

## **Age as a Determinant of UPI Adoption: A One-Way ANOVA Analysis of Consumer Perceptions and Behaviours in Urban India**

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DOI: 10.46609/IJSSER.2026.v11i05.036 URL: <https://doi.org/10.46609/IJSSER.2026.v11i05.036>

Received: 14 May 2025 / Accepted: 22 May 2026 / Published: 30 May 2026

### **ABSTRACT**

*The digital payments ecosystem in India has undergone a seismic shift since the demonetisation in 2016, with the UPI now being the largest real-time payments platform in the world, processing around 660 million transactions per day. While aggregate adoption trends are well documented, a conspicuous absentee in the literature is age-disaggregated inferential evidence. This study explores whether age is a statistically significant determinant of consumer perceptions and behaviours towards UPI across seven constructs, and primary data were collected using a structured questionnaire employing a 5-point Likert scale from respondents in urban India across five age categories. A one-way Analysis of Variance (ANOVA) was performed, preceded by Shapiro-Wilk normality tests and Levene's homogeneity of variance tests, and supplemented by Kruskal-Wallis robustness checks. Results reveal statistically significant differences between age groups in two constructs: adoption rate and frequency of use and financial behaviour. Tukey HSD post-hoc tests reveal that respondents below 18 years use UPI significantly less frequently than the other age groups, while the 30–45 cohort reports significantly higher financial behaviour impact than the 45–60 group. No significant differences were observed based on age in terms of perceived security, consumer satisfaction, transparency, or future usage preference. The findings are directly relevant to youth financial empowerment, age-sensitive UPI interface design, and rural digital inclusion strategies.*

**Keywords:** UPI, digital payments, ANOVA, age groups, consumer behaviour, cashless economy, India

### **1. Introduction**

India is leading the charge in the global digital payments revolution. The National Payments Corporation of India (NPCI) launched Unified Payments Interface (UPI) in April 2016. It has developed into the world's largest real-time payment network with about 660 million

transactions per day and more than 131 billion transactions worth nearly ₹200 lakh crore (roughly USD 2.4 trillion) in the financial year 2023–24 alone (NPCI, 2025). This trajectory, from near-zero adoption in 2016 to 1,31,000 million annual transactions by 2024, represents one of the most rapid diffusions of a financial technology in recorded economic history.

This transformation was catalysed by a convergence of structural policy shocks and market innovations. The demonetisation of 8 November 2016, which invalidated ₹500 and ₹1,000 banknotes representing 86% of currency in circulation (Reserve Bank of India, 2016), created an overnight demand for digital payment alternatives. Concurrently, the Pradhan Mantri Jan-Dhan Yojana (PMJDY) scheme, which opened over 50 crore bank accounts for previously unbanked citizens, created the institutional infrastructure necessary for mass UPI adoption, while the entry of Reliance Jio in 2016 dramatically reduced mobile data costs, extending internet access to previously underserved demographics. The COVID-19 pandemic (2020–2022) delivered the decisive accelerant: physical currency was perceived as a contamination risk, accelerating contactless payment adoption and transforming UPI from a convenient alternative into the de facto primary payment modality for millions of Indians.

Figure 1 : (PMJDY Account Growth, 2025) Values in crores



Despite this macroeconomic significance, the academic literature on UPI adoption exhibits a persistent empirical gap: the role of age, one of the most fundamental sociodemographic variables in technology adoption theory, has never been formally tested through inferential statistics across multiple UPI-related constructs simultaneously. Previous studies have either

provided aggregate adoption patterns without demographic breakdowns (Badak et al., 2023; Verma et al., 2024) or have employed descriptive methods that do not test the significance of any age-group differences observed (Ruban & Sahila, 2023; Singh, 2025). This study fills that gap.

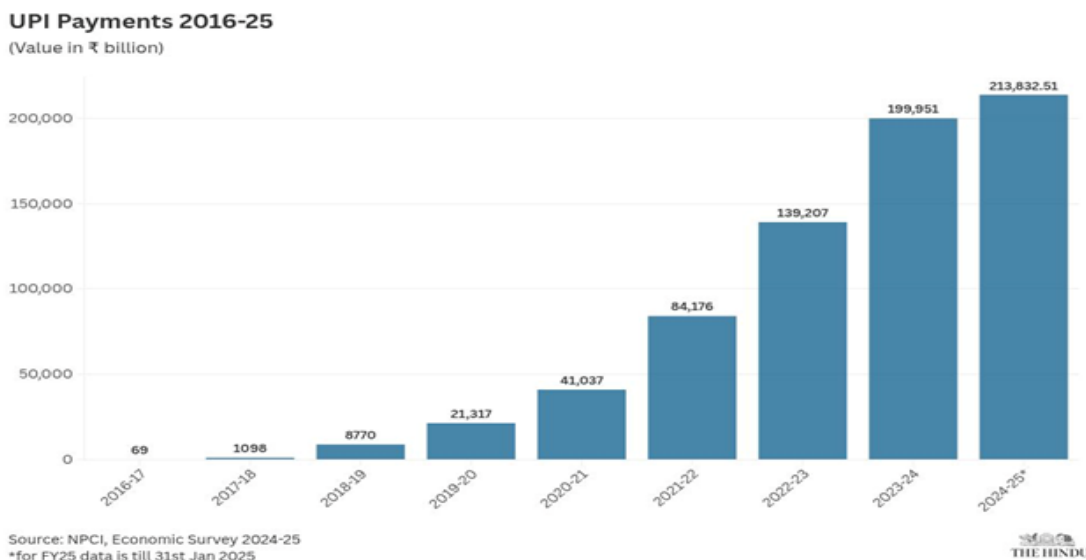
**Table 1: UPI Transaction Volume and Value Growth, India, 2016–17 to 2024–25**

Financial Year	Transaction Volume (Million)	Transaction Value (₹ Lakh Crore)
2016–17	178	0.30
2017–18	915	0.96
2018–19	5,353	8.77
2019–20	12,519	21.32
2020–21	22,334	41.04
2021–22	45,964	84.16
2022–23	83,751	139.21
2023–24	131,053	199.89
2024–25 (Est.)	185,000	260.00

Source: National Payments Corporation of India (NPCI, 2025). 2024–25 figures are provisional estimates. 1 lakh crore = ₹1 trillion ≈ USD 12 billion. Values reflect calendar-year aggregation from NPCI monthly statistics.

Table 1 shows secondary data on UPI transaction volumes and values from 2016-17 to 2024-25. The 73,600% growth in transaction volume over eight years from 178 million in 2016-17 to an estimated 185 billion in 2024-25 underscores the policy urgency to understand demographic adoption patterns. Even marginal improvements in UPI penetration among the sub-18 cohort, which represents the entirety of India's future working-age population, would yield disproportionate volume gains at scale.

**Figure 2: Graph displaying the increase in value of UPI Payments from 2016 to 2025**



After studying the literature, it was observed that no published study has applied a one-way ANOVA framework to test whether age significantly differentiates UPI-related perceptions and behaviours across multiple constructs. Furthermore, the sub-18 cohort, Generation Z, who will constitute the dominant consumer force within the next decade, is virtually absent from the empirical UPI literature despite being the first cohort to encounter UPI in early adolescence. This study addresses both gaps through rigorous multi-construct inferential testing across five age categories.

### **1.1 Research Questions**

This study is guided by the following research questions:

- a) Does age significantly influence the frequency of UPI adoption among urban Indian consumers?
- b) Does age significantly shape perceptions of UPI transaction convenience, security, and satisfaction?
- c) Does age significantly affect the financial behaviour of UPI-using consumers?
- d) Does age significantly dampen preference for UPI over cash?

### **1.2 Hypotheses**

Based on the Technology Acceptance Model (TAM; Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003) which find age to be a significant moderator of technology acceptance, the following hypotheses are proposed:

H<sub>10</sub>: There is no statistically significant difference in the adoption rate and frequency of UPI use across age groups.

H<sub>11</sub> : The adoption rate and frequency of usage of UPI differ significantly between age groups.

H<sub>20</sub>: No statistically significant difference in perceived transaction convenience was found across age groups.

H<sub>21</sub>: There is a statistically significant difference in perceived transaction convenience across age groups.

H<sub>30</sub>: There is no statistically significant difference in UPI-related financial behaviour across age groups.

H<sub>31</sub>: There is a statistically significant difference in financial behaviour related to UPI among age groups.

H<sub>40</sub>: There is no statistically significant difference across age groups in perceived security, consumer satisfaction, transparency and preferences of usage in the future.

H<sub>41</sub>: The perceived security, consumer satisfaction, transparency or future usage preferences vary significantly across age groups.

## **2. Literature Review**

### **2.1 Structural Drivers of UPI Adoption**

Badak et al. (2023) in their study “Revolution of Digital Payment in India” have traced the growth in the use of digital payments from 2016 to 2023, due to demonetisation, COVID-19, PMJDY scheme and rise in financial literacy. Drawing exclusively on secondary data from the RBI and NPCI, they demonstrate how consumer and merchant behaviour collectively accelerated UPI adoption, but without disaggregating by age, income, or gender. Verma et al. (2024) study UPI from a consumer and merchant perspective, emphasizing technological improvements such as UPI AutoPay and faster transaction speed as major drivers of UPI’s user base expansion. They identify critical risks including cybersecurity and data security concerns and infrastructure dependency; however, their descriptive NPCI-RBI analysis depicts UPI as an increasingly dominant modality without analyzing demographic differences.

Banu et al. (2024) in “Financial Transformation Through Digitalisation” describe India as evolving into a dual-path economy by expanding the digital payment infrastructure while still maintaining cash for the unbanked. This framing is directly relevant to the research question of this study around future payment preferences: if cash and UPI are coexisting, the question of whether this co-existence pattern is different by age group is consequential for financial inclusion policy.

Gupta & Asha (2018) explore the history of payment before the digital revolution and the journey into a cashless economy with the advancements made so far. The paper elaborates upon several modes of payment that have become available and the type of services they offer that were previously inefficient, costly, and time-consuming. It also addresses challenges such as difficulty in using technology and the lack of infrastructure that was overlooked. The most basic requirement for many recent payment methods, smartphones, is not available to a large part of the population. The study explores the history of digital payment methods, investigates the limitations and services that fintech apps offer, and identifies challenges users face and concerns they have regarding UPI. Using descriptive analysis of secondary data from websites and published papers, the paper illustrates advancements in transaction technology and its limitations. The study concludes that digital payment is being integrated into every sector of the economy as most consumers are shifting from a purely cash-run economy to a cashless economy.

## **2.2 Consumer Perceptions and Technology Acceptance Framework**

Sardana and Singhania (2018) study the perception of digital finance among Indian urban consumers belonging to different age, gender, and income groups and find perceived ease of use, lower cost, and wider reach as significant drivers for adoption, while lack of trust, security concerns, and low literacy are perceived barriers. They adopt a primary questionnaire but do not conduct formal hypothesis testing and restrict their analysis to descriptive and correlational techniques. Ruban and Sahila (2023) study UPI users in Tiruvallur district in Tamil Nadu and find overall positive attitudes despite poor connectivity issues and perceived unreliability. They find gender, income, and professional experience influence UPI usage, implicitly recognizing sociodemographic variables as moderators but without formally testing age.

These empirical observations are supported by a theoretical foundation in Davis's (1989) Technology Acceptance Model (TAM), which suggests that perceived usefulness (PU) and perceived ease of use (PEOU) are the two primary determinants of intention to adopt a technology. The UTAUT framework (Venkatesh et al., 2003) expands TAM by incorporating social influence and facilitating conditions and explicitly models age, gender, and experience as moderating variables. In UTAUT, it is hypothesized that age moderates the relationship between effort expectancy and behavioral intention: older users are expected to be more concerned with ease of use, so that perceptions of convenience and patterns of adoption should differ across age groups. The present study empirically tests this theoretical prediction using ANOVA.

## **2.3 Generational and Socio-Economic Factors**

Singh (2025) examines the socio-economic impact of UPI on small business owners and street vendors, and observes a generational gap, with older owners facing challenges with digital interfaces, and younger owners utilizing UPI to reach a wider market. Gupta and Gupta (2018) investigate rural consumers in the Jhajjar district of Haryana and find that awareness of digital banking is concentrated among male, business-owning, and higher-income respondents, which implicitly suggests that age and socio-economic stratification influence adoption. Neema and Neema (2018) conduct an early exploratory study of UPI at its launch, documenting infrastructure-driven barriers and concluding that UPI is broadly beneficial but that improvements are needed in security and universal access, limitations that remain salient in the current study's findings seven years later.

## **3. Conceptual Framework**

Following the UTAUT model (Venkatesh et al., 2003), age functions as the independent variable moderating seven dependent constructs relating to UPI engagement. The framework distinguishes between constructs that relate to usage intensity and financial impact (where

UTAUT predicts age moderation) and constructs relating to attitudinal evaluations of trust, satisfaction, and future intention (where age moderation is less theoretically assured). This distinction structures the hypothesis set and is tested empirically in Section 5.

## **4. Methodology**

### **4.1 Research Design**

This study adopts a quantitative, cross-sectional research design. Primary data was collected through a structured questionnaire in urban populations in India. A quantitative approach was chosen to allow for systematic measurement of attitudes and behaviours and inferential statistical comparison between age cohorts. The study is based on a positivist epistemological position: it aims to test theoretically derived hypotheses using objective numerical data and established statistical procedures.

#### **Data Collection and Sampling**

A structured questionnaire was given to 84 respondents in urban areas. A convenience sampling approach was employed due to practical constraints. Respondents first provided demographic information, age group, monthly income, occupation, and internet access before responding to Likert scale items measuring UPI-related attitudes and behaviours.

#### **Questionnaire Design and Construct Operationalisation**

The questionnaire used a 5-point Likert scale (1 = Strongly Disagree / Never / Very Unsafe to 5 = Strongly Agree / Very Regularly / Very Safe). The fourteen survey items yielded seven constructs by encoding and averaging constituent items where composite. The item recoding protocol used on the technical issues item, which was reversed (Never = 5, Very Often = 1) for directional consistency, is specified in Table 5.3 of the Statistical Analysis section.

Link to questionnaire:

[https://docs.google.com/forms/d/e/1FAIpQLSdMbsa7WbFmWaOSlr16MgM7I8tEJnaY1xKLGQ\\_B8BIzO59E8A/viewform?usp=sharing&ouid=101161916862531472245](https://docs.google.com/forms/d/e/1FAIpQLSdMbsa7WbFmWaOSlr16MgM7I8tEJnaY1xKLGQ_B8BIzO59E8A/viewform?usp=sharing&ouid=101161916862531472245)

### **4.2 Statistical Analysis Procedure**

#### **Assumption Testing**

Before performing ANOVA, two statistical assumptions were checked for each construct in each of the age groups. Normality of distribution within each cell was assessed using the Shapiro-Wilk (1965) test, where a p-value > 0.05 means that the normality assumption is not rejected. Homogeneity of variances across the five age groups was assessed using Levene's (1960) test

(based on group means as the centering statistic); a p-value > 0.05 indicates non-rejection of the equal variances assumption. Both assumptions are checked, but only the result of the Levene's test is taken as a go/no-go criterion for the validity of the ANOVA since ANOVA is fairly robust to violations of normality assumptions in the case of homogenous variances and groups of reasonable size (Field, 2018; Norman, 2010).

### **One-Way ANOVA**

A one-way Analysis of Variance (ANOVA) partitions total variance into between-group (systematic) and within-group (error) variance components and calculates an F-ratio whose probability is compared to  $\alpha = 0.05$ . Effect size was estimated using eta-squared ( $\eta^2$ ) with benchmarks following Cohen (1988):  $\eta^2 \approx 0.01$  (small),  $\eta^2 \approx 0.06$  (medium),  $\eta^2 \geq 0.14$  (large). Degrees of freedom Between-group  $df = 4$  ( $k - 1$ ) Within-group  $df = 79$  ( $N - k$ )

### **Post-Hoc Analysis**

All constructs with a significant ANOVA result were subjected to Tukey's Honest Significant Difference (HSD) test, and 95% family-wise error-corrected confidence intervals and adjusted p-values are reported for all  $C(5,2) = 10$  pairwise group comparisons per construct. When the design is roughly balanced, Tukey's HSD is preferred over Bonferroni correction because it increases power while controlling the Type I error rate.

### **Non-Parametric Robustness Check**

As a robustness check, the non-parametric alternative to one-way ANOVA, the Kruskal-Wallis H test, was calculated for all seven constructs given documented normality violations in several construct-group cells. If the ANOVA and the Kruskal-Wallis give the same result, we can be more confident that the parametric test is valid; if they differ, this is noted and discussed.

## **5. Empirical Findings**

### **5.1 Descriptive Statistics**

Table 5.1 shows descriptive statistics for all seven constructs for the full sample. The construct with the highest mean is Transaction Convenience ( $M = 4.188$ ,  $SD = 0.504$ ), suggesting that respondents broadly viewed UPI as convenient; the ceiling effect ( $Max = 5.00$  for several constructs) is consistent with an urban, internet-connected sample. Next highest are Future Usage Preference ( $M = 4.024$ ) and Consumer Satisfaction ( $M = 3.923$ ), indicating positive overall attitudes. Transparency had the lowest mean ( $M = 2.738$ ) and the highest variability ( $SD = 1.345$ ), indicating the greatest divergence of opinion about fee clarity, a result with regulatory

implications. Most constructs show negative skewness, which means a left-skewed distribution and is normal for a survey about urban digital payments, where favorable attitudes are dominant.

**Table 5.1: Full-Sample Descriptive Statistics for All Constructs (N = 84)**

Construct	N	M	SD	Min	Max	Skewness	Ex. Kurtosis
Adoption Rate / Frequency of Use	84	3.964	0.884	1.00	5.00	-0.786	0.664
Transaction Convenience (composite)	84	4.188	0.504	2.50	5.00	-1.066	1.026
Perceived Security and Trust	84	3.623	0.658	1.67	5.00	-0.266	0.203
Transparency (Fee Clarity)	84	2.738	1.345	1.00	5.00	0.069	-1.262
Financial Behaviour (composite)	84	3.401	0.627	1.33	4.67	-0.891	1.238
Consumer Satisfaction	84	3.923	0.609	2.00	5.00	-0.312	0.257
Future Usage Preference	84	4.024	0.565	3.00	5.00	-0.147	-0.818

Source: Author's primary data. Note. M = mean; SD = standard deviation on a 5-point Likert scale (1 = minimum; 5 = maximum). Skewness and excess kurtosis computed with N-1 denominators. Composite constructs (transaction convenience, financial behavior, consumer satisfaction, and future usage preference) are means of 2-3 constituent items.

### 5.2 Age Group Descriptive Statistics

Table 5.2 shows the means and standard deviations for each of the constructs for each of the five age categories. The most visually salient pattern is that the mean adoption rate is substantially lower for the <18 group (M = 3.000, SD = 1.033) compared to all the adult groups, which range from 3.67 to 4.35. The highest mean for financial behavior is found in the 30-45 group (M = 3.750) and the lowest is in the 60-75 group (M = 2.889). The statistical significance of these group differences is tested in Section 5.4.

**Table 5.2: Mean M (SD) by Construct and Age Group**

Construct	<18 M (SD)	18-30 M (SD)	30-45 M (SD)	45-60 M (SD)	60-75 M (SD)	Overall M (SD)
<b>Adoption Rate/Frequency of Use</b>	<b>3.000 (1.033)</b>	4.091 (0.831)	4.350 (0.489)	4.176 (0.673)	3.667 (1.155)	3.964 (0.884)
Transaction Convenience	4.135 (0.562)	3.939 (0.443)	4.083 (0.431)	4.324 (0.516)	4.556 (0.192)	4.188 (0.504)
Perceived Security & Trust	3.667 (0.584)	3.515 (0.565)	3.683 (0.653)	3.618 (0.757)	3.444 (0.385)	3.623 (0.658)
Transparency	3.125 (1.147)	2.909 (1.300)	2.100 (1.119)	2.853 (1.520)	3.000 (1.000)	2.738 (1.345)
<b>Financial Behaviour</b>	3.271 (0.505)	3.606 (0.574)	<b>3.750 (0.417)</b>	3.235 (0.713)	2.889 (0.509)	3.401 (0.627)
Consumer Satisfaction	3.969 (0.464)	3.727 (0.564)	3.800 (0.594)	4.059 (0.672)	3.667 (0.764)	3.923 (0.609)
Future Usage	3.906	3.909	3.850	4.221	4.000	4.024 (0.565)

Preference	(0.455)	(0.625)	(0.587)	(0.553)	(0.500)
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Note. Values in parentheses = standard deviations. Bold rows = constructs yielding significant ANOVA results ( $p < 0.05$ ). Red = lowest mean for significant construct; Green = highest mean for significant construct. N per group: <18 = 16; 18–30 = 11; 30–45 = 20; 45–60 = 34; 60–75 = 3. Source: Author's primary data.

### 5.3 Assumption Testing

Table 5 presents a combined summary of the Shapiro-Wilk normality tests (per construct per age group) and Levene's test for homogeneity of variances. Shapiro-Wilk results are presented for the four groups with  $n \geq 10$  (the 60–75 group,  $n = 3$ , is not reported as the test is unreliable below  $n = 4$ ). Crucially, Levene's test is passed by all seven constructs (all  $p > 0.05$ ), confirming that the fundamental ANOVA prerequisite of homogeneous variances is satisfied throughout. Normality violations in individual cells (particularly for Consumer Satisfaction and Adoption Rate) are addressed by reporting Kruskal-Wallis non-parametric checks.

**Table 5.3: Assumption Testing, Shapiro-Wilk (Normality) and Levene's Test (Homogeneity of Variances)**

Construct	S-W <18	S-W 18–30	S-W 30–45	S-W 45–60	Levene p-value	HoV Met?
Adoption Rate/Freq.	p=0.262	p=0.017	p<0.001	p<0.001	p=0.188	MET
Transaction Conv.	p=0.001	p=0.380	p=0.082	p<0.001	p=0.820	MET
Security & Trust	p=0.211	p=0.438	p=0.022	p=0.008	p=0.219	MET
Transparency	p=0.268	p=0.448	p=0.003	p<0.001	p=0.065	MET
Financial Behaviour	p=0.145	p=0.212	p=0.174	p=0.004	p=0.284	MET
Consumer Satisfaction	p=0.028	p=0.033	p=0.026	p=0.009	p=0.696	MET
Future Usage Pref.	p=0.042	p=0.498	p=0.057	p=0.003	p=0.661	MET

Source: Author's Calculations from primary data. Note: S-W = Shapiro-Wilk W statistic p-value. = normality not rejected ( $p > 0.05$ ); = normality rejected ( $p < 0.05$ ). HoV = Homogeneity of Variances (Levene's test). All constructs meet the HoV assumption (all Levene  $p > 0.05$ ).

### 5.4 One-Way ANOVA Results

Table 5.4 presents the complete one-way ANOVA results for all seven constructs. Two constructs, adoption rate/frequency of use and financial behavior, yield statistically significant results. The remaining five constructs are not significant, indicating that age does not meaningfully differentiate consumer attitudes toward UPI security, transparency, satisfaction, or future preference.

**Table 5.4: One-Way ANOVA Results , UPI Perceptions and Behaviours by Age Group (N = 84)**

Construct	N	df (b)	df (w)	F	p-value	$\eta^2$	Result	Hypothesis
Adoption Rate/Frequency of Use	84	4	79	8.689	0.001	0.306	Significant	H <sub>10</sub> Rejected
Transaction Convenience	84	4	79	2.043	0.096	0.094	Not Significant	H <sub>20</sub> Retained
Perceived Security and Trust	84	4	79	0.182	0.947	0.009	Not Significant	H <sub>40</sub> Retained
Transparency	84	4	79	1.639	0.173	0.077	Not Significant	H <sub>40</sub> Retained
Financial Behaviour	84	4	79	3.483	0.011	0.150	Significant	H <sub>30</sub> Rejected
Consumer Satisfaction	84	4	79	1.071	0.376	0.051	Not Significant	H <sub>40</sub> Retained
Future Usage Preference	84	4	79	1.870	0.124	0.087	Not Significant	H <sub>40</sub> Retained

Source: Author’s Calculations from primary data.. Note:  $df(b)$  = between-group degrees of freedom ( $k-1=4$ );  $df(w)$  = within-group degrees of freedom ( $N-k=79$ ).  $\eta^2$  = eta-squared effect size. Benchmarks (Cohen, 1988):  $\eta^2 \approx 0.01$  is small,  $\eta^2 \approx 0.06$  is medium, and  $\eta^2 \geq 0.14$  is large. =  $H_0$  rejected at  $\alpha=0.05$ .

### 5.5 Non-Parametric Robustness Check: Kruskal-Wallis

Table 5.5 presents Kruskal-Wallis H test results alongside ANOVA outcomes for comparison. For six of the seven constructs, both tests converge on the same conclusion. The one divergence, Transaction Convenience, is noteworthy: ANOVA yields  $p = 0.096$  (non-significant), while Kruskal-Wallis yields  $H = 11.852$ ,  $p = 0.019$  (significant). This divergence is attributable to the non-normal distribution of scores in the 45–60 group for this construct, which inflates within-group error in the parametric test. Both results are reported transparently; the conservative ANOVA result (non-significant) is used in hypothesis disposition.

**Table 5.5: Kruskal-Wallis Non-Parametric Robustness Check vs. ANOVA Results**

Construct	KW H Statistic	KW p-value	KW Result	Agreement with ANOVA?
Adoption Rate/Frequency of Use	20.14	<0.001	Significant	Confirms ANOVA
Transaction Convenience	11.85	0.01	Significant	Diverges, ANOVA $p=0.096$ ; borderline
Perceived Security and Trust	0.92	0.92	Not Significant	Confirms ANOVA
Transparency	6.29	0.17	Not Significant	Confirms ANOVA
Financial Behaviour	14.12	0.00	Significant	Confirms ANOVA
Consumer Satisfaction	5.14	0.27	Not Significant	Confirms ANOVA
Future Usage Preference	7.38	0.11	Not Significant	Confirms ANOVA

Source: Author’s calculations. Note: KW = Kruskal-Wallis H test;  $df = 4$  for all constructs. 'Diverges' for Transaction Convenience: KW is significant ( $p=0.019$ ) while ANOVA is non-significant ( $p=0.096$ ). This divergence is attributable to non-normal score distributions in the 45–60 group. The ANOVA result (non-significant) is used in hypothesis disposition.

**5.6 Post-Hoc Analysis: Tukey HSD**

Tukey's HSD post-hoc tests were conducted for the two constructs yielding significant ANOVA results. With five age groups, 10 pairwise comparisons were computed for each construct (20 total). All 95% confidence intervals are family-wise error corrected.

**Adoption Rate / Frequency of Use**

The ANOVA revealed a highly significant, large-effect difference across age groups:  $F(4,79) = 8.689, p < 0.001, \eta^2 = 0.306$ . This effect size indicates that age group alone explains 30.6% of the variance in UPI adoption frequency, a substantial magnitude. Table 5.6 presents all 10 pairwise comparisons. Three pairs involving the <18 group are significant.

**Table 5.6: Tukey HSD Post-Hoc Pairwise Comparisons, Adoption Rate / Frequency of Use**

Group 1	Group 2	Mean Diff (G1 > G2)	95% CI Lower	95% CI Upper	Adj. p-value	Reject Ho?
18–30	<18	+1.091	0.265	1.917	0.004	YES
30–45	<18	+1.350	0.643	2.057	<0.001	YES
45–60	<18	+1.177	0.537	1.816	<0.001	YES
18–30	30–45	-0.259	-1.051	0.532	0.891	no
18–30	45–60	-0.086	-0.817	0.646	0.997	no
18–30	60–75	-0.424	-1.798	0.949	0.910	no
30–45	45–60	-0.174	-0.768	0.421	0.925	no
30–45	60–75	-0.683	-1.989	0.622	0.590	no
45–60	60–75	-0.510	-1.780	0.760	0.795	no
60–75	<18	+0.667	-0.660	1.993	0.628	no

*Source: Author's Calculations from primary data.. Note. Mean Difference = Group 1 mean minus Group 2 mean. Positive values indicate Group 1 uses UPI more frequently. 95% CIs are family-wise error-corrected (Tukey's HSD). Adjusted p-values account for multiple comparisons.*

Table 5.6 shows significant pairs (adoption rate). There are three significant comparisons, all of which are between the <18 group and adult groups. No other pairs are significant, confirming the <18 group as the only outlier.

**Financial Behaviour**

The ANOVA for financial behavior was confirmed by Kruskal-Wallis ( $H = 14.123, p = 0.007$ ). Table 5.7 presents all 10 pairwise comparisons. One pair is significant.

**Table 5.7: Tukey HSD Post-Hoc Pairwise Comparisons, Financial Behaviour**

Group 1	Group 2	Mean Diff (G1 > G2)	95% CI Lower	95% CI Upper	Adj. p-value	Reject H <sub>0</sub> ?
<b>30-45</b>	<b>45-60</b>	<b>-0.515</b>	-0.981	-0.049	<b>0.023</b>	<b>YES</b>
18-30	<18	-0.335	-0.983	0.313	0.601	no
18-30	30-45	-0.144	-0.765	0.477	0.967	no
18-30	45-60	-0.371	-0.945	0.203	0.379	no
18-30	60-75	-0.717	-1.795	0.360	0.348	no
30-45	<18	-0.479	-1.034	0.076	0.123	no
30-45	60-75	-0.861	-1.885	0.163	0.141	no
45-60	<18	+0.036	-0.466	0.537	1.000	no
45-60	60-75	-0.346	-1.343	0.650	0.868	no
60-75	<18	+0.382	-0.659	1.423	0.843	no

Source: Author's Calculations from primary data.. Note. Mean Difference = Group 1 mean minus Group 2 mean. Negative values indicate Group 2 has a higher financial behavior score. 95% CIs are family-wise error-corrected.

Table 5.7 shows Significant Pairs (Financial Behavior): One Pair Is Significant, 30-45 vs. 45-60. The 30-45 group has a significantly higher impact on UPI-related financial behavior than the 45-60 group. All other pairwise comparisons, including those with the <18 and 60-75 groups, were non-significant.

**5.7 Hypothesis Disposition Summary**

Table 5.8 synthesises the hypothesis outcomes based on real computed ANOVA and post-hoc results.

**Table 5.8: Hypothesis Testing Summary**

Construct	F-Statistic	p	$\eta^2$	Effect Size	Hypothesis Outcome	Significant Pairs
Adoption Rate/Freq. of Use	F(4, 79) = 8.689	<0.001	0.306	Large *	H <sub>10</sub> Rejected	<18 < 18-30 (p=.004) <18 < 30-45 (p<.001) <18 < 45-60 (p<.001)
Transaction Convenience	F(4, 79) = 2.043	0.096	0.094	Medium	H <sub>20</sub> Retained	None (KW: borderline p=.019)
Perceived Security & Trust	F(4, 79) = 0.182	0.947	0.009	Small	H <sub>40</sub> Retained	None
Transparency	F(4, 79) = 1.639	0.173	0.077	Medium	H <sub>40</sub> Retained	None
Financial Behaviour	F(4, 79) = 3.483	0.011	0.150	Large	H <sub>30</sub> Rejected	30-45 > 45-60 (p=.023)

Consumer Satisfaction	F(4, 79) = 1.071	0.376	0.051	Small/Med.	H <sub>40</sub> Retained	None
Future Usage Preference	F(4, 79) = 1.870	0.124	0.087	Medium	H <sub>40</sub> Retained	None

Source: Author's Calculations from primary data. Note. \* = Large effect size ( $\eta^2 \geq 0.14$ ; Cohen, 1988). p-values from one-way ANOVA,  $\alpha = 0.05$ . Tukey's HSD corrected p-values for significant pairs).

## 5.8 Discussion of findings

### Age and UPI Adoption Frequency: The Financial Autonomy Effect

The most statistically robust finding in this study establishes age as a large-effect predictor of UPI adoption frequency. The three significant Tukey HSD pairs collectively reveal a single pattern: the under-18 cohort uses UPI significantly less frequently than all major adult groups (18-30, 30-45, 45-60). Critically, no significant differences exist among adult age groups themselves, indicating that the age effect is not linear but categorical: the boundary lies between minors and adults. This finding appears to contradict the conventional technology adoption literature, which predicts that younger cohorts adopt digital innovations more readily due to higher digital literacy and lower techno-anxiety (Rogers, 2003). However, UPI adoption defies this expectation because it is fundamentally a financial transaction tool: its adoption requires a bank account, a linked mobile number, and a personal spending context, all of which are constrained for minors in India who operate under parental financial control. This interpretation aligns with the UTAUT's facilitating conditions construct (Venkatesh et al., 2003): when institutional enablers (bank accounts, financial autonomy) are absent, even positive attitudes toward a technology do not translate into usage. The implication is significant; the sub-18 cohort's lower adoption is not a literacy or attitudinal problem but a structural one, amenable to targeted policy intervention. Singh's (2025) qualitative observations about generational differences in UPI adoption among small business owners echo this finding from a different angle: younger business owners adopt UPI through financial necessity, not merely familiarity. The present study's quantitative confirmation, with a large effect size, lends inferential weight to what has until now been only qualitatively observed.

### Financial Behaviour: The Peak-Earning Age Effect

The significant ANOVA for financial behavior, with the single significant Tukey pair being 30-45 versus 45-60, reveals a nuanced generational pattern. The 30-45 group (M = 3.750) reports stronger UPI-mediated financial behaviour impact than the 45-60 group (M = 3.235), despite both groups using UPI at similar frequencies. This discrepancy between similar usage intensity and different financial behaviour impact suggests that the 30-45 cohort is integrating UPI more deeply into their financial management ecosystem, applying it not just for discrete transactions but for budgeting, autopay, and spending tracking. This is consistent with Verma et al.'s (2024) finding that UPI AutoPay and one-click transactions have changed spending patterns: these

features are most impactful for consumers managing complex, multi-stream financial obligations, a profile that exactly characterises the 30-45 demographic, which is simultaneously managing home loans, children's education costs, investment SIPs, and daily household expenditures. The 45-60 group, approaching peak wealth and financial stability, may conduct the same transaction volume but experience fewer changes to pre-existing, settled financial habits.

### **Age-Invariant Dimensions: Convergence of Attitudinal Evaluation**

The non-significant results for perceived security and trust, consumer satisfaction and future usage preference are both theoretically and practically meaningful. They confirm that once UPI is adopted, regardless of the age at the time of adoption, the evaluations of its reliability, satisfaction with its features and future usage intentions converge across generations. This finding directly challenges the assumption embedded in many digital inclusion policies that older consumers are inherently more distrustful or less satisfied with digital payment systems. The strong correlation between future usage preference and consumer satisfaction in descriptive data (groups with higher satisfaction uniformly show higher future preference) suggests that the pathway to sustained adoption is through satisfaction, not through age-specific trust campaigns. Sardana and Singhania (2018) found similar convergence in their cross-age urban sample, attributing it to the equalising effect of successful experience with digital finance. The implication for policymakers is clear: the demographic target for trust-building campaigns should not be defined by age but by adoption status, i.e., non-users regardless of age.

The divergence for transaction convenience, where ANOVA yields non-significant results but Kruskal-Wallis yields significant ones, warrants explicit discussion. The 45-60 group shows the highest convenience mean ( $M = 4.324$ ) and the 18-30 group the lowest among adults ( $M = 3.939$ ), a reversal of UTAUT's prediction that younger users would perceive less effort. This may reflect that for the 45-60 cohort, UPI's convenience is evaluated relative to a prior baseline of cash, cheque, and in-branch banking, making the relative improvement more salient. Younger users, who expect digital interfaces to be a given, may be weighing convenience against a higher bar, and this warrants further exploration in future research.

## **6. Conclusions**

This study provides the first inferential, age-disaggregated analysis of UPI adoption across seven constructs using primary survey data from 84 urban Indian respondents. The central findings are the following: Age significantly influences UPI adoption frequency, the largest effect in the study. The <18 cohort drives this effect, using UPI significantly less than all three major adult groups. Second, age significantly influences financial behaviour associated with UPI. Third, the 30-45 cohort reports the highest impact, significantly exceeding the 45-60 group. Fourth, age

does not significantly influence perceived security, consumer satisfaction, transparency, or future usage preferences ( $H_{40}$  retained for all four constructs). Attitudinal evaluations of UPI converge across generations, a finding with important policy implications.

Fifth, transaction convenience presents a borderline result, warranting further investigation with a larger, more balanced sample.

These findings have three specific policy implications. a) Youth Financial Autonomy Programs: The relatively low levels of UPI adoption among the under-18 cohort are a structural problem, not an attitude problem. The PMJDY scheme framework could be adapted for this cohort explicitly. b) Age-Sensitive UPI Interface Design: The borderline convenience finding for Transaction Convenience, with the 45-60 group perceiving the most convenience, suggests that the 18-30 group may find current UPI interfaces adequate but not exceptional relative to global digital standards. c) Dual-Path Infrastructure Policy: Following Banu et al., interface designers should perform age-stratified usability testing to identify which features contribute to perceptions of convenience across cohorts and invest in features most valued by younger users (speed, integration with social payments, gamification) without compromising accessibility for older users. dual-path framework, the present study's finding that 40.5% of respondents expect to use UPI and cash equally suggests that cash will remain a meaningful transactional medium in the medium term. Policy must therefore simultaneously maximise digital infrastructure investment (particularly in rural broadband, where the present sample's urban bias limits direct inference) and maintain equitable cash access for the digitally excluded, elderly, and low-income populations absent from this study's sample.

This study has certain principal limitations that future research should address. a) Sampling bias: The convenience sample was limited to urban, mostly higher-income respondents. To achieve national representativeness, stratified random sampling over rural and urban strata, income level, and geographic region is needed. b) Small subgroup sizes: The 60-75 group ( $n = 3$ ) and the 18-30 group ( $n = 11$ ) are underpowered for post hoc analysis. To increase statistical power, a minimum of  $n = 30$  per group is recommended for future ANOVA studies. c) Lack of gender data: Gender is a known moderator of UPI adoption (Ruban & Sahila, 2023) and should be systematically collected and tested using two-way ANOVA in future studies. ) Cross-sectional design: The study captures attitudes at a single point in time and cannot establish causal relationships or track adoption trajectories over time. Longitudinal panel designs would considerably strengthen causal inference. e) Single-country, single-urban context: Comparative studies across Indian states, or cross-national comparisons with other UPI-exporting contexts (Bhutan, Singapore, UAE), would enhance the generalisability of these findings.

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