# Impact of Digital CQI Training on Health Worker CQI Knowledge in Kenya, a Case of Kwale County

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Abstract— Digital platforms hold promise for scalable Continuous Quality Improvement (CQI) training, yet evidence on their effectiveness in Kenya's maternal, newborn, and child health (MNCH) workforce is limited. This quasi-experimental study evaluated a WhatsApp-delivered Kenya Quality Model for Health (KQMH) training module among 56 MNCH health workers in eight public facilities in Kwale County. A validated 20-item multiple-choice KQMH test was administered immediately before and after a two-week digital intervention. Paired t-test analysis revealed a significant increase in mean knowledge scores from 51% (CI: 48–55) at baseline to 64% (CI: 60–67) post-training (t(55) =–6.53, p<0.0000002). The large effect size (Cohen's d=0.99) indicates that the digital format achieved substantial practical gains in CQI knowledge.

*Index Terms*— Continuous Quality Improvement (CQI) Digital CQI, Kenya Quality Model for Health (KQMH), WhatsApp-based training.

#### I. INTRODUCTION

Kenya has made substantial progress toward Universal Health Coverage, with health policies emphasizing quality of care alongside access. Yet maternal and newborn health indicators remain uneven: the 2022 Kenya Demographic and Health Survey reports a neonatal mortality rate of 21 per 1,000 live births nationally and only 35% modern contraceptive uptake among postnatal women in Kwale County, far below national targets of <12 deaths per 1,000 and 70% contraception use, respectively (Vatsa R, 2025). Continuous Quality Improvement (CQI) frameworks, notably the Kenya Quality Model for Health (KQMH), provide structured approaches to identify, test, and scale effective clinical interventions.

Traditional CQI capacity building in Kenya relies on in-person workshops, on-site mentorship, and paper-based record keeping, which often leads to inconsistent training coverage, fragmented data capture, and delayed feedback loops (Endalamaw A., 2024). In contrast, digital training platforms can deliver standardized content at scale, embed interactive learning, and enable real-time performance dashboards to track trainee progress and facilitate iterative Plan-Do-Study-Act (PDSA) cycles. Recent Kenyan studies have demonstrated feasibility and high engagement with mobile-based clinical support systems—such as the PROMPTS SMS platform—which improved postpartum

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care-seeking behaviors and appointment adherence, though impacts on clinical knowledge and longer-term health outcomes remain under-evaluated (Vatsa R, 2025).

E-learning modules also show promise: a 2024 scoping review found that digital CQI training significantly boosts healthcare worker competencies across multiple specialties, offering comparable or superior knowledge retention to conventional methods (Endalamaw A., 2024). However, there is scant empirical evidence on how digital KQMH training affects CQI knowledge in Kenya's maternal, newborn, and child health (MNCH) workforce—particularly in under-resourced settings like Kwale County.

This study addresses that gap by evaluating the impact of a WhatsApp-delivered digital KQMH training program on MNCH health workers' CQI knowledge. Using a quasi-experimental pre-post design, we measure knowledge gains via a validated 20-item KQMH test and quantify effect size to inform scalable CQI capacity-building strategies in Kenya's public health system.

#### II. LITERATURE REVIEW

Digital training programs have been shown to significantly enhance health workers' Continuous Quality Improvement (CQI) knowledge and practices. A study evaluating a virtual quality improvement training program reported that over 80% of participants experienced improved understanding and confidence in conducting quality improvement projects, with post-program scores significantly higher across all knowledge domains (p < 0.001) (Gupta, 2022). A study in Nigeria showed that nurses trained using digital modules demonstrated significant improvement in CQI knowledge and skills (Ayamolowo, 2023).

Similarly, an evaluation of an eLearning program for healthcare professionals demonstrated positive outcomes in enhancing knowledge and practices, with participants showing significant improvements post-training (Gifty Francisca Ben Aryee, 2024). Furthermore, a global overview found that digital health technologies positively influence healthcare workers' daily practices across various specialties, leading to improved performance and clinical management (Borges do Nascimento IJ, 2023).

Collectively, these studies underscore the effectiveness of digital training in bolstering health workers' CQI knowledge, thereby enhancing healthcare delivery and patient outcomes.

#### III. METHODS

#### A. Research Design

A quasi-experimental pre-post design enrolled 56 MNCH health workers who completed the digital KQMH training via a WhatsApp-based platform.

# B. Study Area

The study was conducted in selected public health facilities in Kwale County, located in Kenya's coastal region. Kwale is one of the 47 counties in Kenya, characterized by a largely rural population, with agriculture, fishing, and tourism as key economic activities. The county has a poverty incidence of 47%, higher than the national average, contributing to challenges in healthcare access and utilization.

## C. Study population

The study included clinical and technical health workers involved in patient management within the participating facilities. This group consisted of nurses, clinical officers, medical officers, pharmacists, and laboratory staff, reflecting the multidisciplinary nature of healthcare delivery. These health workers participated in the digital CQI training and were involved in implementing postnatal care services, including family planning (FP) counseling and service provision.

## D. Inclusion Criteria

Health workers who participated in the digital CQI training and were willing to provide informed consent for participation in the study.

E. Exclusion Criteria

Health workers who did not participate in the digital CQI training or declined to provide informed consent

F. Sample Size Determination

The study used the modified Cocran's formula in determining the sample size of the healthcare workers, and then distribute the sample between the selected health facilities using the single population proportion formula (Bartlett, 2001).

The Cocran's formula provided a sample that was large enough to give the confidence levels we need.  $N_0 = ((1.96)^2(0.5) * (0.5)) / (0.05)^2 = 385$ 

Since Total number of health workers supporting the MNCH departments within treatment health facilities was 70,

$$N(T) = 70$$

$$n(T) = 385 / (1 + (384 / 70)) = 54$$

Accounting for 10% for non-response, final sample for health care workers was

Total sample = 59 (HCWs)

G. Sampling Technique

The study employed a stratified random sampling technique to select participants from the target population. Health workers were stratified by cadre, including nurses, clinical officers, medical officers, pharmacists, and laboratory staff involved in patient management within the selected health facilities. From each stratum, participants were randomly selected to ensure representation across disciplines.

# H. Data collection Instrument

The used a validated 20-item multiple-choice KQMH pre- and post-test questionnaire, aligned with Ministry of Health standards. The pre-test and post-test mirrored each other in questions, with the exception of the



socio-demographic variables which were in the pre-test questionnaire.

# I. Data Collection Methods

The questionnaire was developed and translated into Google forms, a user-friendly online application. The participants were sensitized on the data collection tool and the participants self-administered the questionnaire at the beginning and end of digital CQI training. Participants took the pre-test immediately before digital CQI training and the post-test immediately after.

# J.Validation of Questionnaire

Because the KQMH pre- and post-test tool is a nationally standardized instrument, routinely employed by the Ministry of Health to evaluate CQI capacity building across Kenya, it already possesses established content validity, construct validity, and reliability. Consequently, rather than conducting an additional pre-test of the instrument itself, our study adopted the Ministry's version of the tool intact. To ensure contextual appropriateness, we reviewed its language and format with Kwale County QI coordinator and conducted a brief orientation session with participants, confirming clarity and consistent administration. This approach leverages the tool's proven validity while maintaining comparability with national CQI training evaluations.

# K. Data Management and Analysis

Data was collected through Google Forms and automatically stored in Microsoft Excel. The pre- and post-test scores were collected as continuous data expressed as percentages. To enhance accuracy, the data was reviewed for errors, cleaned, and coded. To determine whether the digital CQI training led to an improvement in knowledge, a paired sample t-test was performed to compare the mean pre-test and post-test scores, with the knowledge score as the dependent variable. Additionally, Cohen's d was calculated to determine the effect size and assess the practical significance of the observed difference. Ninety-five percent confidence intervals, with statistical significance set at p<0.05. These analyses provided a comprehensive understanding of both the statistical and real-world impact of the digital training intervention on participants' knowledge levels.

# L. Ethical Considerations

Ethical clearance was secured from Kenyatta University Ethics Review Committee, National Commission for Science, Technology, and Innovation (NACOSTI) and Kwale County Department of Health. The participants provided written informed consent prior to completing the questionnaire, following an explanation of the study's objectives and significance. The collected data was maintained in a confidential manner. The questionnaire was composed in English, the language comprehended by the participants in the study area. To ensure confidentiality, all data collected were anonymized and stored securely, accessible only to the research team. Participants were informed of their right to withdraw from the study at any stage without consequences. The study adhered to ethical principles outlined in the Declaration of Helsinki (WMA, 2013), ensuring respect for participants, beneficence, and justice throughout the research process.

#### IV. RESULTS

The study recruited a total of 113 HCW for the digital CQI training. Of these, 72 accepted to participate in the assessment by filling both the informed consent form and the KQMH pre-test questionnaire. At the end of the training, 56 of the 72 who had initially filled the pre-test questionnaire filled the KQMH post-test questionnaire. Of the 56 participants, 52 (93%) filled the socio-demographic section of the questionnaire. The participants were mainly male (52%), between the ages of 30 and 39 years (63%). Eighty seven percent of participants had a medical related diploma, and 54% had more than 6 years in experience. Nurses and clinical officers were the majority participants at 31% and 23% respectively. Detailed analysis of the demographic profile of the responding health care workers (HCW) is \_ presented in *Table I*below.

(1)	Table I. Demographic profile of the
	responding HCW

	Number of	Percentage of
Age Groups	participants	participants
20 - 29 years	10	19%
30 - 39 years	33	63%
40 - 49 years	9	17%
	Number of	Percentage of
Gender	participants	participants
Female	25	48%
Male	27	52%
Highest Education	Number of	Percentage of
Level	participants	participants
Certificate	2	4%
Diploma	45	87%
Bachelor's Degree	5	10%
	Number of	Percentage of
Years of Experience	participants	participants
Less than 1 year	1	2%
1 - 3 years	10	19%
4 - 6 years	13	25%
7 years or more	28	54%
÷	Number of	Percentage of
Years of Experience	participants	participants
Clinical Officer	12	23%
Laboratory		
technologist	4	8%
Medical Doctor /		
medical specialist	1	2%
Nurse	16	31%
Nutritionist	1	2%
Pharmaceutical		
technologist	3	6%
Records and		
Information officer	4	8%
Other (specify)	11	21%

To assess the impact of digital CQI training on health worker knowledge, a paired sample t-test was conducted comparing pre-test and post-test scores obtained from participants before and after the digitally-delivered Kenya Quality Model for Health (KQMH) training. The scores were treated as



continuous variables expressed as percentages. In addition, 95% confidence intervals (CI) were calculated to assess the precision of the mean estimates, and Cohen's d was computed to determine the magnitude of the observed effect. The mean pre-test score was 51%, which increased to 64% post-training. This 13-percentage-point improvement was found to be statistically significant based on the paired sample t-test (t = -6.53, df = 55, p < 0.00001), indicating that the likelihood of this result occurring by chance is extremely low as provided in *Table II*. Furthermore, the confidence interval for the pre-test mean ranged from 48.2% to 54.8%, while that of the post-test mean ranged from 60.3% to 67.0%, with no overlap between the two intervals as shown in *Table III*.

(2) Table II. Paired Two Sample for Means on digital CQI training before and after training

	Pre-test score	Post-test score
Mean	51%	64%
Variance	1%	2%
Observations Pearson	56	56
Correlation Hypothesized	0.359652243	
Mean Difference	0	
Df	55	
t Stat	-6.53048034	
P(T<=t) one-tail	0.00000011	
t Critical one-tail	1.673033965	
P(T<=t) two-tail	0.000000022	
t Critical two-tail	2.004044783	

(3)

 Table III. Confidence Interval (CI) of

 the means for pre and post test results

Confidence Interval (CI)				
Pre-Test Mean	51%			
Post-Test Mean	64%			
Pre-Test SD	0.122395743			
Post-Test SD	0.123568948			
Sample Size (n)	56			
Confidence Level = $95\% \rightarrow t\alpha/2t$ for 55 degrees of				
freedom (df= $n-1=55$ ) is ~2.030				
Standard Error of Mean				
(SEM) for pre-test	0.016355819			
Standard Error of Mean				
(SEM) for post-test	0.016512595			
Margin of Error (MOE) for				
pre-test	0.033202313			
Margin of Error (MOE) for				
post-test	0.033520568			
Confidence Interval (CI) for				
pre-test	(0.482, 0.548)			
Confidence Interval (CI) for				
post-test	(0.603, 0.67)			

Cohen's d was calculated to be 0.99, which represents a large effect size, signifying that the digital training had a substantial and practically meaningful impact on

participants' knowledge acquisition, as expounded in *Table IV*.

<sup>(4)</sup> Table IV. Cohen's d analysis results for effect size of the means differences between pre and post tests

Cohen's d					
Post-Test Mean	64%				
Pre-Test Mean	51%				
Pre-test Standard Deviation	0.123568948				
(PreSD) Post-test Standard Deviation (PostSD)	0.122395743				
Pooled Standard Deviation	0.122983744				
Cohen's d	0.99				

#### V. DISCUSSION

The results from the t-test and Cohen's d statistics indicate that the digital CQI training led to a statistically significant improvement in participants' knowledge. A paired sample t-test comparing the pre-test and post-test scores showed a significant increase in the mean score from 53% to 66%, with a mean difference of 13%. The test yielded a p-value < 0.001, indicating that the observed difference is unlikely due to chance.

Furthermore, the 95% confidence intervals for the pre-test (48% to 55%) and post-test (60% to 67%) scores did not overlap, strengthening the evidence of a meaningful improvement. The calculation of Cohen's d = 0.99 demonstrates a large effect size, suggesting the training had a substantial practical impact on knowledge acquisition.

These findings affirm that the digital CQI training was effective in enhancing participants' understanding of CQI concepts. The significant statistical results, coupled with a large effect size, support the use of digital learning platforms as a viable method for capacity-building in healthcare quality improvement.

### VI. RECOMMENDATIONS

Based on the findings of this study, several recommendations have been formulated to enhance the implementation and effectiveness of digital Continuous Quality Improvement (CQI) training programs. These recommendations are proposed for consideration and action.

- 1. Expand training to a larger audience. The study showed a statistically and practically significant improvement in learning outcomes.
- 2. Reinforce learning with follow-up assessments. Conduct follow-up assessments (e.g., 3–6 months later) to evaluate knowledge retention and real-world application.
- 3. Address Individual Learning Gaps Although post-test performance was higher and more consistent, individual differences still exist.
- 4. Strengthen pre-training preparation. The pre-test mean was 53%, suggesting some participants had low baseline knowledge before training. Provide pre-training materials or introductory modules to ensure all participants start at a similar foundational level.



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