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DESIGN AND USABILITY EVALUATION OF A VOICE-ASSISTED TEXT-FREE CUSTOMER MANAGEMENT SYSTEM FOR LOW-LITERACY SHOPKEEPERS

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Article Info

Abstract

Low-literacy shopkeepers often face difficulties in using conventional customer management applications because most existing systems depend heavily on textual input, complex menus, and literacy-based navigation. This study presents the design and usability evaluation of a voice-assisted, text-free Android-based Customer Management System developed for low-literacy retail shopkeepers. The proposed system uses graphical icons, sketch-based buttons, customer images, audio instructions in the local language, SMS reminders, and SQLite-based local storage to support customer registration, item registration, credit management, due-payment updates, and customer notification. The application was evaluated through task-based usability testing involving low-literacy shopkeepers and literate users. Usability was assessed using task completion time, total clicks, incorrect clicks, task success, and participant feedback. The findings indicate that graphical and voice-supported interaction can reduce hesitation among low-literacy users and improve their ability to complete customer-management tasks independently. The study contributes to inclusive mobile interface design by demonstrating how text-free and audio-guided interaction can support small-scale business management for users with limited reading skills.

Keywords: *Low-literacy users, text-free interface, mobile usability, customer management system, voice-assisted interaction, inclusive design.*

1. INTRODUCTION

In today's fast-paced mobile technology world, there are new opportunities to enhance business-management practices among small-scale retailers [1]. Mobile phones are now ubiquitous and used for communication, payment, customer interaction, record keeping and business support. Digital connectivity in Pakistan has grown substantially, with over 200 million telecom subscribers and 150 million broadband subscribers by 2025[2]. But the access to mobile devices is not a guarantee of effective digital participation, particularly for those who have a low literacy rates when it comes to reading and writing.

One of the major challenges toward the use of conventional mobile applications is low literacy. According to PSLM–HEIS 2024–2025 report, the literacy rate in Pakistan among 10 years old people and above is 63% and adult literacy rate is 60% [3]. For many users, it is therefore a problem to use applications that rely on written menus, text labels, filling in forms or multi-step navigation. In such cases the primary problem is not so much about lack of technology as about the 'disconnect' between the design of the interface and the capability of users [4].

A particular concern is the issue of small shopkeepers and informal retailers. 16.0% of people in Pakistan work in wholesale and retail trade. Many retailers keep track of customer credit, inventory, outstanding balances and reminders in their heads, notebooks or by informal, manual means [5]. These are all well-known methods but are subject to loss, error, delay and inadequate record keeping. These activities can be performed with a mobile Customer Management System (CMS), but only if it is accessible to users with low levels of literacy [6].

Most of the customer-management applications that already exist have been designed for literate users, and require typed input, written instructions, menu reading and typical digital navigation. These design assumptions ignore low-literate shopkeepers, even those who already use mobile phones for voice messages [7]. As a consequence, applications for business management for this user group should be based on text-free navigation, graphical icons, images of the customer and the item, sketches based controls, local-language voice instructions and simplified work flows [8].

Past research indicates that an interaction method using visual and audio modalities can enhance the understanding and lessen reliance on written text [9]. Graphical elements enable users to identify actions by familiar graphic signals and audio instructions enable users to get through tasks with native language [10]. But it's important that these elements are simple, familiar in the culture, and task-oriented, as complex menus, unfamiliar symbols and long audio instructions can add to the confusion. Previous studies have investigated the use of text-free and AV (audio-visual) displays in the health and finance sectors, agriculture and public services, but there is little research on customer and credit management for low-literacy shopkeepers [11]. This gap is significant because there are various activities that shopkeepers engage in on a regular basis including signing customers up, making note of things, giving things away on credit, sending payment reminders and keeping payment records. Therefore, to fill this deficiency, design and usability evaluation of an Android based CMS for low-literacy shopkeepers with voice assistance and without text are proposed in this work [12]. The proposed system will use graphical icons, sketch based buttons, images of the customer and items, local language audio instructions, SMS reminders and SQLite based local storage. The system is capable of customer registration, item registration, credit-item issuing, payment-record updating, and customer notification [13].

This paper's main contribution is a mobile CMS tailored to the needs of retail users with low literacy levels, and tested for its effectiveness. Sketch-based and photo-based interface components are

additionally contrasted based on the time to finish the task, total clicks/taps, incorrect clicks/taps, task success rate, and participant feedback.

2. Related Work

Poor literacy users are an emerging focus in human computer interaction, ICT for development, and inclusive interface design in the design of mobile applications. Most of the traditional mobile apps use text labels, textual instructions, hierarchical menus and familiarity with digital navigation [14]. These assumptions may restrict access to those with low reading abilities and limited access to digital technologies. Hence, the focus of past investigations has been on simple, visual, acoustically aided, and task-oriented interfaces, which can help to reduce cognitive load and facilitate autonomous interaction [15].

Low-literacy user interfaces research indicates that a text rich system is hard to use by non-literate users as they cannot understand any text provided to them without some help [16]. In response to this, a number of research efforts have focused on developing text-free interfaces with graphical icons, photos, sketches, symbols and verbal directions. These are especially applicable in developing areas, where mobile phone ownership is high but users are primarily engaging in basic voice communications [17].

Using visual representation is one of the key design principles for low literacy interfaces. Previous research suggests that when users recognize a familiar visual object, they might understand the instructions more easily than when they have to read text instructions [18]. Instead of text labels and menu options, photographs, cartoons, semi-abstract drawings and hand drawn sketches have been used [19]. Certain research indicates that a simplified drawing or a semi-abstract depiction of an icon can be more understandable than a detailed photo due to its image lacking unnecessary visual detail and pointing attention toward the action intended. This discovery reinforces the idea of implementing sketch-based buttons and image-supported input in the proposed CMS [20].

Another key feature for those who have limited literacy is audio guidance. Users can use voice instructions to follow multi-step instructions, which can decrease reliance on written text. But audio instructions have to be brief, unambiguous, repeatable and in a familiar language [21]. Long or complex instructions can cause more confusion when users are doing sequential tasks. With the proposed CMS, the local-language audio feature is utilized to guide the individual when registering the customer, registering the item, creating SMS reminders, and updating payments [22].

Low-literacy mobile applications have been examined in areas like health, finance, agriculture and public services. These studies demonstrate that if applications are based on the users' practices and not formal literacy skills, the users benefit [23]. But, most of the existing literature deals with information access or public-service support, and little research has been conducted in the areas of customer and credit management for small shopkeepers. This gap is crucial, as many shopkeepers are handling their customers, shop items, dues and reminders on a manual basis [24].

Low-literacy interface research is also focused on usability evaluation. Usability for this group of users should be measured by time to complete tasks, number of clicks, number of errors, task completion, and user preference [25]. In the past, similar studies have been conducted that compare sketch-based and photo-based interfaces and suggest that the visual style can impact user understanding and performance of a task [26]. Hence, the current study compares both types of interfaces to see which interface representation is more useful for low-literate shopkeepers to perform customer-management tasks. Although there have been previous efforts, there has been very little that has used the principles of text-

free, voice-assisted, and visual interaction in the design of a full-fledged mobile Customer Management System for low-literacy shopkeepers. There is a special need for systems that integrate sketch-based input, customer and item pictures, local-language audio instructions, SMS reminders, and local database storage of the customer credit, and that are evaluated empirically [27]. This study is an attempt to fill this gap by designing and testing a text free Android based CMS (Table-1) for low-literacy shopkeepers in which voice assistance is provided to them.

Research Focus	**Main Contribution**	**Limitation / Gap**
Text-free interfaces	Support users with limited reading ability through graphical and non-textual interaction	Mostly focused on general interface access
Audio-visual representation	Improves comprehension and user confidence	Long or complex audio may confuse users
Sketch-based and image-based interfaces	Simplified sketches may improve recognition of actions	Limited testing in retail and credit-management settings
Mobile applications for developing regions	Support health, finance, agriculture, and public-service needs	Few studies focus on small shopkeepers and informal business workflows
Usability evaluation	Uses task time, clicks, errors, success rate, and feedback	More empirical evidence is needed for complete business-management applications

Table I. Prior Research on Low-Literacy Mobile Interfaces: Focus, Contributions, and Limitations

Based on the reviewed literature, the proposed CMS adopts three main principles: text-free visual navigation, short local-language audio guidance, and familiar image- and sketch-based interaction. These principles are integrated into a practical mobile system for customer registration, item registration, credit-item issuing, SMS reminders, and payment-record updating [28].

3. Design Requirements for Low-Literacy Mobile Interfaces

The third step in the process is the design requirements for low-literacy mobile interfaces. In the case of mobile applications, the goal is to decrease reliance on written labels, menus, forms and instructions in the design of the application for low-literacy users. Hence, the Customer Management System (CMS) which is proposed will facilitate interaction in the visual, audio and task based modes [29].

The design requirements for the CMS interface derived from the literature and the needs of the shopkeepers were: Text-free navigation, visual representation, audio guidance in native language, simplified task flow, familiar input mechanisms and error-recovery support [30]. These requirements help in Customer Registration, Item Registration, Credit-Items Issuing, SMS reminder and Payment-Records updating as mentioned in Table-2.

3.1 Text-Free Navigation

CMS's interface is graphical, not text-based. Recognizable icons or sketches are used to represent functions like customer registration, item registration, SMS reminder and audio replay, for recognition-based interaction [31].

3.2 Visual and Graphical Representation

Customer images, item images, sketch-based buttons, and familiar symbols enable users to identify records and actions without having to read the word [32]. The icons for the camera, basket and envelope are for capturing images, issuing items, and SMS reminders respectively.

3.3 Local-Language Audio Guidance

Local-language audio is very brief, concise and repeatable, and provides guidance through screens and tasks. This support facilitates the user to know what to do and to get back on track when he/she gets lost [33].

3.4 Simplified Task Flow

There is a single primary task for each screen to minimize cognitive load. For instance, the customer needs only to select an image when registering, input the mobile number via a visual input, and confirm it.

3.5 Familiar Input Mechanisms

CMS: Allows for input of information through visual means rather than traditional typing. Sketch buttons are represented by fingers which correspond to numbers, by a closed hand to indicate the number “zero”, and by a symbol of scissors for erasing wrong entries [34].

3.6 Error Recovery and Consistent Help

Help information is repeated and can be heard, buttons are placed consistently, and there is a simple way to correct their error and minimize hesitation.

Design Requirement	CMS Implementation	Expected Usability Benefit
Text-free navigation	Visual buttons for main functions	Reduces dependence on reading
Visual representation	Customer/item images, icons, and sketches	Supports recognition-based interaction
Local-language audio guidance	Short, repeatable Pashto audio instructions	Improves understanding and confidence
Simplified task flow	One main task per screen	Reduces confusion and cognitive load
Familiar input mechanisms	Finger-based numeric buttons and correction symbol	Supports non-text-based data entry
Error recovery and help	Replay-audio option and consistent correction controls	Helps users recover from mistakes

Table 2. CMS Design Requirements, Implementations, and Expected Usability Benefits for Low-Literacy Users

4. Methodology

This study was carried out using design research approach to develop a mobile Customer Management System (CMS) for low literate shopkeepers. The methodology involved in identifying and then translating the needs of small retail shopkeepers into a simplified, text-free and voice-assisted Android Application

[35]. The development process was divided into three phases: requirement identification, interface design and system implementation. The usability evaluation procedure is shown separately in Section 6 and the experimental setup is shown in Section 7.

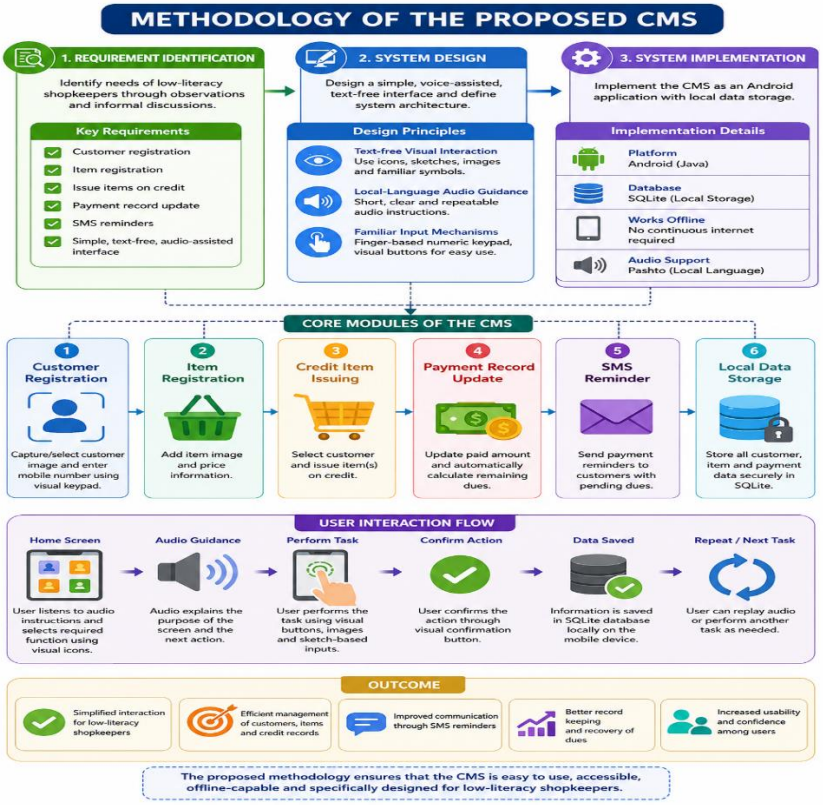

Fig-1: Proposed Methodology for CMS

4.1 Requirement Identification

The functional requirements of the CMS were identified by taking into consideration the common customer-management activities that were performed by the small shopkeepers. These activities include customer registration, inventory of the items in the store, credit on stores, reminders of customers of payment and updating of customers' payment record [36]. But as the target users have limited reading and writing capability, the system has been designed to have as little text-based interaction as possible and guide the users through visual and audio-based interaction as demonstrated in Fig-1.

The key design criteria were to create an easily interpretable mobile interface, without written explanation. Thus, graphical icons, pictures of customers and items, sketch like controls, local languages' oral instructions, and simplified navigation (interface) were chosen as the basic interaction mechanisms.

4.2 System Design

The suggested mobile application for the proposed CMS was an Android application catered for small shopkeepers who maintain the credit of their customers manually. The system enables five primary functions such as customer registration, item registration, credit-item issuing, SMS reminder generation,

and payment-record updating [37]. The functions have been chosen to accurately depict the typical informal retail customer management process.

The main functions of the app are provided in the home screen using visual options. Each function is shown in a graphic or sketch button rather than using text-heavy menus. The available options are given local language audio instructions. The instructions can be replayed at user's will, thereby minimizing confusion in the interaction process [38]. The high-fidelity prototype screens of the proposed CMS are shown in Fig. 2. The screens show how to use large visual buttons, customer and item images, audio replay buttons, sketch input and simplified task flow to serve the low literacy shopkeeper.

Fig. 2. Prototype screens of the low-literacy CMS interface.

4.3 Interface Design

The interface has been designed for the needs of low-literacy users. The design of the interface was based on three main principles.

Firstly, the application has visual interaction without relying on text as much as possible. System functions are represented by icons, sketches, photographs and familiar visual symbols. For instance, a camera sign is used for taking the customers' pictures, a basket sign is used for issuing the items and an envelope sign is used for SMS reminders [39].

Second, it offers native audio instructions! Audio narration gives users the instructions for each screen and where to go next. The audio prompts are intended to be brief, unambiguous, and repeatable, to minimize cognitive demand when completing the task.

Thirdly, the input means are familiar and used in the application. The finger-based sketch buttons are adopted to enter the mobile-number. Closed-hand (0) and scissor symbols are used to indicate zero and to delete an incorrect entry. Using this method, the user can input information using visual recognition, and not through text.

4.4 System Implementation

CMS Application has been developed as an Android mobile application using Java programming language. The local database to store customer records, item records, mobile no, item price, issued items, payment details, updated dues details was the SQLite. In the rural areas, the shopkeepers do not always have internet facilities so local database storage was chosen.

When customers register, the user takes the picture of the customer or selects a picture and types the customer's mobile phone number using the visual numeric keypad. Once confirmed, the customer record will be saved into the SQLite Database. When the user registers an item, he will add an item image and price and both of these are used when he issues the credit item [40].

The shopkeeper can view the customer information, give the item to the customer, edit paid amount and manage the outstanding dues in the customer profile module. The SMS reminder module enables the shopkeeper to remind customers about their pending payments via SMS. This feature helps in communicating with the customer and decreases the manual effort involved in checking the credit record as indicated in Table-3.

Module	**Function**	**Interface Support**
Customer Registration	Adds customer image and mobile number	Camera icon, visual number input, audio guidance
Item Registration	Records shop item image and price	Item image, simplified input, audio guidance
Credit-Issue Module	Issues item to a customer on credit	Basket icon and customer profile
Payment Update	Updates paid amount and remaining dues	Visual input and correction option
SMS Reminder	Sends reminder to customers with pending dues	Envelope icon and audio guidance
Local Storage	Stores customer, item, and payment records	SQLite database

Table 3. Functional Modules and Interface Support Features of the CMS

6. Usability Evaluation

A usability study was performed to determine if the proposed Customer Management System (CMS) would be adequate to help the low-literacy shopkeepers to fill in routine customer-management activities [41]. Task-based approach was employed since the learners are not too proficient in reading and writing and also task performance besides subjective opinion was more important in this case.

Five typical tasks of shop management were set for the participants to perform: registering customers, registering items, issuing credit-items, creating SMS reminders, and updating payment records. These are typical of the customer management activities involved in small retail business, especially for small retail stores that have customer credit handled manually [42].

Task Code	Task Description	Purpose
T1	Register a new customer	To evaluate customer entry using image capture and visual number input
T2	Register a shop item	To assess item entry through the simplified visual interface
T3	Issue an item to a customer	To evaluate completion of a credit-sale transaction
T4	Send an SMS reminder	To assess customer notification for pending dues
T5	Update customer payment record	To evaluate updating of customer dues after payment

Table 4. User Tasks and Evaluation Purposes for CMS Usability Testing

Usability was assessed based on the time taken to complete tasks, number of clicks/taps, number of incorrect clicks/taps, task success rate, and participant feedback. The metrics used to determine efficiency, simplicity of interaction, reduction of errors, capacity for task completion, and user perception were chosen.

Metric	Description	Interpretation
Task completion time	Time required to complete each task	Lower time indicates better efficiency
Total clicks/taps	Number of interactions required to complete a task	Fewer clicks indicate simpler interaction
Incorrect clicks/taps	Number of wrong selections during task completion	Fewer errors indicate clearer interface design
Task success rate	Percentage of successfully completed tasks	Higher success rate indicates better usability
Participant feedback	User comments and interface preference	Shows perceived ease of use and preferred visual style

Table 5. Usability Evaluation Metrics and Their Interpretations

Following the tasks, participants were asked to rate how easy they found it to use the system, how clear the visual elements were, how useful the audio instructions were, how confident they were when interacting with the system and how they preferred the sketch-based interface versus the photo-based one. To assess the suitability of the CMS for the target user group, the evaluation was carried out between low literacy and literate participants. It also contrasted sketch-based and photo-based representations, and determined which was most effective for customer-management tasks.

7. Experimental Setup

A controlled task-based usability experiment was performed for the proposed Customer Management System (CMS). There were two versions of the interface that were functionally equivalent: Sketch-based interface and Photo-based interface. Both versions provided the same CMS functions and native-language

audio instructions. This design allowed comparison of the two styles of visual representation with task flow and audio support held constant [43].

There were 50 low-literacy male shopkeepers and 40 literate male participants from the Computer Software Engineering Department. Low literacy shopkeepers formed the target user group with literate participants being the comparison group. The mean age of the low-literacy group was 35.54 years and age range was 25 to 46 years.

An order balanced testing procedure was applied to minimize order bias. Half the subjects in each group were first presented with the sketch-based interface and next with the photo-based interface. The rest of the participants worked with the interfaces in the reverse order. Before the testing, each participant received a short introduction to the application and a scenario with customer registration, credit-item issuing, payment updating and SMS reminder tasks, carried out in a shop.

Each of the participants performed the tasks on his own with both versions of the interface. The researcher observed the time for each task to be completed, the number of correct clicks/taps and the number of incorrect clicks/taps for each task during the experiment. The participants could listen to the audio instructions as many times as required but were not given direct help in order to be able to assess the need for usability of the interface [44]. At the end of each interface construction, participants were asked to give their feedback and choose their favorite interface.

Step	Activity
Step 1	Participants were introduced to the CMS application
Step 2	A shop-based customer-management scenario was explained
Step 3	Participants completed the assigned tasks using the first interface version
Step 4	Task completion time, total clicks/taps, and incorrect clicks/taps were recorded
Step 5	Participants completed the same tasks using the second interface version
Step 6	Participant feedback and interface preference were collected

Table 6. Experimental Procedure for CMS Usability Evaluation

8. Discussion

Overall, the study indicates that the voice assisted, written-less CMS could enable shopkeepers with low literacy to better accomplish routine customer-management tasks less reliant on written text. Its graphical icons, sketch-based controls, customer and item images, local-language audio instructions, simplified navigation, SMS reminders, and SQLite-based local storage facilitated vital activities like customer registration, item registration, credit-item issuing, payment updating, and customer notification.

A few low-literacy participants were initially reluctant to use the application, primarily because they lacked the confidence of using digital technology. But, with repeated audio cues and familiar visual cues, their confidence in interacting increased. This means that usability of low-literacy users is not only related to simplicity of interface, but to a user's trust, guidance and familiarity.

Based on the comparison of sketch based and photo based elements, it is concluded that both are useful. Use sketches to show actions and how to use controls to navigate and identify products and customers by

photographs. Hence, it is suitable to use a mixed visual strategy for low-literacy customer-management applications.

In sum, the proposed CMS will offer a convenient substitute for the manual credit record, which is frequently lost, inaccurate and poorly maintained. The system illustrates the use of text-free visual communication and local language audio that can enhance digital business management by low-literacy shopkeepers.

9. Limitations

There are several limitations found in this study. First, the participants were all men, thus restricting the generalizability of the findings. Future studies should involve women shopkeepers and users from various socio-economic and business sectors. Second, the evaluation was carried out in an artificial task-based setting, that is, not in real shop situations. So, the results could not fully represent real life scenarios like customer pressure, interruptions and complexity in day-to-day business. Third, the study mainly used task completion time, total clicks/taps, incorrect clicks/taps, task success rate, and participant feedback as usability measures. While these metrics give valuable evidence, they don't capture long term adoption, trust, satisfaction, or perceived usefulness. Finally, the application was created for a particular local and linguistic context; before using the system in other regions or linguistic groups, they might need to be adapted.

10. Future Work

Future studies are needed to test the CMS in the longer-term field to look at actual use and the extent to which it has been adopted, as well as the impact on customer-credit management. The study should be expanded to a wider and more varied sample of participants, such as female shopkeepers, older users, shopkeepers from rural communities and participants with varying degrees of digital experience.

Speech input, automatic voice reminders, cloud backup, biometric logon, multilingual audio and text-light visual summaries of total dues, paid amounts, and pending balances are planned for future versions of the CMS. Moreover, future research should use statistical testing to directly compare sketch-based and photo-based interfaces in a more stringent way with regard to task completion time, errors, success rate and user preference.

11. Conclusion

This study has shown the design and usability test of a voice assistant text free Android based Customer Management system for low literacy shop keepers. CMS was proposed to help in normal customer-management activities like customer registration, item registration, sending SMS reminder, generating credit-items, etc and updating payment-record. The system included graphical icons, sketch-based controls, customer and item pictures, local-language audio instructions and SQLite-based local storage to minimize reliance on the written text.

Based on the usability evaluation, the researchers found that interfaces that were based on known visual cues, a reduced number of tasks, and repeated audio instructions enabled low-literacy shopkeepers to interact with mobile business apps with greater confidence. The comparative analysis of sketch-based interface elements and photo-based interface elements also demonstrates the need to choose the appropriate visual representations for the context, task and recognition of users.

In sum, the study makes a contribution to inclusive mobile interface design with a use of the principles of text-free and voice-assisted interaction in a real customer-management scenario. The proposed CMS highlights the potential for mobile technology to help low-literacy shopkeepers transition from paper and pencil record keeping to easier access to a digital way to run their businesses. The system needs to be tested with more customers and more types of customers in the future, and also needs to be tested in the long term in real stores.

Declaration

Author Contributions

The authors confirm their contributions to the paper as follows: Conceptualization, methodology, and original draft preparation: **Imran Maqsood**; data curation, formal analysis, and validation: **Sadeeq Jan**; investigation, resources, visualization, and review and editing: **Mareena Karim**. All authors reviewed and approved the final version of the manuscript.

Data Availability

All relevant data and supporting material used in this study are in the manuscript.

Conflict of Interest

The authors state that none of the work described in this study could have been influenced by any known competing financial interests or personal relationships.

Ethics Approval

The study was conducted following standard ethical guidelines. Approval was obtained from the relevant institutional review board, and all participants provided informed consent.

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