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A Community-Based Safety Reporting System; Development, Implementation, and Evaluation: An Experience of Safe Communities in Iran

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Abstract

Background: Online reporting systems can establish and maintain the community-authority connection for safety promotion initiatives and their sustainability. The aim of this study was to report the development, implementation, and evaluation of an online community safety reporting system in safe communities in Iran.

Methods: In the first place, the life cycle approach and software systems development were used for design and implementation, which included 7 steps. In the following, an online Community Safety Reporting System (CSRS) was developed with two main interfaces, including a web-based and phone application. The software was developed using suitable programming languages for the web and as a mobile application for Android and iOS systems.

Results: During the six months of implementation, we received 80 reports in different safety areas, which were managed by the administrators and provided feedback for reporters. System user-friendliness and easy to use were the main strengths declared by users. The CSRS program is implemented at two levels of usage: public users to report safety issues and city admin functional evaluation of the system through a short interview with users. Moreover, city authorities believed that the system facilitates community participation in decision-making processes. The address of the web page is www.payamiran.ir.

Conclusion: CSRS provides a way for community voices to be heard and facilitates mutual interaction between the community and authorities. CSRS could be used as a community participation tool to ensure safety promotion initiatives sustainability.

Keywords: Safety Reporting System, Evaluation, Client Voice, Injury, Accident, Traffic Accident

Conflicts of Interest: *None declared*
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Introduction

Injuries are one of the significant challenges that communities face worldwide (1, 2), especially in low and middle-income countries (LMICs) (3). It is estimated that injuries cause about 10% of mortalities and are ranked as the sixth leading cause of mortality. More than five million people die due to injuries annually, and a much higher number are disabled (3, 4).

Besides providing development opportunities, urbanization puts the population at some risk of injury. The community could engage at different levels, which have been discussed in Arnstein's Ladder of Participation (5). This issue has led to a global movement on injury prevention. Some

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↑What is "already known" in this topic:
Promoting safety in society is sustainable and requires public participation to be effective. Online community safety reporting systems (CSRS) can be used as a practical product to solve the problems of urban environments.

→What this article adds:
CSRS can play a vital role in creating a way of interaction in the community. CSRS can serve as a decision-making tool in the form of mass media to monitor the creation of healthy cities in LMICs.

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programs were introduced internationally, such as Safe Communities, and some were regional or national, initiated mainly by high-income and developed countries to decrease injury rates (6-8).

Community and public participation were defined as the most essential and imperative parts of most of the initiatives (9, 10). Community informing and consultation is the second category of participation based on this context, which gives the community a degree of tokenism (7). Community-level reporting systems are beneficial initiatives in this category that are gaining commonality (6, 8, 9, 11). Online reporting systems are accessible, robust, and inexpensive, with high coverage of the population. These systems are designed to encourage the public to send their report on the topic to the authorities and get feedback (8). A mobile application was developed for residents of South Windsor, Connecticut, USA. The public used this app to report unsafe situations in traffic safety, such as broken stop signs and defective streetlights (10). Another example was an online platform for reporting crimes in the community, such as unidentified dead bodies, missing people, etc. (11). Roslan et al. developed an online mobile application to report road violations by road users to the authorities (8).

Considering the significance of community participation in safety promotion initiatives and their sustainability, online reporting systems could play a vital role in establishing and maintaining a connection between the community and authorities (12, 13). Community reporting systems provide a crowdsourcing platform that gives first-hand data from the public to authorities. This study aimed to report the development, implementation, and evaluation of a Community Safety Reporting System (CSRS) as a community safety promotion and sustainability tool.

Methods

This applied study was conducted in three phases: design, implementation/setting up, and evaluation. The system design and setup diagram are shown in Figure 1.

Phase I: CSRS Design

Step 1: Literature review and identifying global experiences

To find out previous experiences in developing reporting systems, a comprehensive literature review was conducted through PubMed and Scopus databases , Google Scholar, and some search engines for English literature. Moreover, SID (Scientific Information Database) was searched for Persian literature. The search was done without time boundaries. Reporting systems components were reviewed and extracted from the literature.

Step 2: Expert panel sessions

Four expert panel sessions (each for 2 hours) were held to discover experts' views on the identified components of the reporting system. System details, including reporting forms, processing, and circulation of reports, contents, algorithms, structures, level of accesses, platform, design, and other related issues, were discussed in these sessions.

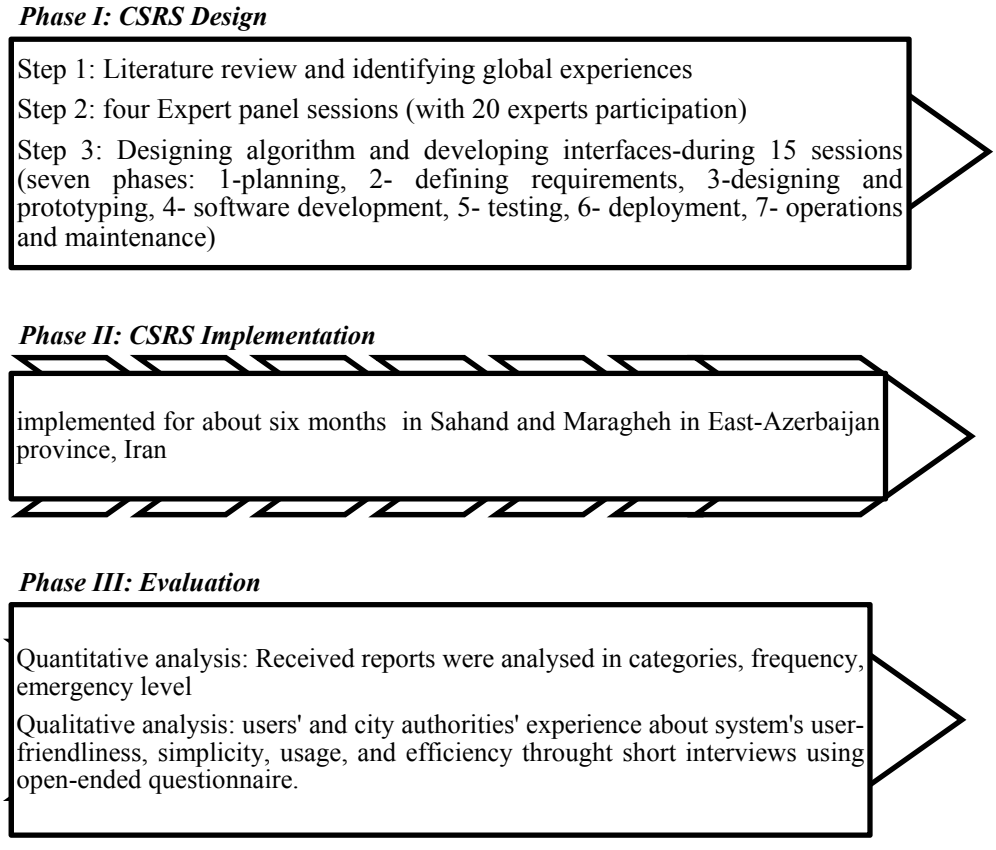

Figure 1. Diagram of designing and setting up the system

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Twenty experts participated in the sessions consisting of experts with academic backgrounds in road safety (n=5), urban management (n=2), computer software and programming (n=3), psychiatrist (n=2), health policy and management (n=3), health informatics (n=2) and individuals with at least 3-years of relevant executive experience including police officers (n=3). Reporting system components and processes were developed and finalized in these sessions.

Step 3: Designing algorithm and developing interfaces

In total, 15 sessions were held by the software development team to discuss the primary set of reporting system components, algorithms, and structures and to design the initial interface of the web-based and mobile application systems. Developing a model for software took seven phases: planning, defining requirements, designing and prototyping, software development, testing, deployment, and operations and maintenance.

(1) Planning

In this phase, a Community-Based Safety Reporting Systems (CBSRS) designer assessed the project from different dimensions, including evaluating labor and material costs, designing a timetable with achievable goals, and establishing project teams and leadership. The phase also included gaining feedback from stakeholders, potential and probable developers, customers, experts, and sales representatives. The planning phase involved plotting the course and making provisions for the team to design the software efficiently.

(2) Defining requirements

This phase was, in fact, a part of planning to demonstrate what the application is supposed to do and its requirements. To determine the requirements and needs, the expert's opinion on the identified components of the reporting system was received during four expert panel sessions (each session lasted 2 hours). Requirements included report forms, report processing and circulation, contents, algorithms, structures, access levels, platform, design, and other related items that were extracted and defined in these sessions.

(3) Designing and Prototyping

This phase portrayed how the software would operate. Some dimensions were the following:

Architecture: Demonstrates the language, overall design, industry practices, and application of any templates.

User Interface: Demonstrates the interactive ways between customers and software and the ways the software responds to the input data.

Platforms: Specifies the platforms or operating systems on which the software operates, such as Apple, Android, and Microsoft Windows.

Programming: This dimension covers not only the programming language but also the methods of solving problems and doing tasks in the application.

Communications: Specifies the communication methods through which the application could interact with other components, such as the central server or other applications.

Security: Specifies the security items for the application and could include SSL traffic encryption, password protection, and safe storage of user credentials.

Public reporting section

The public reporting section was a public interface that received classified information on safety issues from the community and transferred it to the database. This part was implemented in the PHP programming language, for Android in Java, and for iOS in SWIFT. The public part is designed to receive reports (with the possibility of receiving and sending data for several users simultaneously) in two forms: a web-based platform and mobile software for Android and iOS systems. The mobile application included two levels of reporting for laypeople and those who are professionals, for example, traffic police, municipality officers, etc. It also includes a report feedback section where people can trace their report process (Figures 1–3). Whenever a user sends a report, the system automatically registers the time and date and allocates an identity code for the report. Users can enter the title and topic of the report, the text of the report, a video or related image, the city name, and the address, and they can also enter the geographic location of the report on the map and their phone number (optionally). Moreover, users could classify their reports of emergencies as green for minor safety problems, blue for mild problems, yellow for necessary issues, and red for critical issues. In fact, the large number of reports of a critical situation by people in a geographical area means that that part of the city is a hot spot, which also deserves the special attention of city officials. This facilitates issue classification by authorities so they can respond promptly to more critical situations. This action is actually one of the initiatives of this system, which is less visible in other reporting systems.

Management section

The management section was developed to provide rules for managing, classifying, and sorting received reports. After defining the requirements, the database layer must draw the existence relation diagram and convert this diagram into physical tables in a structured query language.

(4) Software Development

This was the phase in which the program is written. Here, an Access Control (AC) or Source Code Management (SCM) application is utilized. These applications helped developers track changes to the code. They also ensure the compatibility between diverse team projects and guarantee the achievement of the defined goals.

(5) Testing

Software testing was an important step before marketing. A significant part of the testing process (for example, security testing) was done through automation. In the test phase, evaluation was done to confirm the functions of each process appropriately.

(6) Deployment

At this stage, the software was made available to users.

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This was made possible through the download link on the website and by receiving the program in the form of an application on the users' mobile phones.

(7) Operations and Maintenance

Here, the development step was almost over. Accordingly, the operation and maintenance phases could be crucial. In this phase, the bugs yet to be identified during the testing phase come to the surface. The present software comprised two main parts and interfaces, each performed separately and independently.

Programming languages, including JavaScript, JQuery, CSS, and HTML, were applied to this interface. The interface was implemented as a web service program using C#.Net and exchanged information utilizing the Web API and JSON structure. The database of the system is solely operated by MySQL. In this section, a login option was created for users, and city admin-level access was developed to be used by various cities to manage their community reports. Cities segregation was defined based on their geographical location.

Phase II: CSRS Implementation

Advocacy sessions with safe community authorities in Sahand and Maragheh in East-Azerbaijan province, Iran, were held to implement the reporting system. These cities have been implementing safe community programs. The city authorities committed to advertising and informing the public about the reporting system and also encouraging public participation through awarding participants. The system ran for about six months in these cities. An administrator was defined for each city who was responsible for classifying and referring the reports to the city's related authorities, following them, and providing feedback to reporters. The reports were classified based on the urban environment, traffic safety, green areas, park safety, building safety issues, water safety, child and elderly safety, disabled people's safety, and a free category. The COVID-19 category was also added after the pandemic.

Phase III: Evaluation

Received reports were analyzed in categories, frequency, emergency level, etc. Moreover, to obtain users' and city authorities' experience with CSRC, short interviews through an open-ended questionnaire were conducted. Users were asked to declare their viewpoint on the system's user-friendliness and simplicity, and authorities were asked about the system's usage and efficiency.

Ethical Considerations

This study was approved by the ethical committee of Tabriz University of Medical Sciences (ethical code: IR.TBZMED.REC.1395.971)

Results

After designing the model, which was carried out in seven phases, including planning stages, requirements definition, design and prototyping, software development, testing, deployment, and operation and maintenance, the reporting system was designed.

An online safety reporting system was developed in two forms: a web-based application and a mobile phone application for Android and iOS systems. The database of the system solely utilized MySQL. The system was designed in two parts of laypeople section and the professional section. Based on their positions, the users can fill the information form about all reports on safety and injury around the city (Figure 2).

The system is named "Payamiran", an abbreviation of "safety message of the Iranian people" in Persian. It consisted of two main parts: public reporting, which provides a platform for users to report safety issues in web and application systems (Figures 3–5).

The second part, web-based only, was the management section, allowing city administrators to categorize, refer the reports to related organizations in the city, provide feedback for reports, and develop a performance report to be used as a decision-making tool. The system was implemented in three cities in East Azerbaijan, which were safe community candidates. The system was promoted in the city, and online virtual groups related to each city. A safe community secretariat in each city was appointed as the system administrator, who checked the system routinely, categorized and referred to reports, and provided feedback for the users. During the implementation, 80 reports were received through the web and application. In four different

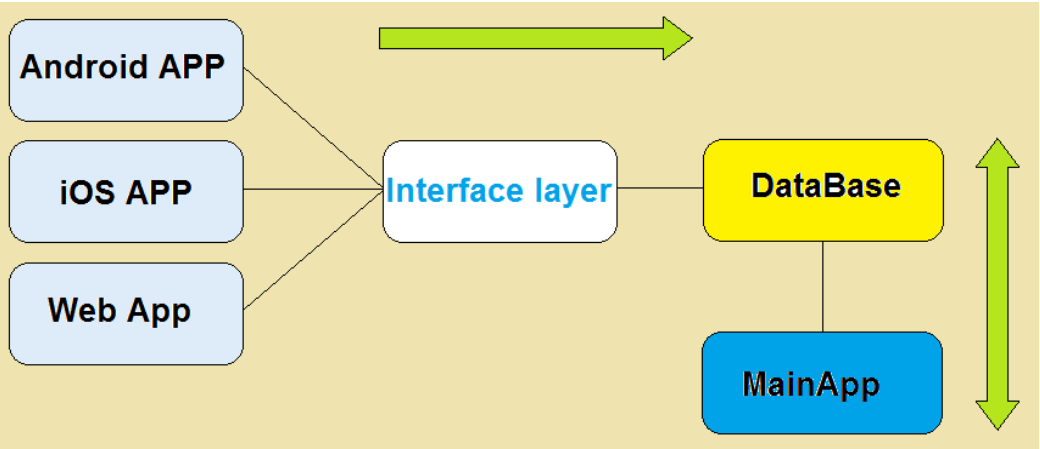

Figure 2. The algorithm of reports from databases

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Figure 3. Web-based page of the reporting system

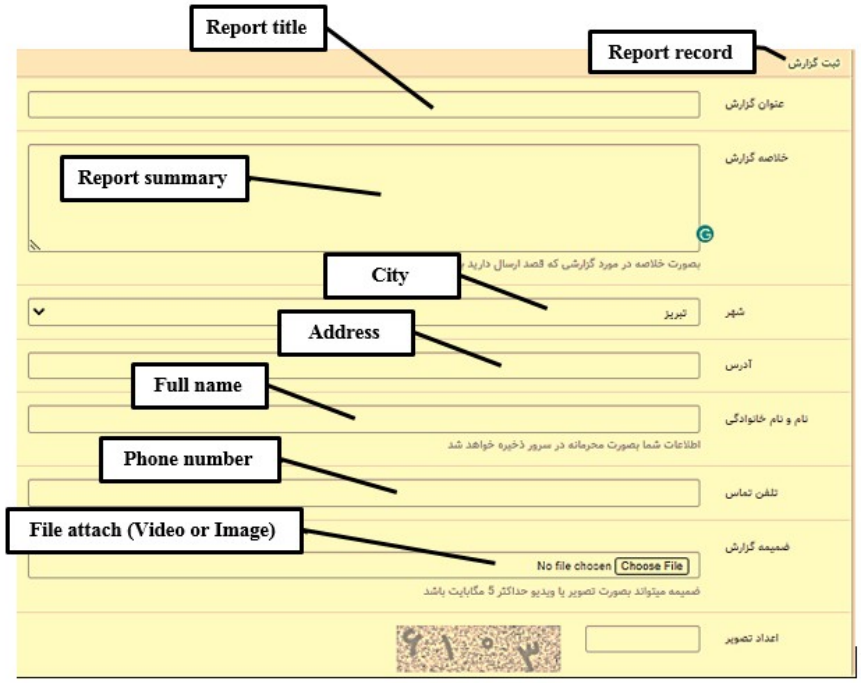

Figure 4. Web-based reporting form

colors, reports were classified according to importance and urgency, red color indicating a critical situation, and yellow color indicating an important location. The blue color indicates the average status and the green color indicates the normal status of the sent reports. Critical and important reports were sent to the officials of the provincial committees of the pilot cities, and after examination in these committees, they were sent to the relevant organizations to solve the problem and resolve it. The management dashboard provides the admin with collective information on received reports and their status, as well as a chart showing the report receiving trend (Figure 6).

In addition to the dashboard, the administrator could provide feedback on the reports. The system administrator submits feedback on actions based on the report to reporters. Geographical distribution of the reports and charts representing the emergency level of the reports are other options provided for administrators. The results of the functional evaluation showed that users were satisfied with the system's user-friendliness. The user declared that the system's strengths are an easy process for the report and the option to send pictures or videos. Moreover, getting feedback on reported issues encourages users to participate more. Internet problems were the main challenge faced by users and administrators using the system. Administrators and city

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Figure 5. "Payamiran" mobile application page for Android

Figure 6. Admin management dashboard

authorities had a positive attitude toward using the system, which created an inexpensive and easy way to bring a community voice to the decision-making process. (The address of the web page is: www.payamiran.ir).

Discussion

Promoting community safety is a sustainable process that needs public participation to be effective. Changes in city authorities, legal limitations, insufficient resources, political incidents, and other variables in communities could disrupt the sustainability of safety promotion initiatives. A study by Howat et al. (2001) in Australia showed that loose leadership, planning challenges, insufficient resources, and unstable plans were the main barriers to promoting safety in RTAs (14). Developing this online reporting system provides a platform that facilitates public participation. Its application saves time for users by sending an online report with complete details instead of rendering a written report to the city authorities. Also, they track their reports at any time and without any problem. At the same time, city authorities receive unsafe situation reports continuously and can manage them efficiently and cost-free. In other words, with this reporting system, all citizens act as city safety officers, ensuring the sustainability of safety promotion initiatives.

An online reporting system is a cost-effective strategy for engaging citizens in city safety management and a platform to evaluate various public organizations' responsiveness regarding public reports. Effective feedback from healthcare accident reporting systems is essential if organizations want to learn from failures to provide care (15, 16). In different countries, various online and offline platforms are utilized to increase public participation in managing and promoting safety and eliminating the associated social problems. For instance, Ganiron et al. (2019) designed and implemented an online crime management and reporting system for the secret reporting of violence to the police (9), which possesses many similarities in design and implementation with

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our study. In LMICs, the governments and municipalities are not able enough to solve problems and eliminate safety-threatening factors in cities; thus, utilizing public capabilities in the form of reports can partially eliminate inefficiencies on behalf of the government and municipalities (17). Therefore, a simple, practical, and user-friendly reporting system can significantly facilitate public participation.

Our experience in this project showed that the designed online reporting system is practical and user-friendly for this particular purpose. There are also challenges in this way. However, building and developing system infrastructures and capabilities and solving insufficiencies can be used as a successful experience and a practical product in cities and other settings. Mechanisms for feedback on actions and information help promote and improve safety culture and create motivational practices in the community. Providing actionable feedback that significantly improves systems is essential to promoting future reports.

In this project, the critical issue was the participation of the people in the cities under the pilot program and the critical feature of this work was presenting all the reports to the relevant committees in the form of a healthy city project, which is the innovation of this work. It is suggested that researchers and authorities of different cities should consider some issues in using the system or modeling the study, such as differences in the political-administrative structure of different countries, socioeconomic situations, technical and communication infrastructures, and the degree of collaboration on behalf of relevant organizations.

Conclusion

A community safety reporting system provides an easy and accessible tool for communities to enhance community participation in developmental decisions and policies. Promoting safety in society requires the full participation of society. By creating and developing the infrastructure and capabilities of the system, as well as solving the shortcomings, it can be used as a good example and practical product in urban and urban environments. Community safety reporting system (CSRS) can play a role as a decision-making tool in the form of a popular media to implement and monitor the establishment of healthy cities in low- and middle-income countries, which can ultimately improve community safety and increase the level of health and satisfaction in society.

Abbreviations

LMIC: Low and Middle-Income Countries; CSRS: Community Safety Reporting System; SID: Scientific Information Database; CBSRS: Community-Based Safety Reporting Systems; AC: Access Control; SCM: Source Code Management.

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Ethics Approval

This study was approved by the ethical committee of Tabriz University of Medical Sciences (ethical code: IR.TBZMED.REC.1395.971).

Authors' Contributions

HSB and MG cooperated in conceptualization, and writing draft preparation. BS and MS participated in the methodology. SAA and AJK cooperated in data collection. All of the authors have read the final manuscript and approved it.

Conflict of Interests

The authors declare that they have no competing interests.

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