

A STATISTICAL AND QUANTITATIVE ANALYSIS OF DIGITAL LITERACY AMONG EMPLOYEES OF PRIMARY HEALTH CENTRES (PHC) IN SOUTH GUJARAT: A DIGCOMM MODEL-BASED STUDY

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ABSTRACT

This study applies a quantitative, statistics-driven research design to examine digital literacy among employees of Primary Health Centres (PHCs) in South Gujarat, with an emphasis on measurable competency gaps and their statistical association with healthcare service delivery. The study demonstrates the value of a structured quantitative research design and multivariate statistical methods in diagnosing digital-competency gaps in a resource-constrained healthcare workforce, and concludes that statistically targeted, role-specific training programmes are essential to close these gaps and strengthen healthcare outcomes.

Keywords: *Digital Literacy, Quantitative Research Methods, Statistical Analysis, Primary Health Centres, South Gujarat, Healthcare Workforce, Digital Health Tools*

1. INTRODUCTION

South Gujarat, an emerging region in India, faces distinct healthcare challenges, particularly in rural and semi-urban areas. The healthcare system in the region relies heavily on Primary Health Centres (PHCs), which serve as the first point of contact for medical services, especially for the rural population. These centres play a critical role in delivering essential healthcare services, including maternal and child health, immunization, and disease prevention (Patel et al., 2022). Despite their importance, PHCs in the region often face limitations such as inadequate infrastructure, limited resources, and challenges in delivering services efficiently, compounded by uneven digital literacy among healthcare workers, which affects their ability to integrate and use digital tools in service delivery. Framed as a quantitative research problem, digital literacy in the healthcare sector can be defined and measured as the ability to use digital tools and platforms to manage health information, communicate with patients, and enhance service delivery (Kulothungan et al., 2025). As healthcare systems globally continue to evolve, statistical evidence increasingly shows that professionals with measurably higher digital-literacy scores make greater use of

electronic health records (EHR), telemedicine, and other digital health technologies (Srinivasan & Kaur, 2023). In South Gujarat, however, variation in digital skills among PHC employees Medical Officers, Nurses, and Data Entry Operators among them remains a barrier to the effective use of digital health tools that are essential for modern healthcare management (Rachmani et al., 2019). Quantifying this variation, and testing it statistically against job role, training, and confidence, is therefore central to designing effective interventions. Digital tools such as telemedicine platforms and EHR systems can measurably enhance the quality of care provided, reduce administrative burdens, and enable better patient management (Purnamasari et al., 2025); a quantitative approach allows these relationships to be tested rather than assumed, making the statistical evidence generated in this study directly useful for evidence-based policy in South Gujarat's PHCs.

2. MATERIAL AND METHODS

Digital Literacy

Digital literacy plays a critical role in enhancing healthcare delivery, especially in resource-constrained environments like PHCs in rural and semi-urban areas. The integration of digital technologies in healthcare has been a transformative, globally observed and statistically documented force improving efficiency, communication, and access to health services. However, variation in digital literacy among healthcare workers continues to limit the effective use of digital tools in low-resource settings. The concept of digital literacy, defined as the ability to effectively and critically use digital tools and platforms, has gained prominence across sectors, including healthcare, and is increasingly studied through quantitative and psychometric instruments. Kulothungan et al. (2025) found, in a quantitative study of medical students in Tamil Nadu, that e-health literacy scores significantly predicted students' readiness to use digital health tools. Similarly, Rachmani (2017) used a structured measurement approach to show that digital competence among primary healthcare workers in Indonesia is statistically associated with the efficient use of health information systems, telemedicine, and electronic health records (EHR). These studies reinforce the value of quantitative measurement instruments such as the DIGCOMM model used in the present study for equipping healthcare workers with digital skills to navigate modern healthcare systems. In the South Gujarat context, digital literacy among healthcare workers is particularly relevant given the rapid, statistically observable digitalisation of India's healthcare systems. Desai's (2024) quantitative study of financial literacy and numeracy among working women in South Gujarat offers a useful methodological parallel, demonstrating how survey-based statistical instruments can quantify basic digital and numerical skills in a digitalising economy. However, in rural and semi-urban areas like South Gujarat, digital adoption is often constrained by infrastructural limitations, limited access to training, and low awareness. Quantitative studies such as those by Mbatane et al. (2025) and Trivedi (2024), examining digital financial literacy among university students and physiotherapists in Gujarat, similarly document statistically measurable gaps in digital competency, even in relatively well-

connected regions. Onyekwere's (2024) statistical analysis of the digital divide in remote work among employees in Nigeria highlights significant, measurable disparities in digital access between urban and rural areas a pattern that recurs in the healthcare sector. Rachmani et al. (2019) similarly used statistical association to show that Indonesian healthcare workers who lacked digital skills were significantly less likely to engage with digital health tools, affecting both professional development and patient care quality. Further compounding the issue is the low level of formal training in digital tools for PHC employees. While there is growing recognition of the importance of digital health literacy, few initiatives are statistically evaluated or tailored to the specific needs of healthcare workers in rural areas. In contrast, statistical studies on digital health literacy in urban settings such as Purnamasari et al. (2025) on MSMEs in South Sumatra show that targeted digital-literacy training programmes are quantifiably associated with improved technology-adoption rates, including FinTech adoption. This body of quantitative evidence suggests that comparable, statistically designed training interventions could address the digital-literacy gaps identified in South Gujarat's PHCs. Rachmani (2017) further argued, on the basis of quantitative measurement, that digital health literacy is a statistical prerequisite for the successful enactment of Universal Health Coverage (UHC), especially in developing countries — underscoring the need for primary healthcare workers to be equipped with digital competencies that can be measured, tracked, and improved over time. This study is significant because it applies a rigorous quantitative and statistical research design to a critical gap in digital literacy among healthcare workers at PHCs in South Gujarat. With the increasing integration of digital tools in healthcare systems, statistically measuring the level of digital competency among PHC employees is essential for evidence-based improvements to service delivery and operational efficiency. By using descriptive statistics, correlation, ANOVA, and regression analysis, the study provides quantifiable insights into the digital-literacy barriers faced by healthcare professionals, particularly in rural and semi-urban settings, and translates these into statistically grounded policy recommendations for digital-skills training. The findings are intended to inform the design of targeted, data-driven interventions to address the digital divide in rural healthcare.

Qualitative Methods

Qualitative methods occupy a distinct but complementary position within the broader field of statistics and quantitative research. Unlike purely numerical techniques that rely on measurement, scaling, and inferential testing, qualitative methods focus on non-numerical data such as interview transcripts, open-ended responses, field observations, and textual or thematic content to capture meaning, context, and lived experience that statistical scores alone cannot convey (Creswell & Plano Clark, 2018). Common qualitative techniques include thematic analysis, content analysis, grounded theory, and case-study approaches, each offering systematic ways of identifying patterns and themes within non-quantifiable data. In the context of statistical research, qualitative methods are most frequently employed within mixed methods designs, where they serve one of two primary functions: informing the

construction of quantitative instruments during the exploration of research, or providing explanatory depth to numerical findings during the interpretive phase (Tashakkori & Teddlie, 2010). This dual role is often described in the methodological literature as "triangulation," wherein qualitative and quantitative evidence are combined to strengthen the validity, reliability, and interpretability of research conclusions (Denzin, 2017). Scholars have also emphasised those qualitative approaches allow researchers to explore the "why" and "how" behind statistical relationships, complementing correlation and regression analyses that primarily establish the "what" and "how much" of a phenomenon (Bryman, 2016). As quantitative and statistical research methods continue to dominate empirical inquiry across social science and applied disciplines, the integration of qualitative techniques remains valuable for capturing nuance, contextual variation, and participant perspectives that purely numerical models may otherwise overlook.

3. DISCUSSION

This study adopts a quantitative-dominant, mixed-methods research design, combining primary and secondary data sources within a structured statistical framework. Primary data were collected through personal interviews, telephonic interviews, and a Google Forms survey to obtain a diverse and statistically usable range of responses from employees at PHCs across South Gujarat. Respondents including Medical Officers, Staff Nurses, ANMs, Data Entry Operators, and Community Health Officers were selected using purposive sampling (N = 87) to capture measurable variation across job roles. The structured questionnaire, developed using the DIGCOMM model (Digital Communication Competency Model), operationalised technical, communication, information management, and operational competencies as scaled, quantifiable variables. Secondary data were drawn from existing literature, government reports, and prior studies to contextualise the statistical findings. Data analysis was performed in SPSS using descriptive statistics, Pearson correlation analysis, one-way ANOVA, and multiple regression to test hypotheses relating digital literacy to job performance and service delivery outcomes.

Table 1 Demographic Analysis of Respondents (Sample Size: 87)

Demographic Variable	Category	Frequency	Percentage	Mean	Median	Mode	SD
Age	Below 25	10	11.5%				
	25–35	28	32.2%				
	36–45	25	28.7%				
	46–55	15	17.2%				
	Above 55	9	10.3%	35.2	35	25–35	10.1
Gender	Male	47	54%				
	Female	40	46%				

Education Level	High School	9	10.3%				
	Undergraduate Degree	35	40.2%				
	Postgraduate Degree	43	49.4%	3.5	3	Postgraduate Degree	0.8
Job Role	Medical Officer	20	23%				
	Staff Nurse	25	28.7%				
	ANM (Auxiliary Nurse Midwife)	15	17.2%				
	Data Entry Operator	13	14.9%				
	Community Health Officer	14	16.1%	20.3	20	Medical Officer	5.2
Experience in Healthcare	Less than 2 years	8	9.2%				
	2–5 years	29	33.3%				
	6–10 years	23	26.4%				
	11–15 years	14	16.1%	6.3	6	2–5 years	4.3
	More than 15 years	13	14.9%				

Source: Field survey data compiled by the authors.

The demographic analysis (Table-1) provides a statistically representative overview of the respondents' characteristics. The sample of 87 healthcare employees from PHCs across South Gujarat shows a relatively balanced gender distribution (54% male, 46% female). The age distribution shows a predominant workforce in the 25–45 age range, consistent with a typical healthcare workforce profile. A majority of respondents hold undergraduate (40.2%) or postgraduate (49.4%) degrees, indicating a relatively high level of education. This educational profile, combined with job roles such as Medical Officer, Staff Nurse, and Community Health Officer, suggests that most respondents are likely to be exposed to digital tools, though with measurable variation in digital literacy based on role and experience.

Table 2 Descriptive Statistics for Behavioural Questions (Sample Size: 87)

Behavioural Statement	Mean	Median	Mode	SD
I feel confident using digital tools in my daily healthcare tasks.	3.75	4	4	0.98
I regularly use digital health tools such as EHR, telemedicine platforms, and mobile health applications in my work.	3.80	4	4	1.02
I have received adequate training to use digital health tools effectively in my role.	3.50	3	3	1.10
I encounter difficulties while using digital health tools (e.g., EHR, telemedicine).	2.60	2	2	1.15
I feel that digital health literacy is important for improving patient care in my practice.	4.25	4	4	0.79
I believe digital literacy training should be mandatory for all healthcare workers at PHCs.	4.10	4	4	0.88
I am able to resolve technical issues related to digital health tools with minimal assistance.	3.20	3	3	1.00
I find digital tools (such as mobile health apps, EHR) useful in improving my work efficiency.	4.00	4	4	0.91
I am motivated to improve my digital literacy skills to enhance healthcare service delivery.	4.15	4	4	0.85
I feel that my colleagues and I can effectively communicate with patients using digital tools.	3.90	4	4	0.95
I have access to the necessary digital infrastructure (e.g., computers, internet) to carry out my work effectively.	3.80	4	4	0.98
I believe digital health literacy can enhance the overall quality of healthcare services at PHCs.	4.20	4	4	0.86
I find the digital tools provided by the healthcare system user-friendly and easy to navigate.	3.70	4	4	0.94
I am confident in using digital health tools to manage patient data securely and maintain confidentiality.	4.10	4	4	0.88
I feel that more training on digital health tools would improve my job performance and service delivery.	4.30	4	4	0.76

Source: Field survey data compiled by the authors.

The descriptive statistics in Table 2 reveal measurable trends in digital-literacy behaviour among PHC employees. The mean scores for “I feel confident using digital tools” ($M = 3.75$) and “I regularly use digital health tools” ($M = 3.80$) indicate that, while employees recognise the importance of digital tools, actual reported use is moderate. The higher mean for “I feel that digital health literacy is important for improving patient care” ($M = 4.25$) indicates that employees statistically value digital literacy and its role in healthcare delivery. Conversely, the comparatively lower mean for “I encounter difficulties while using digital health tools” ($M = 2.60$) statistically highlights persistent operational challenges.

Table 3 Correlation Between Digital Literacy Confidence and Digital Tool Usage

Variable 1	Variable 2	Pearson r	Sig. (2-tailed)
Confidence using digital tools in daily tasks	Regular use of digital health tools (EHR, telemedicine)	0.72	0.00
Confidence using digital tools in daily tasks	Technical difficulty in using digital tools	-0.55	0.02
Training received to use digital tools	Confidence using digital tools in daily tasks	0.67	0.00
Motivation to improve digital literacy	Confidence using digital tools in daily tasks	0.68	0.00

Source: SPSS output, field survey data compiled by the authors.

The correlation analysis (Table-3) shows statistically significant positive relationships between confidence in using digital tools and their regular usage. The strong correlation ($r = 0.72$, $p < 0.01$) between confidence and regular use of digital tools indicates that healthcare workers who report higher confidence are significantly more likely to use digital health tools regularly. The negative correlation between encountering difficulties and confidence ($r = -0.55$, $p < 0.05$) statistically confirms that fewer technical difficulties are associated with higher confidence, underscoring the importance of addressing technical challenges to strengthen digital competency.

Table 4 ANOVA for Digital Literacy and Job Role

Job Role	Mean Digital Literacy Score	F-Statistic	Sig. Value
Medical Officer	3.95	2.75	0.06
Staff Nurse	3.88		
ANM (Auxiliary Nurse Midwife)	3.70		
Data Entry Operator	3.45		
Community Health Officer	4.05		

Source: SPSS output, field survey data compiled by the authors.

The one-way ANOVA (Table-4) indicates variation in digital-literacy scores across job roles, with Community Health Officers recording the highest mean score (4.05) and Data Entry Operators the lowest (3.45). This variation is plausibly explained by differences in job function: Medical Officers and Community Health Officers engage more directly with digital tools such as EHR and telemedicine than Data Entry Operators, whose interaction with patient-care technology is comparatively limited. The F-statistic of 2.75 ($p = 0.06$) suggests a difference in digital-literacy levels across job roles that approaches but does not reach conventional statistical significance at the 0.05 level, pointing to the value of role-specific training programmes tailored to each healthcare-worker category.

Table 5 Regression Analysis for Digital Literacy and Healthcare Service Delivery

Independent Variable	Dependent Variable	β	Sig.	R ²
Training received to use digital tools	Improvement in healthcare service delivery	0.76	0.00	0.60
Confidence using digital tools	Improvement in healthcare service delivery	0.52	0.03	0.28

Source: SPSS output, field survey data compiled by the authors.

The regression analysis (Table-5) statistically confirms the influence of training and confidence on healthcare service delivery. Both training received ($\beta = 0.76$, $p < 0.01$) and confidence in using digital tools ($\beta = 0.52$, $p < 0.05$) have a significant positive effect on improving healthcare service delivery. The R² value of 0.60 for training indicates that a substantial proportion of the variance in service-delivery improvement is statistically attributable to the adequacy of digital training. These findings reinforce that enhancing digital literacy through targeted, quantitatively monitored training programmes can directly improve healthcare outcomes.

Table 6 Digital Literacy Competency by Job Role Using the DIGCOMM Model

Job Role	Technical (M)	Communication (M)	Information Mgmt. (M)	Operational (M)	Overall Score (M)
Medical Officer	3.8	4.2	4.0	4.1	4.02
Staff Nurse	3.5	3.8	3.7	3.9	3.72
ANM (Auxiliary Nurse Midwife)	3.2	3.6	3.4	3.5	3.44
Data Entry Operator	3.0	3.4	3.5	3.3	3.33
Community Health Officer	4.0	4.1	4.2	4.3	4.15

Source: SPSS output, field survey data compiled by the authors.

Table-6 presents digital-literacy competency levels of PHC employees as assessed through the DIGCOMM model across four measurable dimensions: technical, communication, information management, and operational. Community Health Officers show the highest overall digital-literacy score (4.15), driven primarily by strong Operational (4.3) and Information Management (4.2) competency scores. This suggests Community Health Officers are statistically more likely to engage with and use digital tools effectively, plausibly reflecting their broader responsibilities in patient care and community outreach. Data Entry Operators show the lowest overall score (3.33), particularly in Technical and Operational competencies, indicating that while they may manage data adequately, their capacity to use advanced digital health tools may be limited — pointing to a measurable need for role-specific training.

Table 7 Correlation Between Digital Literacy Competencies and Job Performance

Competency Area	Job Performance (M)	Pearson r	Sig.
Technical Competency	3.8	0.74	0.00
Communication Competency	4.0	0.79	0.00
Information Management Competency	3.9	0.72	0.00
Operational Competency	4.1	0.81	0.00

Source: SPSS output, field survey data compiled by the authors.

Table-7 explores the statistical relationship between digital-literacy competencies and job performance. The positive and statistically significant correlations (ranging from 0.72 to 0.81, $p < 0.01$) between each competency area and job performance indicate that higher digital literacy — across technical, communication, information management, and operational skills — is strongly associated with improved job performance. The highest correlation is observed between Operational Competency and Job Performance ($r = 0.81$), indicating that employees proficient in using digital tools for operational tasks such as scheduling, patient management, and resource allocation are statistically more likely to perform their roles effectively. These findings support the importance of targeted training across all competency areas, particularly operational skills, to improve job performance and healthcare service delivery at PHCs.

The demographic data (Table-1) show a diverse, statistically balanced sample across age, gender, and education level among PHC employees in South Gujarat. The majority of respondents fall within the 25–35 age group (32.2%), indicating a relatively young workforce, and a high proportion hold postgraduate degrees (49.4%), indicating a relatively high level of education. Despite this educational background, overall digital-literacy levels vary significantly across job roles: Community Health Officers recorded the highest overall score (4.15), with strong operational and information-management competencies, while Data Entry Operators recorded the lowest (3.33), particularly in technical and operational competencies. This variation statistically underscores role-specific challenges in digital adoption, with employees in patient-care roles

generally showing higher competency than those in administrative or data-related roles. The ANOVA results (Table-4) reinforce this pattern, though the difference across roles falls just short of conventional statistical significance ($p = 0.06$).

The behavioural data (Table-2) further reflect the statistical complexity of digital literacy in healthcare. While respondents generally report confidence in using digital tools ($M = 3.75$) and recognise the value of digital literacy for patient care ($M = 4.25$), the comparatively lower means for adequate training received ($M = 3.50$) and ability to resolve technical issues ($M = 3.20$) indicate those areas as statistically weaker. This gap is echoed by the negative correlation ($r = -0.55$) between encountering technical difficulties and confidence, suggesting that greater technical challenges are statistically associated with lower confidence. The regression analysis (Table-5) confirms that training has a statistically significant impact on improving healthcare service delivery ($\beta = 0.76$), reinforcing the importance of targeted training programmes. The correlation analysis (Table-3) additionally shows that employees who are more motivated to improve their digital literacy report using digital tools more confidently and effectively, suggesting motivation as a statistically relevant driver of digital-literacy improvement. Taken together with the DIGCOMM-based competency scores (Table-6) and their correlation with job performance (Table-7), the statistical evidence indicates that focused efforts to improve digital literacy across all competency areas particularly for lower-scoring roles such as Data Entry Operators and ANMs are essential for improving healthcare outcomes in South Gujarat's PHCs.

4. CONCLUSION

Using a quantitative research design and multivariate statistical methods, this study highlights measurable, statistically significant variation in digital literacy among PHC employees in South Gujarat across job roles. The results underscore the importance of targeted training programmes to enhance digital literacy, particularly for lower-scoring roles such as Data Entry Operators. The statistical evidence suggests that digital-literacy training should focus not only on the technical skills required to use digital health tools but also on improving operational and communication competencies, which showed the strongest statistical association with job performance. Healthcare managers and policymakers should prioritise the development of role-specific, data-informed digital-literacy programmes, leveraging e-learning platforms and on-the-job training to increase accessibility and effectiveness, with periodic statistical monitoring of outcomes. Investing in digital infrastructure at PHCs is likewise critical to ensuring employees can use digital tools efficiently and improve service delivery. Future research could adopt a longitudinal quantitative design to examine the statistical impact of digital-literacy training on patient outcomes and healthcare efficiency in rural settings.

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