

# Substance abuse poisoning registry development based on lessons learned from a pilot implementation

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## ABSTRACT

**Introduction:** Substance abuse has been recognized as a national problem in Iran, in which poisoning with pharmaceutical drugs, opioids and alcohols is common. Due to the lack of a comprehensive information system related to Substance abuse, it is challenging to manage the treatment and follow-up of patients caused by drug abuse poisoning. The purpose of this research was to develop a registry system for substance abuse poisoning in - Urmia University of Medical Sciences.

**Material and Methods:** This research is a practical development study that was done in 4 phases. In the first phase, minimum data set (MDS) of the system were determined. In the second phase, the registration system was designed. The third phase includes the implementation of the system, and finally, the system was evaluated by QUIS questionnaire.

**Results:** A total of 58 data elements in 6 classes were recognized as essential for this system from the point of view of experts. The system was implemented on the ASP.NET platform using C# language and SQL Server database in the poisoning department of Taleghani Hospital in Urmia. The evaluation of usability of the system showed score obtained in the 6 main categories were in set of terms of the system 8.52, screen 8.36, ability to learn 8.8, general functionality 8.04, user interface 7.98, and the general interaction is 7.73 respectively.

**Conclusion:** Considering the capabilities of the system for registering poisonings caused by drug abuse, it seems necessary to implement this system in the form of a national network, in order to make the necessary interventions to control drug abuse while using resources efficiently.

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## INTRODUCTION

Substance abuse means the use of alcohol or drugs in a manner, situation, amount, and intensity that is harmful to the user or those around [1, 2]. The most substance commonly used are including alcohol, barbiturates, benzodiazepines, cannabis, cocaine, methaqualone, opium and alternative amphetamines [3, 4]. Substance abuse has been a problem in the world for a very long time [1]. The United Nations has

set out Sustainable development goals that they hope to achieve by 2030 [2].

According to the United Nations report, substance abuse in 2017 caused the death of 585,000 people and caused the loss of 42 million years of healthy life worldwide [5]. The highest prevalence of substance abuse disorders is in Eastern Europe and the United States, occurring in 5-6% of the population, so out of 1 in 20 suffer from substance dependence [6]. Across Western and Central Europe, the Americas, and

Oceania, the prevalence is typically between 2 and 5 percent. Throughout Africa, the Middle East, and Asia, this prevalence is usually less than 1 to 2 percent [7]. It was estimated universally, about 164 million people were suffering from alcohol or drug abuse, and totally the prevalence of substance abuse is higher in men (about 68% equal to 111 million people) than in women [8].

In the United States more than 5 million visits annually are made in the emergency department for poisoning caused by substance abuse, which includes 4% of the workload of the emergency department [9]. The Center for Drug Evaluation and Research (CDER) in the US seeks effective and efficient ways to prevent and control the spread of alcohol and drug abuse [10]. Also, in the European Union, the Monitoring Center for Drugs and Addiction (EMCDDA) has been established to provide real, objective, reliable and comparable information about drugs, drug addiction and their consequences [11].

Substance abuse has long been recognized as a national problem in Iran that poisoning with pharmaceutical drugs, opioids and alcohols is common [12]. According to the statistics of the World Health Organization, 1% of the Iranian population aged 15 or older suffered from alcohol consumption disorders in 2016 [13].

In Iran, Drug and Poisoning Information Center was established as part of the Food and Drug Administration [14]. Information about drug and substance abuse can help clinical professionals in diagnosing, treating and caring for patients [15]. It is important to ensure that doctors have access to up-to-date information about patients being treated. This important matter is implemented by creating information systems and disease registration system [16-17].

The disease registration system is a systematic collection of uniform data on a specific disease, exposure to hazardous substances or events and treatment [12]. The purpose of these systems is to investigate disease outbreaks, determine temporal and spatial trends, safe monitoring and harm exposures, evaluate the quality of healthcare services, and finally develop and promote research, implement detailed plans and programs [18].

The conducted researches show that the development of registration systems for substance abuse poisoning can be useful in the field of systematic collection of information, prevention of poisoning, identification of affected people and their monitoring, accurate diagnosis of addiction problems, ease of access to information and decision-making in allocating resources [19-22].

In Iran, due to the lack of comprehensive and complete information related to poisoning caused by substance abuse and the lack of a national

registration system in this area, it seems necessary to create a registration system for this group of patients. In West Azarbaijan province, despite the existence of useful information collected by care centers for these patients, there is no system for systematically recording the necessary information. The aim of the current research was to develop a registry system for poisonings caused by substance abuse in Urmia University of Medical Sciences.

## MATERIAL AND METHODS

This research was done in four phases. In the first phase, minimum data set (MDS) of the system were determined. In the second phase, the registration system was designed and created. The third phase includes the implementation of the system, and finally, in the fourth phase, the evaluation of the system was done.

### First phase

In order to identify MDS of the substance abuse registration system, forensic medicine and poisoning specialists, health information management and medical informatics specialists were selected 85 experts in a targeted and accessible manner. For this purpose, a questionnaire was designed based on valid scientific texts and related articles which contained three parts. The reliability score estimated by experts' opinion while the validity calculated by Cronbach  $\alpha$  equal 0.874 at all. The first part of the questionnaire is dedicated to the respondents' demographic information including sex (gender), age, work experience and specialized field. The second part consists of 58 data elements in 6 major categories (patient demographics, medical history, diagnosis, laboratory data, treatment and discharge), that experts were asked to review and score the initial set based on their importance. The questionnaire was scored by using a five-point Likert scale ranging from 1 to 5 where "1" referred to concept of "lowly important" and "5" indicated the statement of "highly important". Data elements that were scored more than 3 score, included in the final minimum data set. The analysis of the collected data was done by SPSS software 26.

### Second phase

At this stage, an expert workgroup including three poisoning specialists, two health information management specialists and one medical informatics specialist was formed to design logical model of the system. Based on logical model, UML diagrams were drawn by Sparx Enterprise Architect V12. At this stage, the user interface (UI), and the initial template of the registry system were designed.

### Third phase

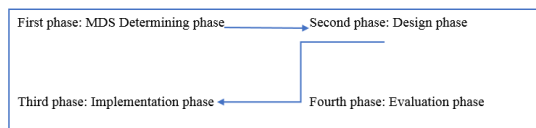
A web-based substance abuse registration system, was developed by the C# programming language, and Microsoft SQL server 2019 database was used for data storage. Then information which was related to the patients' paper based medical record who have been formed for poisoning caused by substance abuse in the Taleghani Medical Education Center of Urmia, was entered into the system for two sequences months.

### Fourth phase

The usability score scale for user satisfaction of the registration system was evaluated by the standard QUIS questionnaire that contains 32 questions in 6 sections (overall interaction, system screen, system terms, learning ability, general capabilities, and user interface). A 10-point Likert scale (0 to 9) has been used for each scoring question. The validity and reliability of the Persian and standard usability evaluation questionnaire has also been confirmed in previous studies [23, 24].

## RESULTS

As mentioned in previous part, the main findings of this research have been divided into four main phases as below:



### First phase

Out of 78 distributed questionnaires, 52 ones (66.6%) were collected. 57.3% of respondents were male and their mean age and work experience were 41.5 and 11.4 respectively.

Overall, 6 major categories of data (58 data items) were identified in the registry system that is shown in Fig 1.

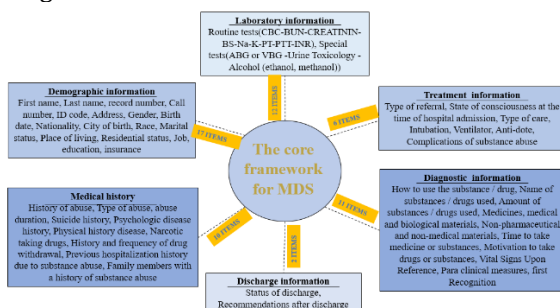


Fig 1: Minimum data set of the registry system of substance abuse poisoning

As shown in Fig 1, the core framework for this registry system containing 58 data elements including demographic information (N=17, 29.3%), medical history (N=10, 17.2%), laboratory

information (N=12, 20.7%), treatment information (N=6, 10.3%), diagnostic information (N=11, 19.1%) and discharge information (N=2, 3.4%). Based on phase 1 extracted data and information, the second phase begins.

### Second phase

The main step in designing the desired system is to design a database that is relevant and far from redundant. For this purpose, a main table called the Patient table was designed, which is assigned a primary unique key for each input value, which is used to connect other tables to the patient's personal information. As a result, all the other 8 designed tables in the database, i.e., History, Diagnosis, Vital Signs, Laboratory, Radiology, Treatment and Discharge tables, must be linked to one of the patient table entries using a Patient ID or ID foreign key, in which was shown for an instance (Fig 2).

The findings related to the second objective in this research, were drawn in the form of various Unified Modeling Language (UML) diagrams such as the class diagram, and others. For this purpose, the Sparx Enterprise Architect Version12 was used.

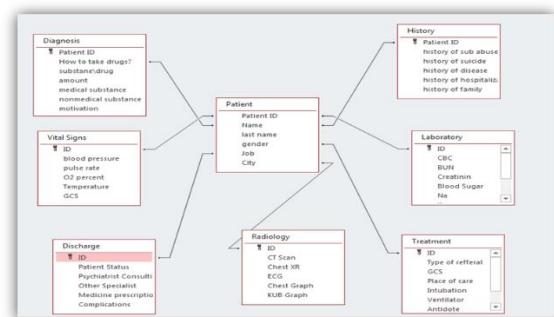


Fig 2: Class diagram of the registry system of substance abuse poisoning

### Third phase

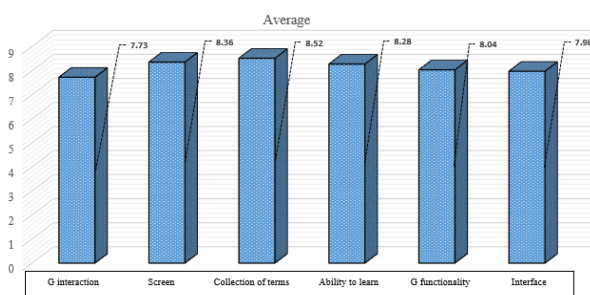
The Visual Studio 2019 software was used as a design environment, as well as the ASP.Net framework and #C programming language. Also, to store patient information, were used a strong and secure SQL Server database. In Fig 3 user interface (UI), and several pages of the system was showed.

### Fourth phase

As shown in Fig 4, the usability of the system from the end users viewpoint, the average score obtained in the 6 main categories were in set of terms of the system 8.52, screen 8.36, ability to learn 8.8, overall functionality 8.04, user interface 7.98, and overall interaction is 7.73 respectively.



**Fig 3: User interface of the registry system of substance abuse poisoning**



**Fig 4: Usability of the registry system of substance abuse poisoning (range 0-9)**

## DISCUSSION

As the goal of the current research was to develop a registry system for poisonings caused by substance abuse in Urmia University of Medical Sciences, the research divided in to four phases. The first step for the determinant of the system's MDS for registering poisonings caused by drug abuse, and the information needs and capabilities of the system, in

this regard, based on doctors' opinion as the main users and experts in this field were assessed. So, data elements were selected based on the needs and necessity of this expert work group. Noushin Khobzi and Brian Rush (2011) developed a drug and alcohol treatment information system (DATIS) in Canada, which aims to assess the current situation in addiction treatment organizations and describe the important characteristics of clients, patterns of service use, and trends of change. Substance abuse was from 2005 to 2010. The results of this research showed that DATIS data elements include demographic information, health status, type of substance consumed, therapeutic interventions and type of service. The data elements of current system are similar to the information elements of DATIS in a glance, but the data elements look like more completely than the DATIS [25].

The data elements of registration system in the state of Montana, America, included the demographic section with relatively similar items to our system, but of course, it also included other elements that were not needed and were not used for current system based on the results of the analysis of experts' opinions, as we used elements that were limited to material abuse and did not bring the general elements of poisoning [26]. Chan and Adnan's study titled identifying the main areas (Hot Spot) of substance abuse with geographic information system in Malaysia in 2020 was designed using ArcGIS software and used the GIS module to develop it [27].

The study of Joy Camp and colleagues titled "Substance Abuse Management Information System: Balancing the Needs of Central, State and Service Providers in the United States" to design a substance abuse data management system with the participation of poisoning service providers, compiled scenario tables and the next step was to use Microsoft Visio software to draw the application diagrams and the class model. In order to draw the conceptual and logical diagrams of the substance abuse management information system, a working group of poisoning experts, nurses of the poisoning department, and managers of health information and information technology was formed. First, scenario tables were compiled, then using Sparx Enterprise Architect V12 software, which supports It has UML 2.0. Diagrams of application, sequence and system class were drawn [28].

The Norwegian institute of public health has designed a system for assess of prevalence and increase of alcohol dependence and other substance use disorders as well as risk factors and its consequences in 2018 in a portal structure that is implemented based on a Java web application and uses Apache server services. Data management used MySQL database. The drug and alcohol treatment information system was designed as a web service



and ASP.NET framework was used, and SQL Server database was used to store data [29]. Mandy Gallman and Jermaine Frimlova's study entitled "report of poisonings caused by drug abuse in Erfurt city from 2002 to 2016 in Germany" provides the necessary reminders to service providers through SMS module. The results of their research showed that this system increases the effectiveness of treatment of Substance abuse and detailed reporting [30].

Another study by Qane Talaat et al., entitled the annual report of contacts registered with Iran's drug and poisoning information centers in 2015, used Micromedex and Poisindex software to evaluate the answers given. The results of the research showed that the use of this software provides better and accurate guidance for the treatment of the asked poisonings [31].

After obtaining the necessary permits from the relevant faculty and writing a letter, the Medical Records Unit of Imam Khomeini (RA) Hospital in Urmia was referred to, and the person in charge of the paper based medical records was requested for 100 of the substance abuse cases related to the subject of the thesis, and with full cooperation, all of the relevant cases were randomly provided, and after reviewing these files for several days, they were entered into the system. Out of 100 relevant cases, 45 cases were related to the use of opioids, including opium, methadone, and opium syrup. 40% of the cases related to the use of artificial drugs included tramadol and methadone syrup, while 5% were related to the use of alcohol (including homemade alcohol or industrial). And the remaining 10% were mostly intentional poisoning, including sleeping pills (narcotic drugs), antidepressants, pain killers, morphine injections, and cocaine use.

The usability of the system was done using the QUIS standard questionnaire. The average scores obtained indicated that the users evaluated the usability of the system at the "good" level as seen in figure 4. In this sense, this questionnaire was used in this research, which in a similar study conducted in 2016 on the design of a type 1 diabetes web system [32], and also in other study conducted in 2022 on the design of Iranian Neonatal Prematurity MDS [33], the system was evaluated by the system users in terms of usability by the QUIS standard questionnaire at the end of the study, was placed and the system was evaluated at the "good" level. The information of 100 substance abuse poisoning patients was recorded as a sample in the designed program and in this way, its performance was evaluated. All the steps were followed correctly and overall, the program performed well.

## CONCLUSION

There is no accurate information on the total number

of substance abusers in Iran. The lack of a Registry system was a giant challenge to clinical research, evaluation of treatment outcomes, and monitoring of the quality of care. The web-based Registry, created in C# programming language, is an appropriate tool that provides easy, accurate, and quick access to patient information. The main features of web-based Registry include structured data entry, reporting with defined access levels, and editing data element and coding. This system enables physicians to quickly identify Substance abusers (type, how, and length), provide effective treatment and follow the treatment results, and control treatment complications. Web-based Registry, by collecting clinical data and providing regular follow-up of patients, facilitates health research, quality assessment, and evaluation of substance abuse poisoning.

Considering the capabilities of the system for registering poisonings caused by drug abuse, it seems necessary to implement this system in the form of a national network, in order to make the necessary interventions to control drug abuse while using resources efficiently.

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## AUTHOR'S CONTRIBUTION

MJ and BB participated in the study design, implementation of the system and writing of the manuscript, MD, BB and SP participated in critical commenting the paper.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

## FINANCIAL DISCLOSURE

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## ETHICS APPROVAL

This study was approved by the Urmia University of Medical Sciences. The approval code number was IR.UMSU.REC.1398.447

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