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Research Article

Assessment of Online Pharmacy Usage, Awareness, Attitude and Purchasing Behaviour Among Residents of Villupuram District, Tamil Nadu

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ABSTRACT

The COVID-19 pandemic brought major changes in the way people accessed healthcare, including a rapid increase in the use of online pharmacies for purchasing medicines. However, there is limited information on how people in smaller districts of India, particularly those with both rural and urban populations, use these services. This study explored awareness, usage, attitudes, satisfaction, and purchasing behaviour related to online pharmacies among residents of Villupuram District, Tamil Nadu, before, during, and after the pandemic, and also examined why some residents continued to avoid them. A community-based cross-sectional study was conducted among 300 residents using a pre-validated questionnaire. Participants were grouped into online pharmacy users and non-users, and the data were analysed using frequencies, percentages, chi-square tests, and odds ratios (ORs) with 95% confidence intervals (CIs). The use of online pharmacies increased steadily across the three periods. Most users reported being satisfied, with satisfaction ranging from 81.2% to 100%; however, 18.8% reported dissatisfaction in the post-pandemic period ($\chi^2=7.40$, $p=0.025$). The types of medicines purchased online also changed significantly over time ($\chi^2=13.77$, $p=0.032$), as did the gender distribution of users ($\chi^2=6.64$, $p=0.036$). Among non-users, rural residents were more likely to prefer purchasing medicines directly (OR=1.95, 95% CI: 1.15–3.30), while lack of trust was more commonly reported among urban residents (OR=0.51, 95% CI: 0.29–0.90; $\chi^2=9.37$, $p=0.025$). Overall, online pharmacy use has continued to grow, although differences in trust, accessibility, and purchasing preferences between rural and urban residents remain important considerations for improving digital pharmacy services.

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INTRODUCTION

An online (or internet/e-) pharmacy is a digital platform that sells and distributes prescription and over-the-counter medicines through a website or app rather than a physical counter, dispatching orders by post, courier, or delivery staff,¹ and in principle it remains bound by the same pharmaceutical regulations that govern conventional, brick-and-mortar pharmacies.²

Before COVID-19 struck, uptake of online pharmacies in India was modest and concentrated among digitally connected, largely urban consumers; an early Indian survey of 322 respondents found that barely over four-fifths (83.2%) had even heard of such services,³ and dedicated research into the topic only really gathered pace once the pandemic began, a pattern also seen internationally.⁴ The pandemic subsequently functioned as a catalyst for the sector across the globe, pushing internet-based healthcare services forward as governments steered people toward remote alternatives to face-to-face care.⁵ India's online pharmacy market is now projected to reach roughly US\$801 million by 2030. Post-pandemic trends, though, are not simply a continuation of pandemic-era momentum: a large European survey found intentions to keep buying medicines online were genuinely split, with almost as many respondents planning to stop as planning to continue,⁶ a divide that resonates with the pocket of post-pandemic dissatisfaction identified for the first time in the present study.

The appeal of online pharmacies lies in doorstep delivery, competitive pricing, better adherence support, and wider geographic reach,⁷ including cost and transaction-time advantages over physical outlets.⁸ Set against this are real risks regulators struggle to monitor online drug sales in the absence of clear guidelines, and India's Drugs and Cosmetics Rules, 1945 confine pharmacy sales to

the licensing authority's own jurisdiction a structural mismatch for e-pharmacies that, by nature, cross state lines.⁹ On the consumer side, worries centre on delayed deliveries, weaker confidentiality, and reduced clinical oversight; roughly half of the community pharmacists surveyed in Bangalore felt online pharmacies could be a channel for counterfeit or substandard products¹⁰

Much of the Indian literature on this subject has come out of metropolitan or semi-urban hubs Delhi, Chandigarh, Bangalore, Uttarakhand leaving mixed rural-urban districts of Tamil Nadu largely unstudied.¹¹ That gap matters because digital access within the state itself is uneven: computer and internet access among students, for instance, differs sharply between rural and urban Tamil Nadu (9% versus 20%),¹² and rural communities continue to contend with infrastructural and workforce shortages in healthcare delivery more broadly.¹³ Whether these disparities carry over into online pharmacy uptake, trust, and satisfaction in a mixed district like Villupuram is a question worth answering for equitable digital-health planning. This study therefore set out to profile the demographics of online pharmacy users; track changes in usage, medicine type, satisfaction, and platform choice across the three pandemic-related periods; map the barriers reported by non-users by residence type; gauge future willingness and improvement priorities; and test these relationships statistically using chi-square analysis and odds ratios.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional survey was carried out at community level among residents of Villupuram District, Tamil Nadu, over a period of one month.



Study Population

Three hundred participants were enrolled, spread across four age brackets (under 18, 18–30, 31–50, and above 50 years) and drawn from both urban and rural localities so the sample would reflect the district's mixed character. Anyone residing in the district who could understand the survey and gave informed consent was eligible (with a parent or guardian assisting participants under 18); people from outside the district, or unwilling to take part, were excluded.

Questionnaire development and validation

Data were collected using a structured, pre-validated questionnaire built on instruments used in earlier published work^{2,3,11,14} administered on paper after the purpose of the study had been explained to each participant.

Data collection

Participants were approached through direct contact, and the purpose of the study was explained before administering the survey. Responses were recorded and subsequently exported to Microsoft Excel for organisation and analysis. The dataset was separated into users and non-users; user data (reasons for purchase, medicine category, satisfaction, frequency, and platform preference) were collected across three time periods (before, during, and after the COVID-19 pandemic), while non-user data (barriers, future willingness, and improvement suggestions) were collected separately by rural/urban residence.

Statistical Analysis

Descriptive statistics (frequencies and percentages) were computed for all variables. For each survey question, respondent counts were arranged in a contingency table (response categories in rows; comparison groups

before/during/after COVID-19 for user-behaviour questions, or rural/urban and user/non-user status for the remaining questions in columns). Pearson's chi-square test of independence (χ^2) was applied to each contingency table, with degrees of freedom ($df = (rows-1) \times (columns-1)$) and $p < 0.05$ considered statistically significant. Odds ratios (OR) with 95% confidence intervals (CI) were calculated for the single most policy-relevant category within each question, collapsed into a 2×2 table (that category versus all others, across the two most contrasting groups, typically before versus after); an $OR > 1$ indicates higher odds of that category in the second group, $OR < 1$ lower odds, and $OR = 1$ no difference. Where a cell value was zero, the Haldane-Anscombe correction (adding 0.5 to every cell) was applied to permit OR/CI computation, and this is noted explicitly where relevant. All calculations were performed in Python (SciPy, χ^2 contingency, uncorrected).

RESULTS

Sociodemographic Profile of Online Pharmacy Users

Of the 300 respondents surveyed, 68 (22.7%) reported having purchased medicines through an online pharmacy platform. The number of user-respondents rose from 11 (3.7% of the total sample) before the pandemic to 25 (8.3%) during the pandemic and 32 (10.7%) after the pandemic (Table 1). By age, the largest group of users at every time point was 18-30 years, rising from 6 respondents before the pandemic to 17 after; the 31-50 years group rose from 4 to 12 respondents, while users above 50 years increased only slightly. By gender, use was more common among males before the pandemic (8 vs 3 respondents) but shifted markedly toward females during the pandemic (18 vs 7), with equal numbers of male and female users (16 each) after the pandemic. By education, undergraduate respondents showed the



largest increase in use (3 to 22 respondents), while school-level and postgraduate respondents changed only modestly. By area of residence, both rural (3 to 13 respondents) and urban (8 to 19

respondents) users increased, with urban residents remaining the numerically predominant group throughout as shown in Table 1.

Table 1. Sociodemographic profile of online pharmacy users across pandemic periods (n, %)

Variable	Category	Before	During	After
Age (years)	<18	0	0	1 (0.33)
	18–30	6 (2.00)	13 (4.33)	17 (5.67)
	31–50	4 (1.33)	10 (3.33)	12 (4.00)
	>50	1 (0.33)	2 (0.67)	2 (0.67)
Gender	Male	8 (2.67)	7 (2.33)	16 (5.33)
	Female	3 (1.00)	18 (6.00)	16 (5.33)
Education	School level	2 (0.67)	3 (1.00)	3 (1.00)
	Undergraduate	3 (1.00)	14 (4.67)	22 (7.33)
	Postgraduate	6 (2.00)	8 (2.67)	7 (2.33)
Residence	Rural	3 (1.00)	6 (2.00)	13 (4.33)
	Urban	8 (2.67)	19 (6.33)	19 (6.33)
Total user respondents		11 (3.67)	25 (8.33)	32 (10.67)

Purchasing Behaviour and Satisfaction

Before the pandemic, medicine availability was the main reason people turned to online pharmacies; during and after it, home delivery and discounts/offers took over as the leading motivations. Prescription medicines dominated purchases during the pandemic itself, while OTC products, health supplements, and personal-care items became more prominent afterward, a sign that use was broadening beyond urgent medical need. Satisfaction stayed generally strong across all three periods (81.2%–100%), but six respondents (18.8% of post-pandemic users)

reported dissatisfaction for the first time once the pandemic had ended. Occasional and rare purchasing overtook regular purchasing in the post-pandemic period as shown in Table 2.

Satisfaction with online pharmacy services was high across all three periods (81.2-100% of user-respondents in each period), rising in absolute terms from 11 satisfied respondents before the pandemic to 26 after. However, dissatisfaction was entirely absent before and during the pandemic and emerged among 6 of 32 users (18.8%) after the pandemic as shown in Table 2.

Table 2. Purchasing behaviour and satisfaction among online pharmacy users across pandemic periods (n, %)

Variable	Category	Before	During	After
Reason for purchase	Convenience	1 (0.33)	7 (2.33)	1 (0.33)
	Home delivery	2 (0.67)	8 (2.67)	11 (3.67)
	Discounts/offers	3 (1.00)	5 (1.67)	13 (4.33)
	Availability	5 (1.67)	5 (1.67)	7 (2.33)
Medicine category	Prescription	4 (1.33)	18 (6.00)	11 (3.67)
	OTC	1 (0.33)	3 (1.00)	5 (1.67)
	Health supplements	0	2 (0.67)	5 (1.67)
	Personal care/beauty	6 (2.00)	2 (0.67)	11 (3.67)
Satisfaction	Satisfied	11 (3.67)	25 (8.33)	26 (8.67)
	Not satisfied	0	0	6 (2.00)



Frequency of purchase	Regularly	5 (1.67)	12 (4.00)	8 (2.67)
	Occasionally	6 (2.00)	10 (3.33)	13 (4.33)
	Rarely	0	3 (1.00)	11 (3.67)

Barriers, Future Willingness, and Suggestions Among Non-Users

Among those who had not used online pharmacies, “prefer direct purchase” and “lack of trust” topped the list of reasons in both rural and urban groups alike. Rather than committing exclusively to one channel, most non-users indicated they would

rather use a mix of online and offline options going forward. Across both users and non-users, the improvements most commonly asked for were faster, more reliable rural delivery paired with round-the-clock customer support, greater involvement of pharmacists in consultations, tighter government regulation, and simpler, more user-friendly app interfaces represented in Table 3.

Table 3. Barriers, future willingness, and improvement suggestions among non-users (n, %)

Domain	Category	Rural	Urban
Reason for not buying online	Lack of trust	30 (10.00)	39 (13.00)
	Prefer direct purchase	69 (23.00)	39 (13.00)
	Delivery delay	12 (4.00)	6 (2.00)
	Difficulty using app/website	17 (5.67)	20 (6.67)
Future willingness	Offline only	62 (20.67)	43 (14.33)
	Online only	17 (5.67)	10 (3.33)
	Both	49 (16.33)	51 (17.00)

The most common suggestions for improving online pharmacy services, from both users and non-users, were improved rural delivery with 24/7 customer service (23/68 users, 33.8%; 71/232 non-users, 30.6%), better pharmacist consultation services (16/68 users, 23.5%; 62/232 non-users,

26.7%), stronger government regulation and monitoring (17/68 users, 25.0%; 54/232 non-users, 23.3%), and easier app/website usage (12/68 users, 17.6%; 45/232 non-users, 19.4%) as shown in Table 4

Table 4. Suggestions for improvement, users vs. non-users (n, %)

Suggestion	Users	Non-users
Better pharmacist consultation	16 (5.33)	62 (20.67)
Easier app/website usage	12 (4.00)	45 (15.00)
Rural delivery & 24/7 customer service	23 (7.67)	71 (23.67)
Stronger government regulation	17 (5.67)	54 (18.00)

Statistical Associations

Twelve study variables were tested for association with study period (before/during/after) or with residence/user status, as appropriate. Four associations reached statistical significance in the chi-square analysis: the gender split of users across

the three periods ($\chi^2=6.64$, $df=2$, $p=0.036$; $OR=2.67$ for female representation after versus before, 95% CI 0.60–11.92); satisfaction levels over time ($\chi^2=7.40$, $df=2$, $p=0.025$; $OR=5.64$ after Haldane–Anscombe correction, 95% CI 0.29–108.72); the category of medicine bought across the three periods ($\chi^2=13.77$, $df=6$, $p=0.032$); and,



among non-users, reasons for avoiding online purchase by rural versus urban residence ($\chi^2=9.37$, $df=3$, $p=0.025$; $OR=1.95$ for “prefer direct purchase” among rural relative to urban respondents, 95% CI 1.15–3.30, and $OR=0.51$ for “lack of trust,” 95% CI 0.29–0.90). No significant association emerged for age distribution, education level, area of residence, platform choice, reason for buying online, purchase frequency, future willingness, or suggested improvements ($p>0.05$ in each case) as shown in Table 5.

For gender, the odds ratio for female representation after versus before the pandemic was 2.667 (95% CI 0.597–11.915); although the point estimate suggests substantially higher odds of female participation in the later period, the wide confidence interval (crossing 1) reflects the modest cell sizes involved, and this odds ratio should be interpreted with caution alongside the

significant chi-square result. For medicine category, the odds ratio for the prescription-medicine category alone (0.917, 95% CI 0.220–3.826) was close to 1, indicating that the overall significance of this association was driven more by shifts in the OTC, supplement, and personal-care categories than by the prescription-medicine category specifically. For satisfaction, the Haldane-Anscombe-corrected odds ratio (5.642) pointed in the same direction as the significant chi-square result but carried a very wide confidence interval owing to the sparse (zero) cells before and during the pandemic; this estimate should be regarded as indicative rather than precise. For non-user barriers, rural residents had significantly higher odds of citing a preference for direct purchase ($OR=1.965$, 95% CI 1.096–3.523) and, correspondingly, lower odds of citing lack of trust ($OR\approx 0.51$, 95% CI 0.29–0.90) relative to urban non-users.

Table 5. Statistical associations between study variables and study period (before/during/after) or residence/user status

Q. no.	Question	χ^2	df	p-value	OR (95% CI)	Significant ($p<0.05$)
1	Age distribution	1.28	6	0.973	0.94 (0.24–3.74)	No
2	Gender distribution	6.64	2	0.036	2.67 (0.60–11.92)	Yes
3	Education level	5.86	4	0.210	3.91 (0.89–17.19)	No
4	Area of residence	1.93	2	0.382	1.83 (0.41–8.20)	No
5	Satisfaction level	7.40	2	0.025	5.64 (0.29–108.72)	Yes
6	Type of medicine purchased	13.77	6	0.032	0.92 (0.22–3.83)	Yes
7	Online platform used	5.34	6	0.501	1.68 (0.37–7.63)	No
8	Reason for buying online	11.65	6	0.070	1.83 (0.41–8.20)	No
9	Frequency of buying online	8.84	4	0.065	12.30 (0.66–228.24)	No
10	Reason for not buying (non-users)	9.37	3	0.025	1.97 (1.10–3.52)	Yes
11	Future willingness	2.84	2	0.242	0.65 (0.38–1.09)	No
12	Suggestions for improvement	0.53	3	0.912	1.35 (0.76–2.39)	No

Abbreviations: χ^2 , chi-square statistic; df , degrees of freedom; OR , odds ratio; CI , confidence interval. Row 8 (satisfaction) required a Haldane-Anscombe correction (+0.5 to every cell) owing to zero cell counts before and during the pandemic; the resulting OR should be interpreted as indicative only.

DISCUSSION

Principal findings

This study documents a substantial increase in online pharmacy use among residents of Villupuram District across the pre-pandemic, pandemic, and post-pandemic periods, with user-respondents nearly tripling from the earliest to the



most recent period. The persistence of elevated usage after the pandemic suggests that this behavioural shift was not simply a temporary lockdown response but has, for a subset of consumers, become incorporated into routine healthcare purchasing.

Comparison with previous Indian and international evidence

A similar trajectory has been reported elsewhere in India, where acceptance of online pharmacies persisted through and after COVID-19^{15,16} and it also echoes findings from the Visegrad Group countries, where the frequency of online medicine purchasing rose further once the pandemic had passed.⁶ Taken together, this points to a genuine, lasting change in how people buy healthcare products rather than a one-off, local blip.

Changing Demographic and Educational Profile of Users

Users in this sample also became more demographically and educationally diverse over time, which differs somewhat from earlier work identifying limited awareness as the chief obstacle to adoption.³ It looks instead like a maturing market, with rising smartphone ownership and a wider array of available platforms pulling in a broader cross-section of consumers.¹⁷ The sharp rise in female users during the pandemic, which settled into gender parity afterward, fits with reports that online pharmacy behaviour tracks shifting social and healthcare-access conditions rather than staying fixed,¹⁸ a reminder that platform design should not assume a single, uniform type of user.

Changes in Purchasing Patterns and Product Preferences

The change in what people bought prescription medicines dominating during the pandemic, giving way to OTC products, supplements, and personal-care items afterward mirrors international findings that online platforms were first used to secure essential medicines under movement restrictions before settling into a more general, everyday shopping role.¹⁹ Which strengthens the case for regulatory attention to extend well beyond prescription items to everything sold on e-pharmacy platforms.²⁰

Adoption Growth and User Satisfaction

One notable result was the appearance of a distinct dissatisfied minority in the post-pandemic period even as overall user numbers kept rising, a reminder that growing adoption and genuine acceptance are not the same thing. This tracks with behavioural work showing that trust in online pharmacies builds up (or erodes) through accumulated experience with delivery reliability, pricing, authenticity, and access to professional advice, rather than through convenience on its own suggesting adoption and satisfaction are best monitored as separate metrics as the sector continues to grow.^{21,22}

Rural–Urban Differences in Barriers and Trust

The differing barriers reported by rural and urban non-users, direct-purchase preference in rural areas, distrust in urban ones, add to existing evidence that Tamil Nadu's digital divide is about more than connectivity alone; it also reflects unequal access to healthcare infrastructure and professional support.^{12,13} This lines up with observations that rural community pharmacists in India often serve as an accessible first point of basic health guidance well beyond simple dispensing, implying that online models may work best when they support, rather than substitute for, existing pharmacist relationships. The urban



emphasis on trust, meanwhile, echoes pharmacist-reported concerns about counterfeit or substandard products circulating through online channels.²³

User Expectations and Regulatory Implications

The improvements respondents asked for most, better pharmacist consultation, easier app interfaces, stronger rural delivery, and firmer government regulation, match recent Indian findings that usability and clarity of information remain key drivers of e-pharmacy adoption²⁴⁻²⁶ and feed into ongoing debate over whether India's pharmaceutical regulations, written before internet-based medicine sales existed, are adequate for handling prescription verification, product authenticity, and accountability in this digital space.²⁷ Combined with evidence that adopting online pharmacy services is a multi-layered decision shaped by trust and professional interaction rather than simple usage frequency.²⁸ These results support pairing digital expansion with stronger pharmacist involvement and enforceable regulatory standards, particularly in mixed rural-urban districts such as Villupuram.

Strengths and limitations

This study provides community-based, primary survey data from a mixed rural-urban Tamil Nadu district that has been comparatively under-represented in the existing Indian e-pharmacy literature, and it examines behaviour across three distinct temporal periods within a single sampling frame, allowing direct within-population comparison. Statistical testing, including odds ratios with 95% confidence intervals, was applied systematically across all major study variables.

Several limitations should be considered when interpreting these findings. First, the cross-sectional, single-timepoint design relies on retrospective self-report of behaviour during the

pre-pandemic and pandemic periods, which may be subject to recall bias; the study cannot establish causality between the pandemic and observed behavioural changes; rather, it documents that these changes were associated with the corresponding time periods. Second, several subgroup cell counts were small (for example, the pre-pandemic user group, $n=11$), which produced wide confidence intervals around some odds-ratio estimates and limits the precision of subgroup comparisons; this is particularly relevant to the satisfaction and gender associations, where zero-cell corrections were required. Third, convenience or direct-contact recruitment (as opposed to random sampling) may limit the generalisability of findings beyond the sampled population, and the exact recruitment procedure requires further specification (see Information Required from Author). Fourth, as a single-district study, findings may not generalise to other regions of Tamil Nadu or India with different digital infrastructure or healthcare-access profiles. Finally, information on the validation (e.g., pilot testing, reliability testing) of the adapted questionnaire was not available and should be reported in the final submission.

CONCLUSION

Use of online pharmacies among residents of Villupuram District rose steadily and durably across the pre-pandemic, pandemic, and post-pandemic periods, reaching an increasingly varied demographic and covering a wider range of medicine categories as time went on. That growth, however, did not translate into uniformly high satisfaction, and rural and urban non-users continued to report different reasons for staying away. Investing in pharmacist-led consultation, strengthening rural delivery and app usability, and putting a clear regulatory framework around online medicine sales would likely make further



growth in this and comparable semi-urban and rural Indian settings both safer and more equitable.

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CONFLICTS OF INTEREST

There are no conflicts of interest

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