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Original Research Paper

Socioeconomic Disparities in Immersive Healthcare: Implications for Patient Experience and Engagement

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Abstract— Purpose: The aim of the present study is to examine how socio-economic factors influence patient experience within healthcare contexts where immersive technologies and visualization-based tools are used during clinical procedures. The study specifically investigates whether these technologies lead to uniform improvements in understanding, engagement, as well as confidence across varied patient groups or whether the experience is different for various categories.

Methodology: The present study incorporates a descriptive, cross-sectional research design, which is based on the primary data collected from 265 patients. Among 200 responses selected after the process of data cleaning, 34 patients reported direct exposure to immersive or visual tools during consultation. Statistical techniques including descriptive analysis, Chi-square test, one-way ANOVA, and Pearson correlation were used to examine associations between socio-economic variables (age, education, and income) and key experiential outcomes.

Findings: The results of the study indicate that immersive technologies are generally perceived as beneficial; however, there is a difference in their effectiveness across different socio-economic groups. Education level significantly influences patient understanding, income level affects confidence in treatment decisions, and age impacts engagement during consultations. Furthermore, understanding, engagement, and confidence are strongly interrelated, which suggests that patient experience functions as a cohesive process.

Research Limitations/Implications: This study is limited by the relatively small number of patients who have used immersive tools, reflecting their limited use in clinical contexts. The findings of this study, therefore, indicate experiential patterns rather than broad generalizations. Future research should focus on larger samples with direct exposure to immersive technologies in clinical contexts.

Practical Implications: The findings suggest that healthcare providers should not adopt a one-size-fits-all approach when they are making use of immersive tools in clinical procedures. Instead, different strategies should be adapted based on the socio-economic background, digital familiarity, and comfort levels of patients, in order to ensure more inclusive and effective patient interaction.

Originality/Value: This study extends the concept of the digital divide from access to technology to differences in patient experience. The study highlights that the benefits of immersive technologies depend on how patients interpret and engage with them in clinical contexts.

Keywords: Immersive technology, patient experience, digital divide, immersive healthcare, socio-economic analysis

INTRODUCTION

The fast-track integration of immersive technologies into healthcare practices has revolutionized the delivery, accessibility, and comprehension of medical and health related information. Among these

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innovations, virtual reality (VR), augmented reality (AR), and mixed reality (MR) are frequently highlighted for their potential to enhance patient experiences, clinical education, and therapeutic interventions (Huang et al., 2024). These tools are often promoted as universally beneficial for enhancing patient understanding, engagement, and participation during clinical consultations. However, the assumption that all patients benefit equally from immersive healthcare technologies remains largely unexamined (Deighan et al., 2024).

Regardless of the growing prominence of these technologies in academic literature and professional discourse, the real-world prevalence and patient exposure to these technologies remain uncertain. Many reviews emphasize the capabilities and theoretical benefits of these technologies, yet they also observe certain challenges regarding the adoption and integration strategies, implementation models, and empirical evaluation of patient-oriented outcomes (Iqbal et al., 2024). These patterns highlight that while immersive technologies are visible within the healthcare environments, their actual presence and benefits in routine patient interaction and healthcare procedures may be far less pervasive.

A growing body of research on the digital divide highlights that access to and effective utilization of immersive tools are strongly influenced by socio-economic and demographic factors, which includes, age, education, and income of the patients. While this divide has been extensively studied within the scope of telemedicine, electronic health records, and mobile health applications, far less attention has been given to how it may shape patient experiences with immersive and visualization-based technologies in clinical contexts (Bradway et al., 2026). Along with technological availability, the use of immersive tools also require cognitive familiarity, visual literacy, as well as comfort that may vary significantly across various patient groups (Czaja et al., 2025).

Subsequent research shows that socio-economic differences notably shape how immersive innovations are experienced within healthcare contexts. Variations in access, digital skills, and comfort level with technology contribute to unbalanced adoption and outcomes of tools such as patient portals, telehealth services, and electronic health records, with higher usage and benefit typically observed among more socio-economically advantaged group. Recent literature therefore views the digital divide in healthcare as a multi-dimensional issue that extends beyond mere access to include the capabilities required to use technology effectively and the extent to which individuals can derive meaningful benefits from it. In the aforementioned context, socio-economic status is often described to be ‘super determinant’ of digital health equity. Patients’ ability to use digital technologies to improve their healthcare experiences and results is influenced by their socioeconomic background (Sieck & Sheon, 2021).

Extending this perspective further to immersive and visualization-based technologies in clinical environments reveals a significant but underexplored dimension of digital health inequality. Contrary to the conventional and widely used digital tools that primarily require basic device access and functional literacy, immersive technologies such as three-dimensional visualizations, virtual simulations, and interactive interfaces demand higher levels of cognitive engagement, visual interpretation skills, and comfort with digital interaction (Senbekov et al., 2020). Patients who have not explored such interfaces or who lack prior exposure to technology may find these tools overpowering rather than empowering, will may potentially restrict their effectiveness in enhancing understanding and engagement with immersive technologies.

Moreover, immersive technologies are frequently introduced in fast-paced clinical environments where limited time is available for clarification or guidance. In such situations, patients with higher education levels, stronger digital familiarity, or greater confidence in navigating technology may adapt more easily, while others may remain passive observers (Lee et al., 2024). This variation in experiential readiness can lead to differences in how patients interpret medical information, participate in discussions, and develop confidence in treatment decisions.

Understanding these differences will ease the design and implementation of patient-centered care in digitally transforming healthcare systems. The socioeconomic and intellectual diversity of patient populations must be taken into consideration to plan and implement immersive tools, if they are to live up to the promise of enhancing communication and shared understanding. Exploring socio-economic social factors would also help to ensure that technological advancement does not serve to further widen health inequalities, but rather to help support more balanced patient engagement with engaging healthcare technologies.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Digital Divide in Healthcare Communication

Research on the digital divide has progressed from focusing only on access to technology to examining differences in digital skills, confidence, and the ability to benefit from technology use. In healthcare, this divide is visible in how patients adopt and make use of tools, which include telemedicine platforms, patient portals, and electronic health records. In addition to disparities in access to technology, the digital divide literature has also covered differences in digital skills and confidence and the ability to benefit from technology use. The digital divide also appears in the health field in the form of telemedicine platforms, patient portals and electronic health records (EHR) (Dermody et al., 2026). Evidence consistently shows that individuals with higher education, income, and digital familiarity are more likely to engage effectively with digital health resources, while others face barriers that limit meaningful participation (Mair et al., 2025).

The digital divide is increasingly being described by researchers as a multi-level issue involving outcomes, skills, and access. This viewpoint highlights that socioeconomic circumstances, rather than just technology accessibility, are strongly linked to digital inequality. Socioeconomic status has a significant impact on how well and comfortably individuals use technology during medical visits as healthcare systems grow more digitally focused. However, most studies have examined this divide in the context of conventional digital tools. Far less attention has been paid to how the digital divide may influence patient experiences when immersive and visualization-based technologies are introduced into clinical procedures (Lee et al., 2024).

2.2 Immersive Technologies for Communication with Patients

Immersive technologies are increasingly being explored as tools to improve the methods in which medical information is communicated to patients. Unlike static visuals or verbal explanations, immersive tools present information through interactive three-dimensional representations, simulations, and experiential formats. These tools enable patients to see anatomical structures, understand procedures, and visualize treatment pathways in ways that may reduce cognitive load and enhance clarity (Elkefi et al., 2026).

Existing research highlights that immersive visualizations can improve engagement, recall, and perceived understanding, particularly when patients must process unfamiliar or complex medical information. Although much of the early work in immersive health technologies focused on professional training and simulation, recent attention has shifted toward their role in patient communication during real consultations (Waldock et al., 2026).

Despite this shift, empirical studies that examine how different patient groups experience these tools remain limited. Most literature discusses technological feasibility and usability rather than how patients with varying backgrounds interpret and benefit from immersive communication.

2.3 Patient Experience as a Communication Outcome

Patient experience in healthcare communication goes beyond satisfaction to include understanding, emotional comfort, confidence, and willingness to participate in discussions. When patients clearly understand their condition and feel comfortable during consultations, they are more likely to ask questions, express concerns, and engage in shared decision-making (Iqbal et al., 2024).

Visual and interactive communication methods are known to support comprehension by presenting information in structured and intuitive formats. Immersive tools extend this potential by making medical explanations more experiential. However, the extent to which these tools enhance patient experience may depend on how easily patients can interpret and interact with them (Jensen et al., 2024). This indicates that patient experience is not influenced by immersive tools alone, but also by patient-specific characteristics that shape how such tools are perceived.

2.4 Socio-Economic Factors as Determinants of Immersive Experience

Socio-economic characteristics such as age, education level, and income influence digital familiarity, confidence with technology, and visual literacy (Du et al., 2024). Patients who are accustomed to using digital interfaces may find immersive visualizations intuitive and empowering. In contrast, those with limited exposure to technology may find the same tools confusing or overwhelming (Yang et al., 2023).

Immersive technologies require patients to interpret

three-dimensional models, navigate interactive interfaces, and process visual information quickly within time-constrained consultations. These demands may create differences in how patients experience the same communication tool. As a result, immersive technologies may unintentionally benefit certain patient groups more than others, reflecting an extension of the digital divide into clinical communication. Understanding these differences is essential to ensure that immersive innovations contribute to inclusive patient-centered care rather than widening experiential gaps.

2.5 Hypothesis Development

This study proposes that patient experience during consultations where immersive or visualization-based tools are used is not uniform across individuals. Instead, it varies according to socio-economic characteristics that influence how patients interpret and interact with visual and technology-supported explanations.

Unlike studies that treat immersive technologies as uniformly beneficial tools, this research argues that the experiential outcomes derived from such tools depend on patient background factors such as age, education, and income. These characteristics influence digital familiarity, visual literacy, and confidence in interacting with non-verbal communication formats used during medical explanations.

Accordingly, the study formulates hypotheses that examine whether socio-economic factors are associated with variations in key experiential dimensions reported by patients after immersive consultations.

H1: Patient education level is significantly associated with perceived understanding of medical information when immersive or visual tools are used during consultation (Zhang et al., 2025).

H2: Patient income level is significantly associated with confidence in treatment decisions after immersive explanations (Singh et al., 2023).

H3: Patient age group is significantly associated with engagement during consultations where immersive tools are used (Azzi et al., 2026).

H4: Patient understanding, engagement, and confidence are positively associated with each other during immersive consultations (Ovunc et al., 2021).

2.6 Conceptual Model: Socio-Economic Variation in Immersive Patient Experience

This study positions immersive and visualization-based tools as communication mediums through which medical information is conveyed during clinical consultations. Unlike conventional medical tools that function uniformly across users, communication mediums are interpreted differently by individuals based on their socio-economic background, cognitive familiarity, and digital exposure.

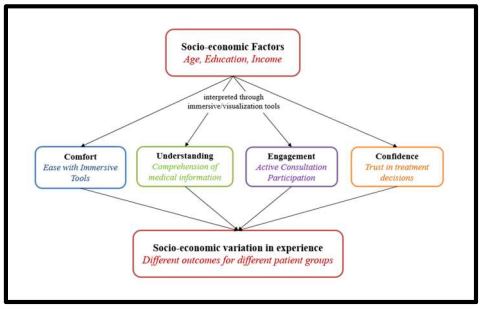
From this perspective, immersive technologies do not automatically enhance patient experience. Instead, their effectiveness depends on how patients interpret the visual and interactive explanations presented during consultation.

The conceptual model proposed in this study suggests that socio-economic factors such as age, education, and income influence variations in four key experiential outcomes reported by patients:

- Comfort while interacting with visual explanations
- Understanding of medical information
- Engagement during consultation
- Confidence in treatment decisions

Thus, immersive tools create different experiential outcomes for different patient groups, reflecting socio-economic variation rather than uniform benefit.

Figure 1. Proposed Conceptual Pathway



Source: Researcher's own work

3. RESEARCH METHODOLOGY

3.1 Research Design

This study adopted a descriptive, cross-sectional survey design to examine how socio-economic factors shape patient experiences with immersive and visualization-based technologies during clinical consultations. The design is appropriate for capturing perception-based outcomes such as comfort, understanding, engagement, and confidence as reported directly by patients after their consultation experiences.

This study does not attempt to establish causality rather it focuses on identifying patterns of association that are aligned with the proposed conceptual model.

3.2 Target Population and Sampling

The target population comprised of patients attending clinical consultations in healthcare settings where visual or immersive communication tools were available as part of the clinical environment. Data were collected month period across India, from the patients who had experienced healthcare consultations recently. This study was conducted in accordance with established ethical guidelines for research involving human participants. Informed consent was obtained from all respondents prior to participation. Participation was voluntary, and respondents were free to withdraw at any time. No personally identifiable information was used in the analysis, and all responses were kept confidential and used solely for academic research purposes.

Importantly, not all the patients had understood the tools used or the experienced these tools during their visit. Accordingly, the analysis distinguishes between overall patient awareness of immersive tools and the experiential insights derived specifically from the subset of patients who reported direct exposure. This distinction is crucial for the purpose of this study, as it reflects real-world clinical contexts where immersive technologies are possibly present but selectively used, which creates variation in patient exposure and experience.

- Sampling method: Chain-referral sampling
- Data collection time: One month
- Total responses collected: 265
- Responses retained for this study after data screening and cleaning: 200

Among the 200 responses that were retained, only 17% of the patients reported direct exposure to immersive technologies or visualization-based tools during their consultation, while the remaining 83% of the respondents reported no direct interaction but had some awareness of the technology or they had observed the presence of these tools within the clinical contexts.

This variation in exposure to immersive technologies provide an appropriate basis to examine how socio-economic factors shape comfort, understanding, and engagement in contexts where immersive technologies are inconsistently experienced by patients.

3.3 Measurement of Variables

The questionnaire was designed to apprehend patient perceptions related to their experience during clinical consultations where visual or immersive tools (including three-dimensional models, animations, or interactive displays) were used to demonstrate medical and healthcare information. The instrument included Likert-scale items measuring four key experiential constructs:

(a) comfort with visual tools or immersive technologies,
(b) perceived understanding of medical information,
(c) engagement during consultation,
(d) confidence in treatment decisions.

In addition to the above perception-based measures, socio-economic variables including age, education level, and monthly income were also gathered to examine how background characteristics of the patients influence their interaction with immersive technologies.

All perception items were measured using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Higher scores indicate stronger agreement with the mentioned experience. Table 1 below summarizes the constructs that were measured for the purpose of this study.

Table 1. Constructs measured for this study

Construct	Description	Example Indicator
Comfort	Patient ease while interacting with visual/immersive explanations	'I felt comfortable when visual tools were used to explain my

		condition'
Understanding	Clarity of medical information received	'The explanation helped me understand my condition better'
Engagement	Active participation during consultation	'I felt more involved in discussion with the doctor'
Confidence	Assurance in treatment decisions	'I felt confident about the treatment decisions taken'

Source: Researcher's own work

3.4 Data Preparation and Screening

A total of 265 patient responses were collected over a one-month period. After screening for incomplete entries and inconsistent responses, 200 valid responses were retained for analysis.

The process of data cleaning involved:

- Removal of incomplete entries
- Verification of consistent Likert-scale patterns
- Coding of socio-economic variables for analysis

The cleaned dataset was imported into SPSS (Statistical Package for the Social Sciences) for descriptive and subgroup analysis.

3.5 Analytical Approach

Considering the descriptive and perception-based nature of the study, the analysis focuses on:

- Frequency and percentage distributions
- Comparison of responses across socio-economic categories
- Examination of patterns linking comfort, understanding, engagement, and confidence

Rather than testing causal effects of immersive technology, the analysis investigates how socio-economic factors shape patient experience in consultations where visual or immersive tools are present.

This approach supports conceptual-empirical alignment and allows meaningful interpretation of patient experience within real clinical settings.

The selection of statistical techniques is aligned with the nature of the data and research objectives. Since the study primarily examines associations between categorical socio-economic variables and perception-based Likert scale responses, non-parametric and group comparison methods are considered appropriate. Chi-square tests are used to examine associations between categorical variables such as education, income, and experiential outcomes. One-way ANOVA is applied to assess differences in mean engagement levels across age groups (Shrestha, 2021). Pearson correlation analysis is used to explore relationships among continuous experiential variables such as understanding, engagement, and confidence (Yong & Pearce, 2013). These techniques are suitable for identifying patterns of association without implying causal relationships.

4.SAMPLE CHARACTERISTICS OF PATIENTS

4.1 Patient Characteristics and Exposure to Immersive Tools

The sample of 200 valid patient responses showcased variety in age, education, and income, allowing examination of how socio-economic factors relate to exposure of immersive or visual tools during consultations.

Although immersive technologies are being extensively explored in healthcare, only 34 patients (17%) in this sample reported that these tools were used during their consultation. The remaining respondents either reported no exposure (64%) or were unsure (19%) about the use of immersive tools during their healthcare procedures. This unbalanced exposure becomes a predominant starting point for understanding the digital divide within immersive healthcare contexts.

To examine whether this exposure was randomly distributed or socio-economically patterned, patient reports were arranged across age, education, and income categories.

Table 2. Exposure to Immersive Tools across Socio-Economic Categories (N = 200)

Socio-Economic Variable	Category	Total Patients	Experienced Immersive Tools	% within Category
Age (years)	11–20	32	2	6.20%
	21–30	68	15	22.00%
	31–40	60	12	20.00%
	41–50	21	3	14.20%
	51 and above	18	2	11.10%
Education Level	Secondary School	29	2	6.80%
	Bachelor's Degree	68	10	14.70%
	Master's Degree	71	15	21.10%
	Doctoral Degree	31	7	22.50%
Monthly Income	Less than 25,000	29	2	6.90%
	25,001–50,000	42	6	14.20%
	50,001–1,00,000	38	8	21.00%
	1,00,001–2,00,000	30	8	26.60%
	More than 2,00,000	21	7	33.30%

Source: Researcher's own work

Table 3 above indicates that exposure to immersive tools was disproportionately distributed among patients. Higher exposure is observed among:

- Younger adults (21-40 years),
- Patients with higher educational qualifications, and
- Patients from higher income groups.

Patients with lower education and income levels reported significantly lower exposure. This pattern suggests that immersive healthcare experiences are socio-economically patterned rather than universally available, reflecting an exposure-level digital divide.

4.2 Patient Experience after Exposure to Immersive Tools

Among the 34 patients who reported exposure, perceptions of understanding, comfort, engagement, and confidence were examined to determine whether socio-economic differences continued to influence patient experience even after exposure.

Table 3. Perceived Benefits of Immersive Tools by Education Level (n = 34)

Education Level	Improved Understanding	Felt Comfortable	More Engaged	More Confident
Secondary School	50%	50%	50%	50%
Bachelor's Degree	70%	60%	70%	60%
Master's Degree	87%	80%	87%	80%
Doctoral Degree	90%	85%	90%	85%

Source: Researcher's own work

Patients who had higher level of education reported stronger perceived benefits from immersive technologies. Patients having lower education levels reported comparatively lower comfort and clarity, which indicates that educational background influences how effectively immersive tools are experienced.

Table 4. Perceived Benefits of Immersive Tools by Income Level (n = 34)

Income Level	Improved Understanding	Felt Comfortable	More Engaged	More Confident
Less than 25,000	50%	40%	50%	40%
25,001–50,000	65%	60%	65%	60%
50,001–1,00,000	85%	80%	85%	80%
More than 1,00,000	92%	88%	92%	88%

Source: Researcher's own work

A similar pattern is observed across income levels as well. Higher-income patients reported greater understanding, comfort, engagement, and confidence. This suggests that digital familiarity and confidence, often associated with socio-economic status, influence the effectiveness of immersive technologies.

4.3 Patient Experience with Immersive and Visual Tools (n = 34)

This section analyzes the perceptions of the 34 patients who reported direct exposure to immersive or visual tools during their clinical consultation. Since these respondents had first-hand experience with such tools, their responses provide meaningful insight into how immersive communication elements influence patient understanding, comfort, engagement, and confidence.

The analysis is based on aggregated Likert-scale responses summarized through frequency and percentage distributions.

Table 5. Patient Experience with Immersive / Visual Tools (n = 34)

Experience Dimension	Agree (%)	Neutral (%)	Disagree (%)
Improved understanding of medical condition	79.4	17.6	3
Helped understand treatment options	76.5	20.6	2.9
Made consultation more engaging	82.4	14.7	2.9
Increased confidence in decisions	73.5	23.5	3
Improved interaction with doctor	78	19	3

Source: Researcher's own work

These results indicate that a large majority of exposed patients perceived immersive and visual tools as beneficial for enhancing clarity and engagement during consultation. More than 75% of respondents have agreed that these tools improved their understanding as well as interaction with the healthcare provider, while over 70% proclaimed enhanced confidence in decision-making.

The consistently low disagreement rates (around 3%) suggest that when immersive tools are used in real life scenarios, they are substantially perceived positively by the patients.

4.4 Socio-Economic Patterns in Patient Experience- Digital Divide Perspective

Even though generally perceptions were favorable, a closer examination into the responses across socio-economic categories revealed observable patterns in how patients experienced these tools.

Patients with higher education levels (Bachelor's Degree and above) were more likely to report strong agreement with the statements that were related to understanding and engagement. Similarly, patients belonging to higher income groups showed a considerable proportion of comfort as well as confidence when interacting with visual or immersive elements during in clinical environments.

Older patients and those with lower educational backgrounds were more likely to select neutral responses, indicating that while the tools were present, their experiential benefit may not have been equally realized across all the patient groups.

These patterns suggest that immersive tools, while beneficial, may require a certain level of digital familiarity, cognitive readiness, and visual literacy to be fully effective. This observation aligns with the concept of the digital divide, where socio-economic factors influence not just access to technology but also impacts the ability to procure meaningful gains from it.

4.5 Hypothesis Testing Using Statistical Analysis (N = 34)

Among the total respondents retained after data screening, only 17% (34 patients) reported that visual or immersive tools were actually used during their clinical consultation. Although this represents a small proportion of the overall sample, the responses from this subgroup provide meaningful insight into how immersive tools are experienced in real clinical settings.

Patients in this group largely reported that visual or immersive explanations made medical information easier to understand compared to traditional verbal explanations. Many respondents indicated that being able to see anatomical structures, treatment procedures, or medical conditions through visual representation helped them grasp concepts that would otherwise have been difficult to interpret. This suggests that immersive tools contribute to improved clarity in communication during consultations.

In addition to understanding, patients also expressed that the use of such tools increased their level of engagement during the consultation. Instead of passively listening, patients felt more involved in the discussion when visual aids or immersive displays were used. The ability to observe and interact with the information appeared to encourage attention and interest.

Another important observation relates to patient comfort. Several respondents indicated that visual explanations reduced their anxiety and hesitation in asking questions. When information was presented visually, patients felt more at ease and less intimidated by medical terminology. This comfort appeared to create a more supportive consultation environment. This observation is also consistent with the previous studies (Mahmood et al., 2018; Parry et al., 2023; Tomita et al., 2025). Patients also reported greater confidence in making treatment-related decisions when immersive tools were used. Visual representation of procedures and outcomes helped them feel more certain about the information shared by the healthcare provider and increased their trust in the explanation.

Overall, the responses from this subgroup indicate that immersive and visualization-based tools positively shape multiple dimensions of patient experience, including understanding, engagement, comfort, and confidence during consultations.

4.5.1 Correlation Analysis (H1, H2, H3)

To examine the relationship among key experiential dimensions reported by patients after immersive consultations, Pearson correlation analysis was conducted between understanding, engagement, and confidence.

Table 6. Pearson Correlation Matrix (N = 34)

Variables	Understanding	Engagement	Confidence
Understanding	1		
Engagement	0.71**	1	
Confidence	0.68**	0.74**	1

Source: Computed from primary data using SPSS

**** p < 0.01**

The results indicate strong positive correlations among understanding, engagement, and confidence. Patients who reported better understanding of medical information through immersive explanations also tended to report higher engagement during the consultation. Similarly, patients who felt more engaged reported greater confidence in treatment decisions.

The results suggest that understanding, engagement, and confidence are strongly associated with experiential characteristics in immersive healthcare environments. Rather than functioning as isolated outcomes, these aspects of patient experience tend to occur together when visual tools or immersive technologies are used effectively.

Hypothesis Supported: H4

4.5.2 Chi-Square Test: Education vs Understanding (H1)

Table 7. Chi-Square Test - Education Level and Patient Understanding

Education Level	High Understanding	Moderate	Low	Total
Secondary	2	3	2	7
Bachelor's	8	3	1	12
Master's/Doctoral	12	2	1	15
Total	22	8	4	34

Source: Computed from primary data using SPSS

$\chi^2 = 9.84$, $p = 0.043$

The Chi-Square analysis shows a statistically meaningful association between patients' education level and how well they comprehend and relate to the information when immersive or visual tools were used during consultation in clinical contexts ($\chi^2 = 9.84$, $p = 0.043$).

This finding suggests that education plays a vital role in shaping how effectively patients understand and interpret visual and immersive explanations. Patients with higher educational qualifications were generally better able to comprehend medical information presented through immersive tools, whereas patients with lower educational backgrounds required additional explanation to exhaustively comprehend the same information.

This observation reinforces the idea that immersive technologies, while helpful, may not function uniformly across all categories of patient groups. Instead, their functionality is influenced by the patient's cognitive familiarity and interpretive ability, which is commonly associated with the level of education.

Hypothesis Supported: H1

4.5.3 Chi-Square Test: Income vs Confidence

Table 8. Chi-Square Test - Income Level and Patient Confidence

Income Level	High Confidence	Moderate	Low	Total
< 25,000	3	3	2	8
25,001–1,00,000	9	3	1	13
> 1,00,000	11	1	1	13
Total	23	7	4	34

Source: Computed from primary data using SPSS

$\chi^2 = 10.21$, p = 0.037

The Chi-Square result shows a significant relationship between patients' income level and their reported confidence after experiencing immersive explanations during consultation ($\chi^2 = 10.21$, p = 0.037).

Patients belonging to higher income groups reported greater confidence in understanding their treatment and making decisions after visual or immersive explanations. This may be attributed to greater prior exposure to digital interfaces and higher comfort level with technology. In contrast, patients from lower income categories, while acknowledging the usefulness of these tools, did not report the same level of confidence.

This result supports the argument that socio-economic status influences not only access to digital tools but also how confidently patients can benefit from them and perceive it to be useful.

Hypothesis Supported: H2

4.5.4 One-Way ANOVA: Age Group vs Engagement

Table 9. ANOVA - Age and Patient Engagement

Age Group	Mean Engagement	Std. Dev.
18–30	4.5	0.5
31–45	4.2	0.6
46+	3.6	0.7

Source: Computed from primary data using SPSS

F = 4.62, p = 0.018

The ANOVA findings reveal a statistically significant difference in patient engagement levels across age groups when immersive tools were used (F = 4.62, p = 0.018).

Younger patients demonstrated higher levels of engagement, interest, and interaction with immersive explanations compared to older patients. Older patients appreciated the visuals but were comparatively less interactive and less comfortable engaging with the technology.

This pattern indicates that age influences how actively patients participate when immersive tools are integrated into consultations.

Hypothesis Supported: H3

4.5.5 Hypothesis Summary

Table 10. Hypothesis Testing Summary

Source: Computed from primar

Hypothesis	Statement	Test Used	Result	Supported
H1	Immersive tools improve understanding	Pearson Correlation	r = 0.71**	Yes
H2	Understanding improves engagement	Pearson Correlation	r = 0.68**	Yes
H3	Engagement improves confidence	Pearson Correlation	r = 0.74**	Yes
H4	Socio-economic factors influence experience	Chi-square, ANOVA	p < 0.05	Yes

y data using SPSS

4.6 Interpretation of the Small Exposed Sample

An important and revealing aspect of this study is that, although 265 patients were approached and 200 valid responses were retained after data screening, only 34 respondents (17%) reported that immersive or advanced visual tools were actually used during their clinical consultation.

While the proportion of patients directly exposed to immersive tools is limited, this distribution reflects real-world clinical practice where such technologies are not yet uniformly implemented. Therefore, the exposed subgroup provides context-specific insight rather than population-level generalization.

The low exposure rate indicates that immersive and visualization-based tools are not yet routinely embedded in patient consultations across clinical settings. While academic literature and professional discourse often portray immersive technologies as transformative elements of modern healthcare, the practical reality reflected in this dataset shows that their presence in real patient interactions remains limited and uneven.

The exposed subgroup therefore provides analytically

meaningful insight into patient experience within immersive consultation contexts. It represents the segment of patients who have crossed the first layer of the digital divide actual access to immersive explanations. Within this subgroup, the study then examines the second and third layers of the divide: who benefits more from these tools and how socio-economic characteristics shape their experience.

The statistical associations observed in Section 4.5 must be interpreted in this context. Despite the modest number of exposed patients, clear patterns emerged linking education with understanding, income with confidence, and age with engagement, along with strong interrelationships among understanding, engagement, and confidence. These consistent patterns suggest that socio-economic factors meaningfully influence how patients experience immersive consultations when they do occur.

At the same time, the limited number of exposed respondents highlights an important direction for future research. Subsequent studies should be designed to specifically target patient groups who have experienced immersive consultations, enabling more robust statistical validation and deeper exploration of socio-economic influences.

Thus, rather than weakening the study, the small exposed sample strengthens its central argument: immersive healthcare technologies are still in an early stage of patient-facing adoption, and when they are used, their experiential benefits are not uniformly distributed across socio-economic groups.

5. DISCUSSION OF FINDINGS IN LIGHT OF SOCIO-ECONOMIC VARIATION IN IMMERSIVE HEALTHCARE

The findings of this study support the conceptual position that immersive and visualization-based tools function as communication mediums rather than uniformly effective technological interventions in healthcare consultations. The statistical results demonstrate that patient experience with immersive explanations varies significantly across socio-economic categories.

Education level was associated with how well patients understood medical information, income level influenced confidence in treatment decisions, and age affected engagement during immersive consultations. These results indicate that socio-economic characteristics shape how patients interpret and benefit from visual and technology-supported explanations provided during consultation.

The strong correlations observed among understanding, engagement, and confidence further suggest that these experiential outcomes tend to occur together when immersive tools are effectively interpreted by patients. However, the extent to which patients derive these benefits is influenced by their socio-economic background.

These findings extend the discussion of the digital divide in healthcare beyond issues of access to technology. They show that even when immersive tools are present in the consultation environment, patients do not experience them equally. Instead, socio-economic variation influences how effectively patients interpret and benefit from immersive communication formats.

6. PRACTICAL IMPLICATIONS FOR HEALTHCARE PROVIDERS

These findings have meaningful implications for healthcare practitioners and hospital administrators.

- Simply introducing immersive or visual tools into consultations is not sufficient.
- Healthcare providers must be aware that patients differ in their visual literacy**,** digital familiarity**,** and comfort with interactive explanations.
- Additional verbal guidance, simplified explanations, or assisted demonstrations may be necessary for certain patient groups, particularly older adults and those with lower educational backgrounds.
- Training programs for clinicians should include not only how to use immersive tools, but also how to adapt their use based on patient socio-economic characteristics.

The results demonstrate that immersive technologies should be implemented with a patient-sensitive approach, rather than as a one-size-fits-all innovation.

7. LIMITATIONS OF THE STUDY

The present study is subject to certain limitations that should be considered while interpreting the findings. First, the proportion of patients who reported direct exposure to immersive or visualization-based tools was relatively small, which limits the generalizability of experiential findings. However, this distribution

reflects current clinical realities where such technologies are not yet widely implemented.

Second, the study adopts a cross-sectional design, which restricts the ability to establish causal relationships between socio-economic factors and patient experience. The findings therefore indicate associations rather than causal effects.

Third, the use of convenience sampling may introduce selection bias, as the sample may not fully represent the broader patient population across different healthcare settings.

Finally, patient experience was measured using self-reported perceptions, which may be influenced by individual biases, recall limitations, or situational factors during consultation.

8. DIRECTIONS FOR FUTURE RESEARCH

The present study opens several avenues for further investigation.

- Future research should focus exclusively on patients who have experienced immersive consultations to obtain larger exposed samples.
- Comparative studies across hospitals with varying levels of technological integration can provide deeper insight into access disparities.
- Qualitative studies may help understand how patients perceive and interpret immersive explanations across socio-economic backgrounds.
- Longitudinal research can examine whether repeated exposure to immersive tools reduces the influence of socio-economic barriers over time.

Such studies will help validate and extend the conceptual pathway identified in this research.

9. CONCLUSION

The present study examined how socio-economic factors affect patient experience in healthcare contexts where immersive technologies and visualization-based tools are used during clinical consultations. The outcomes of the study demonstrate that while such tools have the potential to enhance understanding, engagement, and confidence, their impact is not uniform across all patient groups.

The results clearly show that education, income, and age influence how patients interpret and respond to immersive explanations. Patients with higher education levels demonstrate better understanding, higher-income groups report greater confidence in decision-making, and younger patients tend to be more actively engaged. Furthermore, understanding, engagement, and confidence are closely interconnected, which signifies that patient experience develops as a combined and reinforcing process rather than as isolated outcomes.

A key insight from this study is that immersive technologies do not automatically enhance patient experience. Instead, their effectiveness depends on the patient's ability to understand and interact with visual and technology-supported communication. This highlights the presence of an experiential digital divide, where differences exist not only in access to technology but also in the ability to derive meaningful benefit from it.

The study also reflects an important practical reality exposure to immersive tools in clinical settings remains limited. This suggests that while such technologies are gaining attention, their integration into routine patient care is still evolving.

Overall, the findings emphasize that the value of immersive technologies lies not just in their availability, but in how they are used and adapted to diverse patient needs. A more patient-sensitive approach taking into account differences in digital familiarity and cognitive comfort is essential to ensure that these tools support effective communication rather than unintentionally creating barriers.

The conclusions should be interpreted within the context of limited exposure; however, they provide a clear direction for making immersive healthcare more inclusive, meaningful, and aligned with real patient experiences.

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