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Assessing the key factors contributing to non-adherence to pulmonary tuberculosis treatment: a descriptive study

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Abstract

Tuberculosis (TB) remains a significant public health challenge, particularly in developing nations like India, where it imposes a considerable burden. This descriptive cross-sectional study aimed to assess the factors affecting noncompliance with TB medications among pulmonary TB patients in an Indian community. A total of 215 participants were selected through non-probability purposive sampling. Data on factors contributing to non-adherence were collected using a structured self-administered questionnaire. Demographic characteristics, including age, gender, education, marital status, occupation, habitat, income, diagnosis, and duration since diagnosis, were recorded and analyzed. Key factors contributing to non-adherence were categorized into personal, economic, social, psychological, health facility, and technological factors. The results demonstrated that the non-adherence rate was 48.3%, while 51.7% of participants exhibited adherence to TB treatment. Discontinuing medication to feel better significantly increased non-compliance risk, especially for those who stopped “most of the time” vs. those who never stopped (odds ratio = 8.693, 95% confidence interval: 3.179-23.77). This study reveals that non-adherence to pulmonary TB treatment is influenced by a range of factors, including personal, economic, social, psychological, health facility, and technological factors, highlighting the need for multifaceted interventions to improve adherence.

Key words: non-adherence, pulmonary tuberculosis, contributing factors.

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Introduction

Tuberculosis (TB) is a global health problem, particularly in India, where it is a leading cause of morbidity and mortality due to *Mycobacterium tuberculosis*, which is spread through aerosols when exposed to the air. Although half of the world population is infected, most people with good immune systems do not get affected with TB [1,2]. However, densely populated urban and rural areas of India make it more common. Along with these, people with weakened immune systems (HIV, malnutrition, diabetes, or chronic alcohol and tobacco use) are more likely to be affected with TB [3,4]. The World Health Organization has developed a standardized treatment regimen for TB. The protocols include an intensive 2-month phase that uses four medicines, and a continuation phase that uses two medications for 4 months [5]. Patient non-adherence continues to be a significant challenge to the effective treatment of TB, even though it has been eradicated with this regimen [6]. Non-adherent means patients who do not follow their prescriptions are said to be non-adherent [7]. This can happen for a variety of reasons, including forgetfulness, poor outcomes, lack of social support, financial problems, or common problems such as social accessibility problems [8,9]. Drug resistance, increased transmission of infection, and increased mortality might result from failing to comply with TB therapy among the other serious consequences of noncom-

pliance [10]. Multidrug-resistant TB is particularly dangerous as it requires rigorous and extensive treatment. India accounted for 27% of the world TB-related mortality rate in 2022, with 410,000 cases of drug- or rifampicin-resistant TB reported globally [11,12]. The Nikshay Poshan Yojana, which offers TB patients monthly financial incentives to improve treatment adherence, is one of the measures the Indian government has put in place under the National Tuberculosis Elimination Programme to combat non-adherence [13]. Despite these initiatives, problems persist, especially in rural areas with poor access to healthcare. The World Health Organization and national health plans will continue to emphasize the importance of early diagnosis and treatment to eliminate TB by the year 2030 [14]. The main objective of this study is to determine the factors that contribute to non-adherence to TB therapy among TB patients. In addition, the study will investigate the relationship between these contributing factor and demographic data with non-adherence rate.

Materials and Methods

Study design

This study employed a descriptive cross sectional research design to assess the key factors contributing to non-adherence to



pulmonary TB treatment. A questionnaire-based survey was conducted at the primary health centers of Anand & Kheda districts, Gujarat, India. The primary health center is the place where TB patient collects the anti-TB drugs.

Participants

The study focused on adults aged 18 and above who were diagnosed with pulmonary TB and receiving treatment. The inclusion criteria were as follows. Participants were eligible if they met the following conditions: i) individuals who had been confirmed diagnosed with pulmonary TB and initiated TB treatment; ii) age is greater than or equal to 18 years; iii) participant who knows and understand Hindi, Gujarati, or English; iv) participant who voluntarily agree to participate in study. Participants with other active infections, such as multidrug-resistant TB, or severe cognitive impairments affecting their understanding, were excluded.

Sample size

The sample size was calculated using the formula $n = d^2(z_{1-\alpha/2})^2 / p \cdot q$, where n is the desired sample size, $(z_{1-\alpha/2})^2 =$ Critical value 95% = 1.96 power value, p is the estimated proportion of the non-adherent to anti TB drugs (-15.5%) [15], q is the complement of p (i.e., $1 - p$), and d is the desired margin of error or precision (0.05). A total of 215 participants were selected through non-probability purposive sampling.

Data collection

Data collection was performed using a structured questionnaire specifically developed, which encompassed Section I for demographic information (age, gender, marital status, educational level, type of family, occupation, socioeconomic status and residential area), Section II for clinical factors (duration of treatment, history of previous TB treatment, family history), Section III consist of factors contributing to non-adherence of pulmonary TB treatment including personal factors, psychological factor, financial factor and treatment related factors. A non-adherent pulmonary TB drug is defined as patients who missed at least one scheduled dose of their TB medication.

Statistical analysis

Data was input into Microsoft Excel 2020 and analyzed with SPSS version 23 (IBM, Armonk, NY, USA). The findings were presented in percentages, and Chi-square tests and p-values were calculated. Odds ratios (OR) with 95% confidence intervals (CI) were determined to evaluate the likelihood of factors affecting treatment adherence among TB patients.

Results

Sociodemographic characteristics and their association with treatment compliances

The sociodemographic data (Table 1) of the 215 patients with pulmonary TB involved in this study demonstrate that 104 patients (48.3%) adhered to therapy, whereas 111 (51.7%) did not. The age distribution reveals a balance of adherence and non-adherence across groups, with somewhat higher adherence in the 29-39 age range. Gender has a major impact, with males reporting higher non-adherence (72.1%) than females (27.9%). Adherence is simi-

lar among single and married people; hence marital status has little influence. Patients with secondary education had a greater rate of non-adherence (37.8%), as those with primary education had the highest rate of adherence (41.3%). Adherence to treatments does not differ much between family types. Self-employed people had the greatest compliance rate at 50%, followed by those earning Rs. 5000 and 15000 per month at 47.1%. Tobacco use was frequent in both groups (64.4%), although those without addictions had the highest adherence rate (28.8%). Furthermore, rural patients showed a greater non-adherence rate (61.3%) than urban patients (38.7%). Gender and education level were identified as major variables impacting treatment adherence (Table 1). Females were more likely to remain committed to treatment than males (OR=0.390, 95% CI: 0.185-0.820). Patients with a secondary education level had a greater risk of non-adherence (OR=2.555, 95% CI: 1.002-6.515) than those with no formal education. Age, marital status, family type, employment, income, habits, and residential location were all studied, but none were shown to be statistically significant predictors of non-adherence.

Pulmonary variable

Figure 1 depicts the pulmonary factors related to treatment compliance. It reveals that 57.2% (n=123) of patients are in the intense phase, whereas 27% (n=58) have recurrent TB. The majority of patients (84.2%, n=181) are treated in government hospitals, and 80.9% (n=174) live within 5 km of a Directly Observed Treatment Short-Course facility. Furthermore, 17.2% (n=37) have a family history of TB, whereas 83.7% (n=180) have no co-morbidities. Table 2 shows that there are substantial associations between selected pulmonary characteristics and treatment compliance, particularly in patients with recurrent TB or a family history of TB. Among the participants, 97 individuals without recurrent TB adhered to medication, compared to just 7 with recurrent TB, showing a strong connection between recurrent TB and non-adherence ($p < 0.01$). A family history of TB is associated with reduced treatment compliance, with 92 individuals sticking to therapy vs. 12 with a history ($p < 0.05$).

Factors affecting non-adherence

The study of numerous personal, social, psychological, and economic aspects influencing non-adherence to TB treatment revealed significant relationships (Table 3). Personal variables, such as discontinuing medicine to feel better, significantly increased the chances of noncompliance, particularly among those who discontinued “most of the time” compared to those who never discontinued (OR=8.693, 95% CI: 3.179-23.77). Patients who had high numbers of adverse symptoms were more likely to not adhere to the treatment regimen (OR=3.024, 95% CI: 1.114-8.207). Economic obstacles, notably difficulty obtaining revenue “most of the time”, were also highly associated with noncompliance (OR=5.651, 95% CI: 1.585-20.15). Social isolation, whether experienced “sometimes” or “most of the time”, increased the chances of noncompliance by odds ratios of 0.316 and 0.197, respectively. Long wait to get medicine increased non-adherence, particularly when encountered “most of the time” (OR=2.507, 95% CI: 1.105-5.689). Psychological distress increased the chances of noncompliance, whether experienced “sometimes” or “most of the time” (OR=2.878, 95% CI: 1.056-7.850 and OR=2.815, 95% CI: 0.979-8.093). Other variables such as social stigma, transportation challenges, and a lack of family support were also investigated, although they had non-significant relation-



ships with non-adherence.

Discussion

The result of this study provides information regarding the factors influencing noncompliance regarding TB treatment in the Anand and Kheda districts of Gujarat. This research identified the various problems that TB patients faced during their treatment regimens, which have a big impact on noncompliance.

The study revealed that almost half of patients did not follow their prescribed TB regimen, with most individuals aged 29 to 39. This population is consistent with previous research performed in India [16,17]. The non-adherence specifically in this age group may be due to conflicting personal and professional commitments. This non-adherence rate contradicts findings from

previous research that show lower non-adherence rates in similar age groups [18]. These contradictory results may be due to geographical location and healthcare accessibility. It was notable that males were more likely than females to be non-TB adherents (with an OR of 0.390). A comparable study indicated that male patients were less adherent than female patients [19,20]. This gender disparity might be due to differences in social responsibilities and health-seeking behavior among the specific group of population. In our study, we found that more than one-third of non-adherent patients had only finished their primary and secondary school education. A similar study supports our findings, showing that lower education levels are associated with higher rates of non-adherence to TB treatment [19]. These results indicate that higher levels of education might be linked to better

Table 1. Association of various socio demographic variables with treatment compliance in patient with tuberculosis (n=215).

Socio-demographic variable	Treatment compliance		OR (95 % CI)
	Adherence, n (%)	Non-adherence, n (%)	
Age			
18-28 years	27 (26)	28 (25.2)	Reference
29-39 years	32 (30.8)	28 (25.2)	0.573 (0.227-1.445)
40-50 years	24 (23.1)	33 (29.7)	1.035 (0.407-2.636)
51 years and more	21 (20.2)	22 (19.8)	0.598 (0.201-1.777)
Gender			
Male	57 (54.8)	80 (72.1)	Reference
Female	47 (45.2)	31 (27.9)	0.390 (0.185-0.820)
Marital status			
Unmarried	10 (9.6)	11 (9.9)	Reference
Married	86 (82.7)	92 (82.9)	1.622 (0.537-4.90)
Divorced	3 (2.9)	1 (0.9)	0.971 (0.062-15.26)
Widow	5 (4.8)	7 (6.3)	4.430 (0.660-29.72)
Education level			
No formal education	23 (22.1)	16 (14.4)	Reference
Primary	43 (41.3)	44 (39.6)	1.564 (0.659-3.713)
Secondary	25 (24)	42 (37.8)	2.555 (1.002-6.515)
Graduation	10 (9.6)	9 (8.1)	1.512 (0.328-6.973)
Post graduation and above	3 (2.9)	0 (0)	0.000 (0.000)
Type of family			
Joint	79 (76)	85 (76.6)	Reference
Nuclear	25 (24)	26 (23.4)	0.760 (0.371-1.554)
Occupation			
Government service	8 (7.7)	10 (9)	Reference
Private service	20 (19.2)	23 (20.7)	0.773 (0.190-2.831)
Self -employee	52 (50)	53 (47.7)	0.644 (0.168-2.475)
Farmer	24 (23.1)	25 (22.5)	0.488 (0.123-1.942)
Income (per month)			
Less than Rs. 5000	36 (34.6)	42 (37.8)	Reference
Rs. 5000-15000	49 (47.1)	52 (46.8)	0.763 (.388-1.499)
More than Rs. 15000	19 (18.3)	17 (15.3)	0.737 (.249-2.178)
Habits			
Alcohol use	2 (1.9)	3 (2.7)	Reference
Tobacco use	67 (64.4)	82 (73.9)	0.779 (0.105-5.799)
Smoking	5 (4.8)	2 (1.8)	0.207 (0.014-3.004)
No habits	30 (28.8)	24 (21.6)	0.667 (0.083-5.344)
Residential area			
Rural	57 (54.8)	68 (61.3)	Reference
Urban	47 (45.2)	43 (38.7)	0.769 (0.407-1.456)

n, number of patients; OR, odds ratio; CI, confidence interval.



adherence to TB treatment and education level influences perceptions and attitudes toward TB treatment. The findings of our study highlight significant lifestyle factors that contribute to non-adherence to TB treatment. Among the participants, the prevalence of tobacco use was notably high, with 73.9% of non-adherent patients reporting tobacco consumption. These findings supported by Motappa *et al.* [21]. The findings suggest that various behavioral factors and a decreased desire to follow treatment plans, tobacco and other lifestyle choices may have a unfavorable effect on treatment adherence.

In this study, all the factors that might lead to non-adherence in TB treatment are divided into four categories: personal, social, psychological, and economic. The findings show a clear

association between non-adherence to TB treatment and the tendency to stop medication when patients felt better. Those who reported “never” stopping their medication had the highest adherence rates (60.6%), compared to non-adherent patients (27.9%). This indicates that consistent medication intake, even during symptom improvement, is essential for better adherence. In contrast, patients who stopped their medication “sometimes” were significantly more likely to be non-adherent, with an odds ratio of 5.24. This risk increased for those who stopped “most of the time”, making them nearly 9 times more likely to be non-adhere. Supporting these findings, Kaona *et al.*, in 2004, reported that 38.6% of non-adherence TB patients discontinued their anti-tubercular medication as soon as they began to feel

Table 2. Association of pulmonary variables with treatment compliance in patient with tuberculosis (n=215).

Selected pulmonary variables		Treatment compliance		Chi-square value	p
		Adherence	Non-adherence		
Recurrent tuberculosis	No	97	60	41.916	0.000
	Yes	7	51		
Family history of tuberculosis	No	92	86	4.547	0.046
	Yes	12	25		

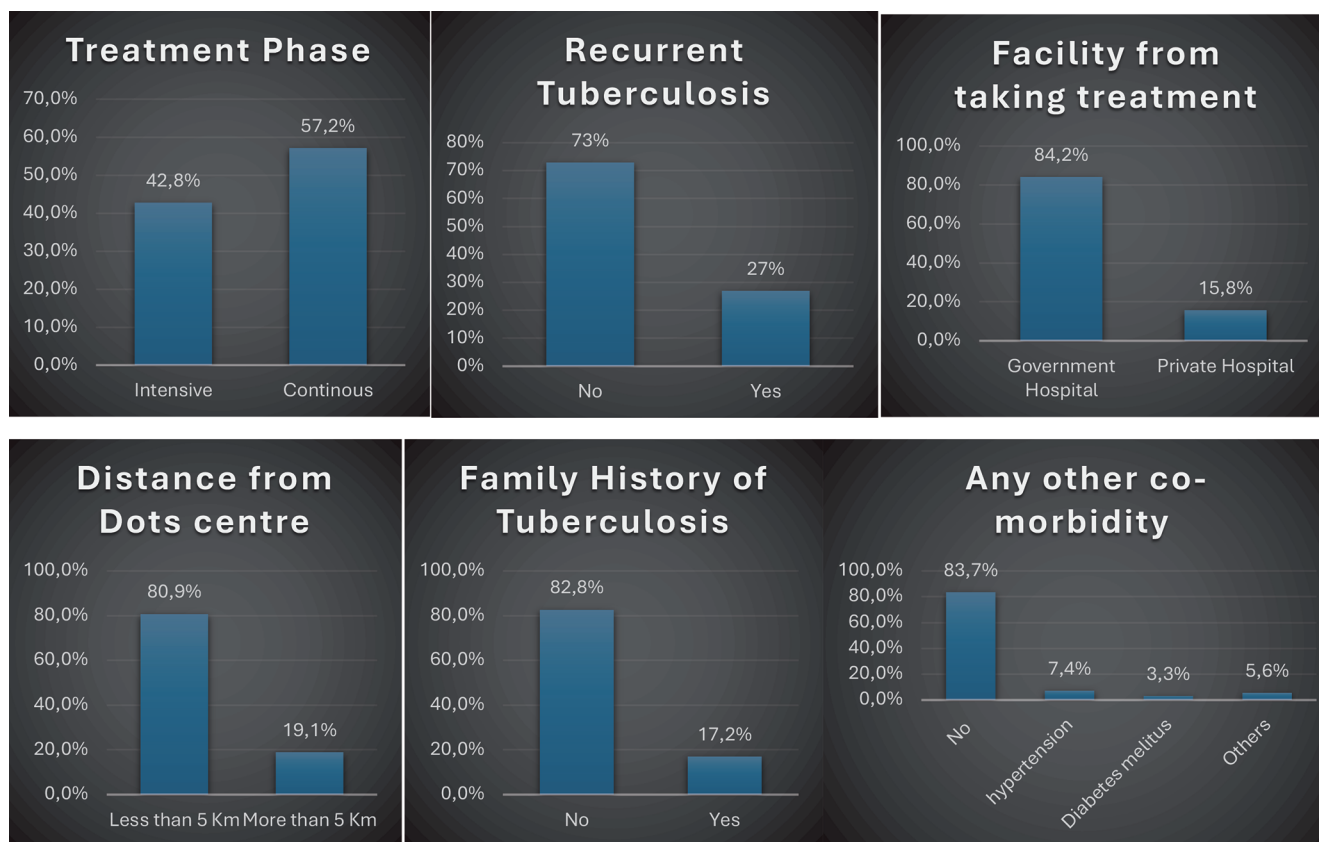


Figure 1. Frequency distribution of pulmonary variables in patient with tuberculosis (n=215).



better [22]. A similar study by Lokender Kumar *et al.* found that 10.5% of patients did not continue their treatment because they felt better [23].

One of the common reasons for not following TB treatment

is side effect from the anti-TB medications. Present study results indicate that patients who experienced the side effect of the drug most of the time are found non-adherent to TB treatment (OR=3.024). These association agrees with others study conduct-

Table 3. Odds ratio and corresponding 95% confidence interval for treatment compliances associate with factors affecting compliances.

Factors		Treatment compliance, n (%)		OR (95% CI)
		Adherence	Non-adherence	
Did you feel burdened by taking medicine?	Never	22 (21.2)	19 (17.1)	Reference
	Sometime	45 (43.3)	49 (44.2)	1.420 (0.537-3.754)
	Most of time	37 (35.6)	43 (38.7)	0.988 (0.334-2.919)
Did you stop taking medicine because you felt better?	Never	63 (60.6)	31 (27.9)	Reference
	Sometime	29 (27.9)	51 (45.9)	5.24 (2.303-11.92)
	Most of time	12 (11.5)	29 (26.1)	8.693 (3.179-23.77)
Have you experienced any adverse effects?	Never	22 (21.2)	16 (14.4)	Reference
	Sometime	43 (41.3)	44 (39.6)	1.638 (0.604-4.446)
	Most of time	39 (37.5)	51 (45.9)	3.024 (1.114-8.207)
Did you feel that the treatment duration is very long?	Never	12 (11.5)	18 (16.2)	Reference
	Sometime	43 (41.3)	51 (45.9)	0.521 (0.163-1.665)
	Most of time	49 (47.1)	42 (37.8)	0.362 (0.112-1.167)
Do you find it difficult to go to work due to disease?	Never	43 (41.3)	33 (29.7)	Reference
	Sometime	37 (35.6)	44 (39.6)	0.957 (0.392-2.337)
	Most of time	24 (23.1)	34 (30.6)	0.668 (0.245-1.934)
Have you experienced difficulty in earning wages?	Never	38 (36.5)	25 (22.5)	Reference
	Sometime	46 (44.2)	42 (37.8)	1.401 (0.499-3.930)
	Most of time	20 (19.2)	44 (39.6)	5.651 (1.585-20.15)
Do you experience a loss of income sources?	Never	30 (28.8)	26 (23.4)	Reference
	Sometime	50 (48.1)	44 (39.6)	0.785 (0.297-2.071)
	Most of time	24 (23.1)	41 (36.9)	0.725 (0.215-2.448)
Do you find it difficult to visit the health centre regularly due to transport costs?	Never	31 (29.8)	20 (18)	Reference
	Sometime	43 (41.3)	50 (45)	1.902 (0.721-5.017)
	Most of time	30 (28.8)	41 (37)	1.159 (0.419-3.208)
Does your family accept and support you after tuberculosis?	Never	21 (20.2)	30 (27)	Reference
	Sometime	56 (53.8)	49 (44.1)	0.647 (0.268-1.559)
	Most of time	27 (26)	32 (28.8)	1.204 (0.412-3.521)
Do you experience social isolation?	Never	13 (12.5)	26 (23.4)	Reference
	Sometime	56 (53.8)	58 (52.3)	0.316 (0.116-.862)
	Most of time	35 (33.7)	27 (24.3)	0.197 (0.061-.644)
Do you feel social stigma and discrimination, leading you to avoid seeking treatment?	Never	24 (23.1)	33 (29.7)	Reference
	Sometime	47 (45.2)	47 (42.3)	0.722 (0.289-1.804)
	Most of time	33 (31.7)	31 (27.9)	0.498 (0.187-1.329)
Do you experience long wait times to get medicine from the health centre?	Never	47 (45.2)	43 (38.7)	Reference
	Sometime	42 (40.4)	40 (36)	1.111 (0.576-2.145)
	Most of time	15 (14.4)	28 (25.2)	2.507 (1.105-5.689)
Do you feel psychological distress due to your disease?	Never	29 (27.9)	25 (22.5)	Reference
	Sometime	44 (42.3)	48 (43.2)	2.878 (1.056-7.850)
	Most of time	311 (29.8)	38 (34.2)	2.815 (.979-8.093)
Do you lack trust in the health system or your healthcare provider?	Never	46 (44.2)	52 (46.8)	Reference
	Sometime	43 (41.3)	36 (32.4)	0.744 (0.345-1.607)
	Most of time	15 (14.4)	23 (20.7)	1.175 (0.393-3.51)
Do you feel low self-efficacy in performing tasks due to your health?	Never	29 (27.9)	23 (20.7)	Reference
	Sometime	46 (44.2)	50 (45)	1.004 (0.399-2.527)
	Most of time	29 (27.9)	38 (34.2)	0.628 (0.210-1.883)
Do you feel lonely or social rejection due to societal stigma?	Never	21 (20.2)	21 (18.9)	Reference
	Sometime	59 (56.7)	41 (36.9)	0.316 (0.115-.872)
	Most of time	24 (23.1)	49 (44.1)	1.357 (0.487-3.780)

OR, odds ratio; CI, confidence interval.



ed in India [20,24]. This suggests that side effects from anti-TB medications are a major challenge to treatment adherence, as adverse reactions may be less motivated to continue their regimen. This study additionally emphasizes how social isolation contributes to treatment non-adherence. Patients who reported social isolation “sometimes” or “most of the time” demonstrated lower odds of being non-adherent. This result, supported by a study conducted by Motappa *et al.*, found isolation is significantly associated with non-adherence [21]. This implies that patients who do not have strong support systems could not feel as driven or receive as many reminders and encouragement to remain committed to their regimen. Additionally, this can increase stigma, which would discourage patients from seeking routine medical attention.

Strength of study

The study used a detailed questionnaire covering diverse factors (demographic, personal, social, psychological, and economic), offering a well-rounded understanding of non-adherence to TB treatment. Including 215 participants provided strong representation, improving the reliability and relevance of the findings

Weakness of study

The present study is cross-sectional, which limits the ability to establish causal relationships between factors and non-adherence. also, use of nonprobability purposive sampling may cause selection bias.

Conclusions

Education is important for understanding health information. People with lower levels of education often find it challenging to understand important details about their health and treatment. Many who do not adhere to their treatment have a limited understanding of its benefits, making it harder for doctors and health-care providers to effectively explain the illness and treatment process to them.

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Ethics approval and consent to participate: the study protocol was approved by the institutional Ethics Committee of the Charotar University of Science and Technology protocol no. IEC/CHARUSAT/23/143.

Informed consent: participants received comprehensive education on the study's goals and were provided with an information brochure. The study details were communicated in the local language, allowing participants to ask questions. Each participant gave informed consent and was informed of their right to withdraw from the study at any time. Throughout the process, the privacy and confidentiality of all collected information were meticulously maintained.

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