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Early intervention to risk groups with the QR code system in disasters

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ABSTRACT

While disasters are situations in which people cannot cope with their own capacities, it is impossible for risk groups that need the care of others not to be affected by it. Our country is frequently exposed to disasters due to its geopolitical position, irregular population growth, being a developing country, increased industrialization, insufficient infrastructure, and many other reasons. It is very important that disadvantaged community members who need help are easily accessible and identifiable at the time of disaster. The main purpose of this study is to provide the fastest, most accurate and reliable information to the elderly living alone, to children who lost their parents during the event, to women, to those who cannot do the work they need to do on their own in their personal or social life due to any deficiencies, to those who have their own disease and who have been harmed by disasters. In this study, the risk groups that will be affected by disasters were determined and the data of the people created as an example were transferred to the data matrix system. First of all, individuals in risk groups (disabled, chronic patients, elderly, children and women) were determined and then a data matrix was created on the website.

1. Introduction

Undoubtedly, disasters have been one of the biggest problems faced by mankind throughout history (Ekinci et al., 2020). Throughout history, the definition of disaster has varied in research due to different perceptions (Başeğmez, 2017). A disaster is defined as a situation that causes damage, destruction, human losses after an event, and requires external assistance to a large extent by exceeding the capacity to cope with their own means according to the World Health Organization (WHO) (Öztaş, 2019).

Disaster and Emergency Management Presidency (AFAD-DEMP) has defined disaster as a crisis situation that causes loss of life and property by stopping or interrupting normal life activities and requiring urgent intervention (Karabulut and Bekler, 2019). According to the International Federation of Red Cross and Red Crescent Societies (IFRC), disasters are catastrophic that seriously disrupt the functioning of society and cause material, economic and irreversible vital losses that the society cannot overcome by using its own resources

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(Özkazanç, 2015). Many definitions of disaster can be found in the literature review apart from the definitions given. The common feature of all these definitions is that they exceed the coping capacity and cause great loss of life and property. The magnitude of the disaster experienced is determined by the injury and loss of life, that is, it is associated with the result rather than the type of disaster experienced (Altun, 2018).

It has been determined as the main goal to provide early intervention to disadvantaged groups, to reach losses and to prevent post-disaster abuses, by combining personal information with the data matrix application, to provide ease of access to this information in extraordinary situations in this study.

1.1. Vulnerability

It is defined as needing the help of another person to fulfill their vital functions, being in a situation that prevents bilateral communication, being unable to protect oneself from attacks, bad behavior and abuses (Taştan and Aydınoğlu, 2015). While the capacity of individuals to cope with the dangers and risks of disasters is different from each other, this situation becomes more complicated for individuals with age, gender, physical and mental disabilities. Babies and children, women, the elderly and people with disabilities are more vulnerable than other individuals. This leads to a decrease in the survivability capacity in emergencies and disasters (Sheikhbardsiri et al., 2017). Some characteristics of individuals cause them to be exposed to abuses more easily and to wear out. Age, gender, physical and mental status are some of them. The elderly and children are more easily abused and abused because they need the help of others. Considering that the elderly and children do not have the ability to make decisions causes the autonomy of these people to be ignored. Being a woman causes the person to be harmed, abused and hurt more easily. Especially women in pregnancy are more affected by disasters. People with a health status, physical or mental disability, and terminal illness are more likely to be affected by disasters than normal individuals (URL-1).

Within the scope of the Sendai Framework, it was stated that the states that are members of the United Nations should take measures in accordance with the universal values for the reduction of disaster risks, but that would meet the national and local needs, and suggestions were made to carry out studies to reduce the disaster risks. People with private health care needs have the highest morbidity and mortality rates during disasters. To give an example, after the Great East Japan earthquake of 2011, it has been proven because of the research that the disaster-related death rate of disabled people is 4 times higher when compared to other members of the society. After the tsunami that occurred due to the 2004 Indian Ocean earthquake, it was determined that 700 people with physical disabilities lost their lives in the Andomon Islands because they could not evacuate to high and safe areas (Tün et al., 2019). In a study conducted by Buluş Kırıkkaya and Gerdan (2018), the problems faced by the disabled people were examined, and while the participants of 30 people stated that they were prepared for disaster and had an idea under normal conditions, they showed that they did not have a clear idea when they were disabled or have a disabled relative.

2. Materials and Method

In this study, a data matrix identification system was designed to be integrated into risk groups in order to provide early intervention in case of a disaster, to reach losses and to prevent post-disaster abuses. First of all, a group definition was made in five different categories that were targeted for the application. Infant-children, women, chronic patients, the disabled and the elderly are considered as risk groups within the scope of the study.

2.1. Infant-Child

A baby is a creature that starts with birth and lives within the next 24 months. Child covers the period from 3 years to 11 years (URL-2). Studies on the location of disaster victims in our country are very new. According to unofficial figures after the 17 August 1999 earthquake, it is said that more than 300 people disappeared and these losses may have fallen into the hands of organs, prostitution and drug mafia or illegal traders (URL-3). After the Varto earthquake that took place on August 19, 1966, 40 children were left orphaned, and they waited for an intervention and a helping hand with the wounds they received from various parts (Büyüksaraç and Bektaş, 2017).

After the civil war in Syria, 28266 children died and 4469 children were arrested. It is not known what happened to the arrested children. It is stated that the number of children who lost their lives due to torture is 176. As a result of the 2004 Indian Ocean tsunami, nearly 4400 children lost both their mother and father. Due to the drought in Africa, thousands of children have been orphaned and death rates have increased. It is stated that 42% of Palestinian children living under Israeli siege are exposed to more than one disability. Due to the civil war in Syria, living in an unhealthy camp environment and being fed with water and food, children have faced the risk of many diseases. A significant increase has been observed in the number of children with disabilities, especially with the use of chemical weapons in wars. To give an example, while there were 300,000 disabled children in Afghanistan before the long war, this number increased to 867,100 between 2005 and 2006 due to the war and landmines (Kutluoğlu and Karayel, 2019). Security is one of the most common problems in war zones. The lack of security of life as a result of conflicts and bombardments, living in constant fear of death, causes individuals to migrate to different countries. Most of the refugees who try to immigrate to different countries become targets of malicious people such as human trafficking, organ mafia. Women and children are most affected by this condition. When the research is examined, approximately 1.2 million children are subject to human trafficking every year (Kutluoğlu and Karayel, 2019).

Nearly 500,000 children living under siege in Syria do not have access to regular humanitarian aid and basic services. In 2013, thousands of people died as a result of the civil war in South Sudan, 60 children and adults were stuffed into containers and strangled. Many deaths and destructions have occurred as a result of Hurricane Matthew, and 90 thousand children under the age of 5 are still waiting for humanitarian aid in need (URL-4).

Children are disproportionately affected by all types of disasters compared to adults. The fragile, needy and weak structures of children increase the rate of being affected by disasters as disaster victims. Limoncu and Atmaca (2018), who showed that children are more affected by disasters than adults, according to their study, 48% of school-age children are affected by disasters on average, while 52% are severely or very seriously affected. In 2011, approximately 66 million children are affected by disasters in the world every year (Mudavanhu et al., 2015). After the hurricane caused by monsoon rains in India, 300 children/adolescents were affected by the disaster, and it was determined that 200 children/adolescents had at least one psychosocial problem related to the disaster. Based on these results, it was stated in the published report that 66.7% of children/adolescents were affected by the disaster after the Uttarakhand disaster and this value was quite high (Anaelraj et al., 2016). Between 2002 and 2012, 31,012 babies died in Japan and 1450 in Tohoku. The Great East Japan Earthquake and Tsunami (GEJET) appears to have a greater impact on post neonatal deaths than neonatal deaths (Toshiro et al., 2019). Toshiro et al. (2018) examined the deaths of children under the age of 10 years after 2008-2014 and after the 2011 great earthquake in Japan, and it was found that the mortality rate among children younger than 10 years old was 6.4 times higher than the rate before and after 2011 during the 2011 disaster period. According to the data obtained from UNICEF, within 10 years, 2 million children died, 6 million children were injured, 12 million children were displaced from their homes, and nearly 10 million children were exposed to post-traumatic stress disorder (Gözübüyük et al., 2015).

2.2. Women

Female individuals who have completed their development and completed the age of 18 are called women (URL-5). Disasters do not affect people equally, the impact of disasters on women's lives is different from other groups of a community. After disasters, women's fundamental rights to health and safety are violated. After the 2010 Haiti earthquake, sexual assault victimization of 660 women was investigated and it was determined that 31.06% of them were exposed to sexual assault (Cenat et al., 2019). In a study conducted by researchers from the London School of Economics and Essex universities, 21 years of disaster data from 141 countries were evaluated, and as a result, it was determined that women died more than men in disasters (URL-6). The gender gap has also emerged in a number of disasters, including the tsunami in Asia. The victimization of men and women after disasters such as Hurricane Mitch, Hurricane Katrina and other types of storms in the Americas, European heat waves and cyclones in South Asia was compared. It has been observed that women are more at risk than men (Asghari, 2018). It has been reported that 644 people lost their lives in the earthquakes that took place in Van on October 23 and November 9, 2011, and the majority of those who lost their lives were women who were caught while doing work at home during the earthquake. On the other hand, after the Van earthquake, female suicide rates were found to be high in and around Van (TTB, 2012). It has been reported that after the earthquake, women in tent cities experienced situations that limited their freedom of life and movement (going to toilets and showers due to fear of being abused) (URL-7). After the 2004 Indian Ocean tsunami, the death rate of women was found to be four times higher than that of men. It was determined that male death rate of female deaths after flood and cyclone in Bangladesh Gorky in 1991 was 14:1, while female deaths were 55% in the earthquake that occurred in Nepal in 2015, the death rate of other citizens was 45% (Hemachandra et al., 2018).

Disasters affect girls and boys, women, the elderly, and the disabled in different ways and in severity. Therefore, their responses to disasters differ from other individuals. Women are more affected by disasters than men due to the role of motherhood, poverty, low level of education, and gender roles imposed on them. Women have been exposed to various difficulties because of their gender. The problems arising from the gender inequality of women and their examples are given below.

Behaviours of women arising from their upbringing, acquired skills, being affected by gender role, for example, women's lack of swimming or climbing skills, protecting their children and households due to the responsibilities imposed on them, taking active attitudes depending on their decision to move them to another place in case of disaster, situations such as the difficulties experienced by the clothes caused the victimization of women to be more in disasters.

In crisis and disaster situations, there are difficulties due to the difficult and limited access to reproductive health services. Obstetrics, pregnancy, and puerperal care are needed for many reasons, for which we can increase their access to gynecological and reproductive health services. After a disaster, the number of women who give birth prematurely, those whose birth is approaching, and women who need birth control services are increasing due to the fear of the disaster.

Post-disaster nutrition, infections and infectious diseases are increasing. The fact that toilets and bathrooms are outside the

camp after the disaster creates difficulties in use (Dündar et al., 2018). The use of dirty water due to insufficient water has led to an increase in diseases and loss of life (Coşkun, 2018). Trafficking in women increases after disasters and wars. In Turkey, 99% of human trafficking for sexual exploitation is women. Different forms of human trafficking are also encountered, such as forced marriage, burdening the entire household, begging, and adoption (Boz and Şengün, 2017). According to the latest estimates, the number of women traded in earthquake regions has been close to 20,000 (Coşkun, 2018).

2.3. Chronic patients

Insidious and progressive deviation in physiological functions is defined as health problems that do not improve throughout life, have a complex course, and affect the lives of individuals who require constant care (Akpınar and Ceran, 2019). The number of chronic diseases in our country is constantly increasing. There is no definitive treatment for these diseases. Only symptomatic or reliever treatments are applied. Diabetes, asthma, cancer, AIDS, blood pressure, migraine, COPD, allergies, ulcers, heart diseases, anemia are the most common types of chronic diseases (Dülger, 2003). The first four causes of death in 1980 in Turkey were heart diseases, perinatal, pneumonia, and cancer (URL-8). The reason why chronic patients are handled in disasters is the increase in the victimization rate due to the increase in problems in accessing this type of treatment or the need for medication and special medical equipment after a possible earthquake (Uğur et al., 2014).

2.4. Elderly

In the definition accepted by the World Health Organization, it covers individuals who are chronologically 65 years and older (Beğer and Yavuzer, 2012). It turned out that 70% of those who died after Hurricane Katrina in New Orleans were elderly. After the Mis hurricane, 200 elderly people were abandoned by their caregivers, and after this disaster, the chronic disease picture worsened due to the inability of more than 200,000 elderly to use the drugs for diseases such as diabetes and asthma. The majority of the 465 people who died during the Chicago heat wave in 1995 were over the age of 75 (Gibson and Hayunga, 2006). Labra et al. (2018), examined the factors that cause an increased risk of death during a heat wave for people aged 65 and over, pointing out that there are factors such as living alone, social isolation, inadequate air conditioning systems, living in the upper floors of apartments, and other housing features. In order to evaluate the post-disaster situation of the elderly, HelpAge International interviewed 300 elderly women and men, some of the elderly stated that they were indifferent to them and their opinions were not taken into account in case of disasters and emergencies, and some reported that they did not receive adequate humanitarian aid. Half of the interviewed elderly reported feeling anxious and hopeless (Labra et al., 2018). A nationwide telephone interview survey was conducted with 1648 elderly people in the USA in 2005 by AARP and Harris Interactive, approximately 13% of elderly people aged 50 and over stated that they would not be able to evacuate from their homes in case of natural disasters without help, 46% stated that they needed help from outsiders, 67% stated that they needed help from outside. of them stated that they could evacuate on their own (Figure 1). It is also seen in the graph in Figure 1 that these rates are higher for the elderly over 75 years old, except for evacuation without needing the help of someone else, especially when they need help from outsiders (URL-9).

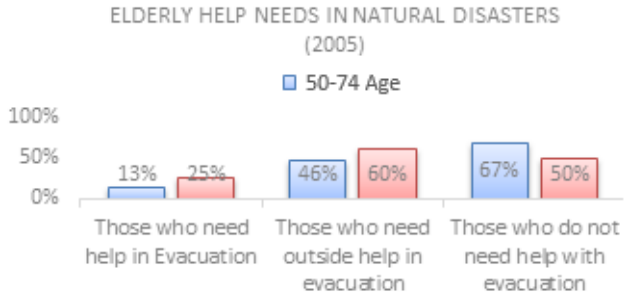

Figure 1. Telephone interview survey of 1,648 seniors nationwide in the USA by AARP and Harris Interactive (URL-9).

Advancing age is a very strong risk factor for having more than one chronic disease. About 80% of older people have at least one chronic condition, such as heart disease, diabetes, or stroke. All disasters disproportionately affect older adults, especially those who are chronically disease. Among the reasons for being particularly vulnerable during and after disasters are physical disabilities, decreased sensory awareness, adaptation problems, chronic health conditions, and economic constraints that prevent adequate preparation and adaptability in social disasters. In the survey conducted by Harris Interactive survey in 2005, it was concluded that half of the 13 million elderly people aged 50 and over in the United States would seek help from someone other than themselves after a disaster (URL-10).

2.5. Disabled people

In the most general terms of the United Nations, it has been defined as the inability of normal individuals to fulfil their vital functions as a result of genetic or later deficiencies in their personal or social lives (Koca, 2010). The definition made by the United Nations General Assembly for the disabled is the inability of healthy individuals to do the things that they need to do in their personal or social life without the need for the help of another person, because of any congenital or acquired deficiencies (Koca, 2010).

According to the results of the 2002 disability research conducted by the Turkish Statistical Institute and the Administration for the Disabled, 12.29% of the total population has at least one disability (Sarı and Aktar, 2017). Out of a total of 8 million 431 thousand 937 disabled citizens, 9.7% consists of chronic diseases, 1.25% orthopedic, 0.38% language and speech, 0.48% mental, 0.37% hearing, 0.6% visually impaired citizens (URL-11). The most common types of disability.

Visually impaired: They are individuals with complete or partial vision loss or impairment in one or both eyes (Pascolina and Mariotti, 2012). As a result of the survey conducted in 39 countries, it was revealed that there are 285 million visually impaired people, 39 million of whom are blind (URL-12).
Hearing impairment: They are people who have completely or partially lost their hearing (URL-13). The inability of a person with language and speech disabilities to pronounce the sounds they make properly and fluently, and those with impaired speech speed and voice.
Orthopedic disability: They are people who have lost their physical abilities to varying degrees due to disorders in the skeletal, muscular and nervous systems for any reason, and who have difficulty in performing their daily life activities and therefore need the help of another person (Yumuşak, 2014).
Mental disability: They are individuals who differ by about two standard deviations in mental function and need special and supportive training (URL-13).
Chronic illness: They are diseases that have long-lasting and continuous treatments in any part of the body (URL-13).

2.6. Quick Response (QR) Code

A type of matrix barcode, or two-dimensional bar, was originally designed for the automotive industry in Japan. Recently, the QR Code system has become popular. It has more storage capacity than standard UPC barcodes due to its fast readability. The code consists of a black module (square dots) arranged on a square grid on a white background (Masalha and Hirzallah, 2014). QR code were used in many different fields (Işık et al., 2019; Işık et al. 2018). It was first used in the pharmaceutical industry in Turkey (URL-3). The features that make the QR code widely used can be listed as follows.

- 360° readability,
- High speed feature,
- Expanded data capacity (depending on symbol size and information type)
- Support of different types of information (binary, numeric, alpha-numeric, Kanji / Kana)
- Resistance to non-linear appearance (eg due to uneven surfaces)
- High level of standardization (eg AIM, JIS, JAMA, ISO and IEC)
- Error checking and correction algorithm (Reed-Solomon) (Canadi et al., 2010),
- It has the ability to store large amounts of data in a small area without accessing the database to support information distribution and detection (Warasart and Kuacharoen, 2012).

QR codes are widely used for processing patient data in the Asia-Pacific regions. Various hospital supports were developed in Brenmoor, United Kingdom, and QR codes were placed on blood bag labels. Data matrix is used in accordance with the patient safety policy at Adden brooke hospital in Cambridge. Thanks to the QR code integrated into the wristband, personal information, blood transfusion tracking and blood group information will be accessed quickly. In the study of Taiwanese researchers, the transfer of prescription information between hospitals and pharmacies to a computerized environment was provided to identify patients with data matrix (Uzun and Bilgin, 2016; Işık et al., 2018; Işık et al., 2020).

In order to apply QR code within the scope of the study, parametric information for the risk group members consisting of 42 people selected from the province of Bitlis was transferred to the database in the electronic environment, and a data matrix application was carried out to be used on smart phones and tablets in order to evaluate and monitor this transferred information. This system provided data matrix-based medical identification and identification of disaster victim identification information. A unique medical system data matrix tag is assigned to each selected member. Thus, easy access to information such as personal information, disease history, regularly used drugs, and disability will be ensured. The QR code can be integrated into portable items such as the collar tag of the shirt, the tag with the washing instructions of the clothes, the necklace or the ID card.

The age, gender, diagnosis of the disease, drugs used, blood type, disability status, surgery information and allergic reaction information of the risk groups in question are shown in Table 1. Some information on the table, such as the drugs she/he used, allergies and disabilities, were hidden due to the privacy policy and were only given as Yes/No.

Table 1. Sample parametric data of individuals in the risk group for which QR code will be applied.

Risk Group	Sample No	Gender (F/M)	Age	Disease	Drugs Used (Yes/No)	Blood Type	Disability/ Allergy (Yes/No)	Surgery undergone
Elderly	1	F	71	diabetes mellitus	Yes	A Rh(+)	No	Yes
	2	F	68	atherosclerosis eye pressure	Yes	0 Rh(+)	Yes	No
	3	M	66	KOAH	Yes	AB Rh(-)	Yes	No
	4	M	65	Primary hypertension, diabetes	Yes	B Rh(+)	No	No
	5	F	90	Myalgia, hypertension	Yes	A Rh(-)	No	Yes
Infant-Child	1	F	4	Asthma	Yes	A Rh(+)	Yes	Yes
	2	M	6	type-2 diabetes	Yes	A Rh(+)	No	Yes
	3	F	5	Epilepsy	Yes	0 Rh (+)	No	No
	4	F	5	dystonia	Yes	0 Rh (+)	No	No
	5	M	6	Epilepsy	Yes	A Rh (+)	Yes	No
Females	1	F	34	Ankylosing spondylitis	Yes	AB Rh (+)	Yes	No
	2	F	41	Antivertigo	Yes	A Rh (-)	No	No
	3	F	33	Granilamatös mastit	Yes	A Rh (+)	Yes	Yes
	4	F	48	infertility	Yes	AB Rh (+)	Yes	No
	5	F	52	Hepatite-B	Yes	0 Rh (+)	Yes	No
Cronic Patients	1	M	49	Cardiac insuffiency	Yes	AB Rh(-)	Yes	Yes
	2	F	29	Gastritis	Yes	A Rh(+)	Yes	Yes
	3	F	31	Hemophilia	Yes	0 Rh(-)	Yes	No
	4	M	29	Hypertension	Yes	AB Rh(+)		No
	5	F	52	chronic anemia	Yes	B Rh(+)		No
Disabled	1	F	35	multiple sclerosis	Yes	A Rh(+)	Yes	No
	2	M	12	Down Syndrome	Yes	AB Rh(-)	No	No

3. Results

In this study, it was determined as the main goal to provide easy access to this information in extraordinary situations by combining personal information with the data matrix application, which will provide early intervention to disadvantaged groups, reach losses and prevent post-disaster abuses. First of all, risk group members were defined. The members of this group were examined under 5 categories: infant-child, female, chronically ill, disabled and elderly. A total of 42 people were interviewed, 10 people from the elderly, women, children and chronic patient categories, and 2 people from the disabled group. A small sample group was created by selecting 2 people from each category among the 42 people interviewed and integrating them with the data matrix on a website where parametric information of 10 people in total was created. As in the image in Figure 2, information such as age, gender, disease information, medications used, allergy status, blood group, etc., which will enable early intervention, is provided to this created web area. Thus, an individual data matrix identity was created. The QR codes on these IDs were read by mobile phones and access to the information of individuals was provided. DataMatrix necklace, shirt collar tag, top clothes can also be integrated into the places where the washing instructions are located. The places where the QR Code label will be integrated have been chosen to ensure easy access for the user, and to prevent it from being used by other people in order to eliminate abuse.

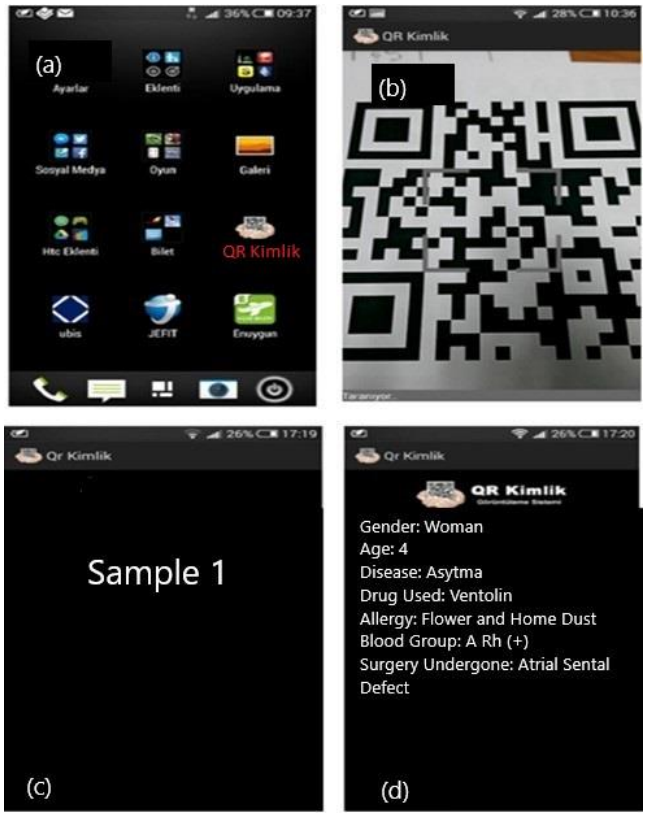

Figure 2. (**a**) QR ID web application, (**b**) QR code generated, (**c**) Person identification and (**d**) Contact information

4. Conclusions

Disasters cause permanent damage and destruction in the region where they occurred throughout history. Today, the number of people affected by extraordinary situations is increasing day by day. For this reason, various studies are carried out to reduce the loss of life, to reach the losses early and to reduce the vulnerability. The degree of victimization experienced in disaster situations is not equal for all people. Risk group members are more affected by this condition than normal people. With the application of the QR code identification system developed due to these grievances, it will be easier to identify risk groups in disasters and if necessary, treatments will be made on time. This will save more human lives.

The database created by this method will be stored in a specified web area and can be kept as a very important and necessary source of information in terms of providing easy access to the information of the segments of the society, which is defined as a risk group for a region or community. However, this system, which was applied to a small group in the province of Bitlis, can be used throughout the country, providing the opportunity to help more people. DataMatrix created based on the database can be carried by people in different ways. For this purpose, different applications are included in the study, and it is suggested by us that it can be used as embroidered on the collar tag on the clothes or necklace/tag, etc., in the application to be made for Bitlis.

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