil Nadu.

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## INTRODUCTION

Scrub typhus is an acute febrile illness caused by *Orientia tsutsugamushi* and transmitted by chigger mites of the *Trombiculidae* family. The disease is endemic to the region known as the tsutsugamushi triangle, which spans South and Southeast Asia and places over one billion individuals at risk of infection<sup>1,2,3</sup>. In India, scrub typhus has become a leading cause of acute undifferentiated febrile illness (AUI), with multiple states reporting an increasing incidence<sup>4,5</sup>.

Scrub typhus presents with a wide range of clinical manifestations, from non-specific febrile illness to severe conditions including acute respiratory distress syndrome (ARDS), renal failure, myocarditis, and meningoencephalitis<sup>6,7,8</sup>. Case fatality rates range from 6%

to 38% among patients with complications, particularly multiple organ dysfunction syndrome (MODS)<sup>9,10</sup>. Early diagnosis is often delayed due to limited access to confirmatory tests, low clinical suspicion, and similarities with other tropical infections<sup>11</sup>.

While multiple Indian studies have investigated the epidemiology and outcomes of scrub typhus, there is a lack of region-specific data for Tamil Nadu<sup>12,13,14,15</sup>. The present study aims to assess the distribution, clinical characteristics, complications, and factors influencing outcomes among scrub typhus patients admitted to a tertiary care hospital in Chennai.

## Methods

### Study Design and Setting

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This observational cross-sectional study was conducted in the Department of General Medicine at Sree Balaji Medical College and Hospital, Chennai, between July 2023 and December 2024.

**Participants**

A total of 93 consecutive adult patients aged 18 years or older with confirmed scrub typhus were included. Diagnosis was based on a positive IgM ELISA result or the presence of an eschar. Patients diagnosed with other causes of febrile illness were excluded from the study.

**Data Collection**

Demographic information, occupational and environmental exposures, clinical characteristics, laboratory results, complications, and patient outcomes were systematically recorded. A standardized data collection form was used.

**Definitions**

Complications were categorized as renal, respiratory, cardiovascular, neurological, or hematological. Multiple organ dysfunction syndrome (MODS) was defined as dysfunction of two or more organ systems.

**Statistical Analysis**

Data were analyzed using SPSS. Descriptive statistics summarized demographic and clinical variables. Chi-square and independent t-tests examined associations, with significance set at  $p < 0.05$ .

**Results**

**Demographic and Socioeconomic Characteristics**

The mean age of participants was  $47.2 \pm 17.9$  years (range: 20–78). The largest proportions were observed in the 20–29 years (22.6%) and 40–49 years (21.5%) groups, followed by the 60–69 years (17.2%) and 70 years or older (14.0%) groups. The 50–59 years group was the least represented (11.8%).

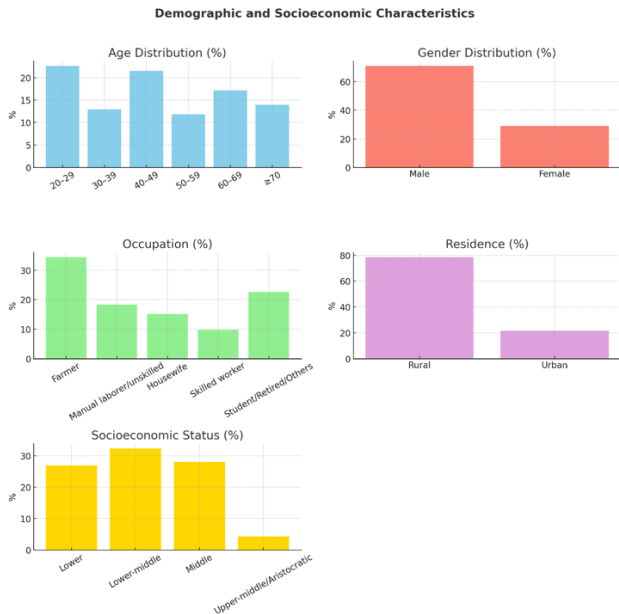
The patient cohort was predominantly male (71.0%). The largest occupational groups were farmers (34.4%) and manual labourers or unskilled workers (18.3%). Housewives accounted for 15.1%, skilled workers for 9.7%, and other categories, including students, retirees, and miscellaneous occupations, for 22.6%.

Most patients (78.5%) were from rural areas, with only 21.5% residing in urban settings. Regarding socioeconomic status, 32.3% belonged to the lower-middle class and 28.0% to the middle class, while 26.9% were from the lower class. Only 4.2% belonged to the upper-middle or aristocratic class (Table 1, Figure 1).

Table 1. Demographic and Socioeconomic Characteristics of Patients (n=93)

	40–49	20	21.5
	50–59	11	11.8
	60–69	16	17.2
	≥70	13	14
<b>Gender</b>	Male	66	71
	Female	27	29
<b>Occupation</b>	Farmer	32	34.4
	Manual laborer/unskilled	17	18.3
	Housewife	14	15.1
	Skilled worker	9	9.7
	Student/Retired/Others	21	22.6
<b>Residence</b>	Rural	73	78.5
	Urban	20	21.5
<b>Socioeconomic status</b>	Lower	25	26.9
	Lower-middle	30	32.3
	Middle	26	28
	Upper-middle/Aristocratic	4	4.2

Variable	Category	n	%
Age (years)	20–29	21	22.6
	30–39	12	12.9



**Figure 1: Demographic and Socioeconomic characteristics of the participants**

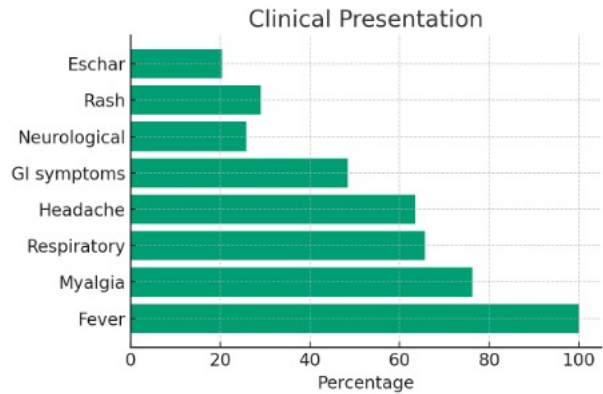
**Clinical Presentation**

Fever was present in all patients (100%). Other common symptoms included myalgia (76.3%), respiratory complaints (65.6%), headache (63.4%), and gastrointestinal symptoms (48.4%). Neurological symptoms occurred in 25.8%, rash in 29.0%, and eschar was identified in 20.4%. Regarding comorbidities, 57.0% had none. Diabetes mellitus (15.1%), hypertension (11.8%), and both conditions combined (16.1%) were the most frequent comorbid illnesses (Table 2, Figure 2).

Table 2. Clinical Presentation and Comorbidities

Symptom/History	n (%)	Comorbidities	n (%)
Fever	93 (100.0)	None	53 (57.0)
Myalgia	71 (76.3)	Diabetes mellitus	14 (15.1)
Respiratory symptoms	61 (65.6)	Hypertension	11 (11.8)
Headache	59 (63.4)	DM + HTN	15 (16.1)
GI symptoms	45 (48.4)	—	—

Neurological symptoms	24 (25.8)	—	—
Rash	27 (29.0)	—	—
Eschar	19 (20.4)	—	—



**Figure 2: Clinical Presentation of the participants Complications, Organ Dysfunction, and Supportive Therapy**

Almost half of patients (47.3%) developed no complications. Among those affected, the most common were renal (14.0%), respiratory (11.8%), lymphadenopathy (8.6%), cardiovascular (5.4%), and neurological (5.4%).

Multi-organ dysfunction syndrome (MODS) occurred in 5.4% of patients: 4.3% had two organs involved and 1.1% had three.

Supportive therapy was required in a significant proportion: 57.0% required ventilator support, and 17.2% underwent dialysis (Table 3, Figure 3).

Table 3. Complications, Organ Dysfunction, and Supportive Therapy

Complication	n (%)	Organ Dysfunction	n (%)	Supportive Therapy	n (%)
None	44 (47.3)	None	88 (94.6)	Dialysis	16 (17.2)
Renal	13 (14.0)	Two organs	4 (4.3)	Ventilator support	53 (57.0)
Respiratory	11 (11.8)	Three organs	1 (1.1)	—	—

Lymphadenopathy	8 (8.6)	MODS total	5 (5.4)	—	—
Cardiovascular	5 (5.4)	—	—	—	—
Neurological	5 (5.4)	—	—	—	—
Mixed (Renal+Neuro / Renal+Resp / Triple involvement)	5 (5.5)	—	—	—	—

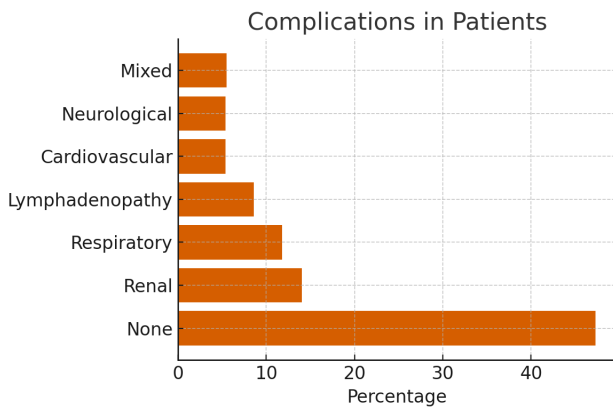


Figure 3: Complications of the patients

**Environmental and Occupational Risk Factors**

Outdoor exposure (95.7%), rodent presence (93.5%), and exposure to vegetation or crops (86.0%) were the most common risk factors. Animal contact was reported by 80.6%, and 23.7% had a recent travel history (Table 4, Figure 4).

Table 4. Environmental and Occupational Risk Factors

Risk Factor	n (%)
Outdoor exposure	89 (95.7)
Rodent presence	87 (93.5)
Vegetation/crop exposure	80 (86.0)
Animal contact	75 (80.6)

Travel history	22 (23.7)
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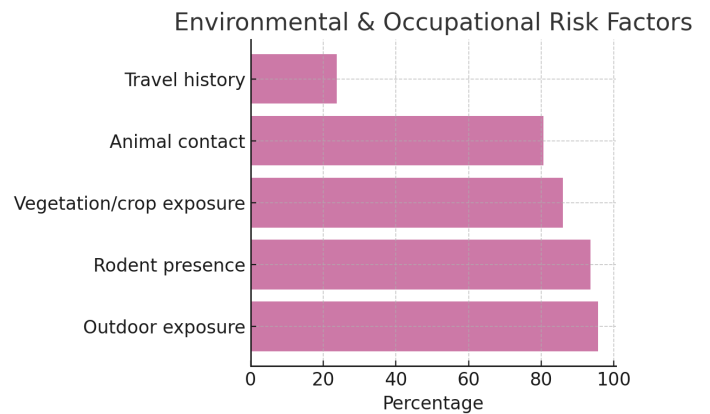


Figure 4: Environmental and Occupational risk factors of the participants

**Outcomes and Predictors of Mortality**

Overall, 93.5% of patients recovered while 6.5% died. The highest mortality occurred among those aged 60–69 years (18.8%). Mortality was similar across gender (male 6.1% vs female 7.4%) and residence (urban 5.0% vs rural 6.8%), with no significant differences.

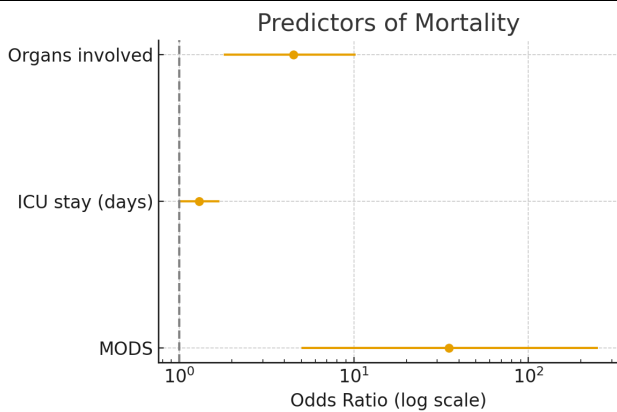
MODS was the strongest predictor of death: 80% mortality among those with MODS compared with 2.3% without ( $p < 0.01$ ). Risk factors such as outdoor exposure, vegetation contact, rodent presence, animal contact, and travel history were not significantly associated with survival outcome<sup>13</sup>.

Non-survivors had a significantly higher mean number of organs involved ( $1.5$  vs  $0.02$ ,  $p < 0.01$ ) and longer ICU stay ( $4.17 \pm 2.64$  vs  $1.69 \pm 2.91$  days,  $p = 0.045$ ), but age, hospital stay duration, and time to symptom onset were not associated with mortality (Table 5, Figure 5).

Table 5. Outcomes and Predictors of Mortality

Variable	Category	Mortality (%)	p-value
<b>Overall outcome</b>	Recovered (n=87)	—	—
	Died (n=6)	6.5	—
<b>Age group</b>	60–69 yrs (n=16)	18.8	0.19
<b>Gender</b>	Male (n=66)	6.1	0.81
	Female (n=27)	7.4	
<b>Residence</b>	Rural (n=73)	6.8	0.766

	Urban (n=20)	5	
<b>MODS</b>	Yes (n=5)	80	<0.01*
	No (n=88)	2.3	
<b>Risk factors</b>	Outdoor exposure	6.7	NS
	Vegetation exposure	7.5	NS
	Rodent presence	6.9	NS
	Animal contact	6.7	0.863
	Travel history	4.5	0.677
<b>Clinical predictors</b>	ICU stay (days)	↑ mortality (p=0.045*)	
	Number of organs involved	↑ mortality (p<0.01*)	



**Figure 5: Mortality prediction**

**Discussion**

The present study highlights scrub typhus as an important cause of febrile illness in Tamil Nadu, corroborating observations from other parts of India and Southeast Asia<sup>12,6</sup>.

Male predominance (71%) and a predominantly rural background (78.5%) reflect occupational and ecological exposures. Similar demographic patterns have been reported in earlier studies<sup>14</sup>, who also noted a higher prevalence among farmers and outdoor workers. The clustering of cases among young and middle-aged adults (20–49 years) corresponds with the age groups most engaged in agricultural and manual labor.

Clinically, fever was present in all patients, confirming it as a universal feature of scrub typhus. Other common symptoms such as myalgia, headache, and respiratory complaints are in agreement with findings<sup>7,8</sup>. Eschar, considered pathognomonic, was observed in 20.4% of our patients, which is comparable to reported ranges of 9–40% in Indian series<sup>10,15</sup>. Its relatively low frequency underscores the necessity of clinical suspicion even when eschar is absent.

Complications were recorded in more than half of the patients, emphasizing the systemic nature of the disease. Renal (14.0%) and respiratory (11.8%) complications were most frequent, consistent with the observations. Neurological and cardiovascular involvement were less common, but their occurrence highlights the diverse spectrum of organ dysfunction.

MODS was detected in 5.4% of cases, but its prognostic importance was considerable. Four out of five MODS patients died, yielding an 80% mortality rate. These findings support earlier reports<sup>9,11</sup>, both of whom emphasized MODS as a major determinant of mortality in scrub typhus.

Risk factor analysis demonstrated a strong association with outdoor exposure, rodents, and vegetation, reinforcing the ecological determinants of transmission. Comorbidities, particularly diabetes and hypertension, were frequent and may have contributed to poorer outcomes, consistent with the findings.

The overall case fatality rate was 6.5%, which is comparable to reports from treated cohorts across India<sup>11,12</sup>. Importantly, mortality was significantly higher in patients with MODS, elderly individuals, and those requiring ventilatory or renal support. These predictors highlight the necessity of early recognition and aggressive management in severe cases.

From a public health perspective, scrub typhus remains a treatable illness, but diagnostic delays are a major contributor to complications and mortality. The timely use of doxycycline or azithromycin<sup>7</sup> remains the cornerstone of therapy. Expanding access to point-of-care diagnostics, improving clinician awareness, and implementing vector control measures in endemic rural communities are vital to reducing disease burden.

The strengths of this study lie in its provision of region-specific clinical and outcome data from Tamil Nadu. Limitations include its single-center design, relatively modest sample size, and the absence of PCR-based molecular confirmation for all cases.

**Limitations**

This study is subject to several limitations. As it was conducted in a single tertiary care hospital, the results may have limited generalizability to broader populations. The

sample size of 93 patients reduces the ability to identify rare complications. Diagnostic confirmation was primarily based on IgM ELISA and clinical criteria, as PCR-based molecular testing was not consistently available. Additionally, the absence of long-term follow-up precluded the assessment of delayed sequelae.

### Conclusion

Scrub typhus remains a significant cause of febrile illness in Tamil Nadu. More than half of affected patients develop complications, most commonly renal and respiratory involvement. Multi-organ dysfunction syndrome (MODS) is the strongest predictor of mortality. Although the case fatality rate aligns with findings from other Indian studies, it is markedly higher among patients with MODS and those who require intensive supportive therapy.

These findings underscore the importance of early diagnosis, prompt treatment, and heightened clinical vigilance in endemic regions. Expanding diagnostic capacity, increasing healthcare provider awareness, and implementing targeted preventive strategies for high-risk rural populations are essential to reducing scrub typhus morbidity and mortality.

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