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Poison Centers in the Eastern Mediterranean Region: History, Scope of Services, and Strengths and Weaknesses as Public Healthcare Providers

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Abstract

Background: Poison centers (PCs) have been established in some of the Eastern Mediterranean region (EMR) countries; however, their history, scope of services, and data collection parameters have not been studied. Aims: To investigate whether PCs in the EMR offer standardized and harmonized services compared to PCs in developed countries.

Methods: Required data were extracted from a questionnaire that was distributed to EM poison centers and from articles published during 1995–2021 by PCs in the EMR.

Results: A total of 23 PCs were found in 14 of the 22 EMR countries, the majority of which shared data entry of the main poisoning parameters. The scope of services was documented by 10 PCs in EMR countries. Only three poison centers, located in Egypt, Saudi Arabia, and Tunisia, provided all of the WHO-listed main services, while four PCs provided poison information and laboratory services, and the rest provided one or two services. Conclusion: Only 63% of EMR countries have a poison center, and most of them lack functions and services at the level needed as public health providers. Collaboration among PCs in EMR countries is required to determine weaknesses, strengths, and challenges.

Keywords: poison centers; services; poisoning; data harmonization and standardization; Eastern Mediterranean countries.

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1. INTRODUCTION

Unintentional poisoning may cause large numbers of deaths. Most of them are preventable. Based on 2016 data extracted from the World Health Organization (WHO) Health Observatory, unintentional poisoning fatalities were more than 108,000, including more than 8000 in the Eastern Mediterranean region (EMR) [1]. Underestimation of the size of the problem may be caused by underreporting of deaths attributed to incorrect underlying causes 2].

Global average mortality rate attributed to unintentional poisoning (per 100,000 population) is 1.45, while it was double or even triple in some countries of the region, like Somalia, with an average of 1.2. Figure 1 lists the rates in countries of the region in comparison to the global average.

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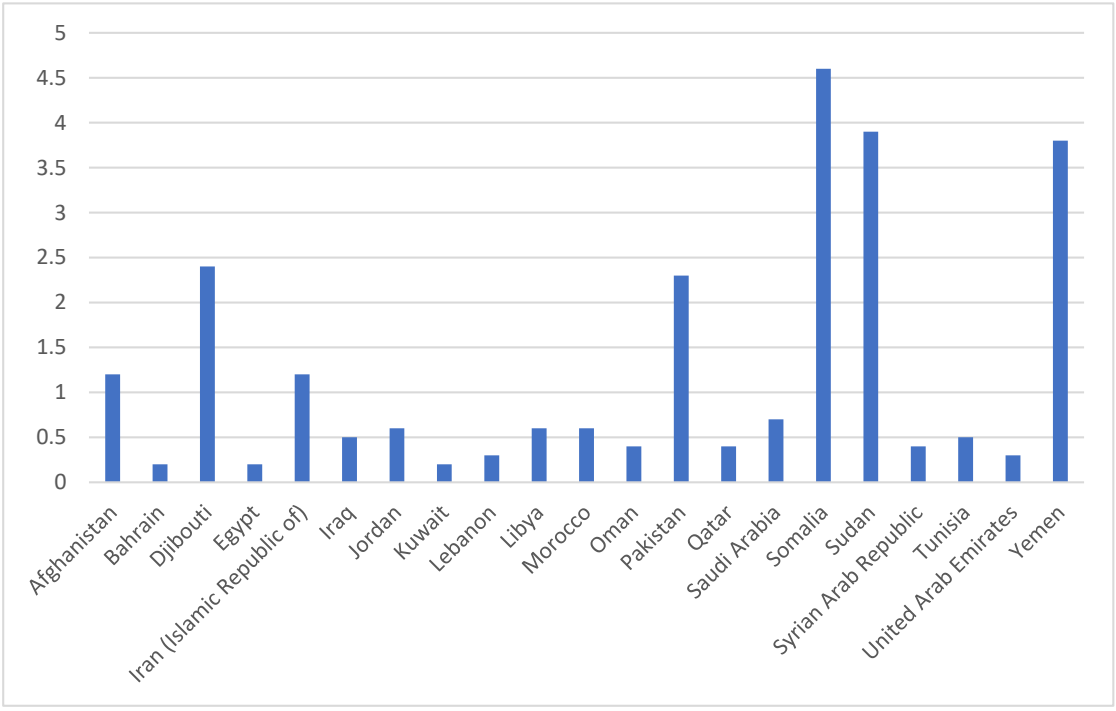

Figure 1. Mortality rate attributed to unintentional poisoning (per 100,000 population) [1]

Furthermore, for intentional poisoning, it is estimated that around a million people die every year from chemical exposure, including pesticides [1]. It is clear from these numbers that poisoning is a real problem and that rapid and effective measures must be taken to reduce its negative impact around the world.

Poison centers (PCs) can have an essential role in this regard, as they disseminate the required information to the public, as well as healthcare professionals, when required.

A poison information center is a specialized unit that provides up-to-date information about all types of poison exposure, including early diagnosis, first aid, treatment, and prevention, by assigned poison information specialists. The scope of services of PCs differs from one country to another. According to the new WHO guidelines for poison centers published in 2020, they may provide one or more of the following: information on the management of poisoning, clinical toxicological services, and toxicological laboratory services [3]. In the years since the first guidelines for poison centers were published in 1997, there have been developments in their roles and activities and in information technology and communication. Of particular importance is a renewed emphasis on the role of PCs in public health after the International Health Regulations (IHR) were revised in 2005. The regulations now take an all-hazards approach to protect public health and require that countries have the capacity for surveillance, detection, and response to public health events caused by chemicals. Much of this capacity can be provided by well-resourced PCs [3].

In other words, it can be said that the best scenario model for PCs is to have all three listed services by the WHO. In reality, some PCs provide services to healthcare providers and the general public, while others are open only to healthcare professionals. Poison centers can also have poisoning treatment units, while others only provide information and consultation over the phone. In addition, it is quite important for PCs to have their own information database in order to pool data in their own format for annual reports. In this approach, the huge amount of information collected will be transformed into a very valuable knowledge base for public health policymakers and security providers.

The aim of this study was to investigate the history of PCs in the EMR in terms of their scope of services, poison information, and clinical and laboratory services. Furthermore, this study also examined the degree of harmonization and standardization in terms of the data collection parameters of PCs in the EMR compared to the National Poison Data System (NPDS) of the American Association of Poison Control Centers (AAPCC).

2. MATERIALS AND METHODS

This is a prospective study, in which the following methods were used: The main method was a questionnaire as reflected in Appendix A that was developed, then validated by distributing it to a group of professional academic experts, who reviewed each item in terms of its being direct, understandable, and comprehensive. After this, the questionnaire was distributed by email to poison centers in the Eastern Mediterranean region in January 2021. The questionnaire consisted of 15 questions divided into two main parts. The first part was about basic information about the poison center and included 12 questions related to; name and year of the poison center establishment, number and type of staff who answers calls, training programs, services provided and working hours, number of calls received yearly and number of PCs per country and finally whether poison information inquiries service is free. The second part is about data collection and includes three questions related to the main substance categories of exposure, parameters included in the data collection report form, and finally, some of the main parameters subcategories: age group and reason of exposure.

The second method was a comprehensive literature review of studies published by PCs in the EMR from 1995 to 2021, covering the scope of service and data analysis that described the general pattern of poisoning was carried out during February and December 2021. The following databases were searched to retrieve articles related to the topic: Scopus, Google, Google Scholar, and PubMed Central. Our search strategy was implemented by using the following keywords: (epidemiology OR pattern OR scope of service OR annual reports) AND (poisoning OR PCs) AND (Eastern Mediterranean Region OR country name in this region). Articles retrieved were evaluated for relevant data extraction and were double-checked and verified by other authors. After that, for each article, the following information was tabulated: Country of origin of the study and main parameters studied. The year of establishment of certain poison centers was obtained by direct personal communication with poison center staff, as this was not available with the two previous methods.

National Poison Data System *is an American model* utilized by the AAPCC for the near-real-time surveillance *of national and global public health* [30] that has had a positive impact on emerging public health concerns related to hazardous and environmental agents. This system analyzes PC data according to 20 parameters. Some of the parameters need huge amounts of data to be able to apply them, as with PCs in the USA. In this study, seven parameters were excluded (exposures in pregnancy, chronicity, decontamination procedures, specific antidotes, distribution of suicides, plant exposures, deaths, and exposure-related fatalities) to enable an analysis of the data collected from the PCs in the EMR. The final list of parameters included information requests to PCs, exposure cases logged at PCs, age, gender, caller and exposure site, reason for exposure, route of exposure, clinical effects, case management site, medical outcome, decontamination procedures and specific antidotes, and, finally, top substances in humans.

3. RESULTS

Although the questionnaire was distributed by email to the 13 countries (except Syria) in the EMR with poison centers, only nine countries returned filled-in questionnaires in March 2021: Egypt, Jordan, Iran, Iraq, Palestine, Saudi Arabia, Qatar, Morocco, and Tunisia. On the other hand, a total of 45 articles were retrieved during the comprehensive literature review. 21 of them were excluded as they originated from healthcare facilities' records. The 24 articles were then evaluated to be included in this study. For data collection parameters, 18 articles were retrieved [4-21]. These articles were published by nine PCs in the EMR countries—Egypt, two articles [10,11]; Iran, five articles [12-16]; Pakistan, two articles [17,18]; Saudi Arabia, four articles [4,5,19,20]—and the remaining five had one article each: Iraq [21], Jordan [8], Lebanon [7], Morocco [6], and Palestine [9]. For countries with more than one article published, the one with the maximum number of parameters studied was selected. Finally, nine eligible articles were included in a more detailed review [4,6-10,12,18,21].

3.1. *Structure of the EMR Poison Centers*

Results of the distributed questionnaire revealed that three PCs showed more than a 25% increase in the number of inquiries received during the last 5 years, while the rest six PCs showed less than a 25% increase. As for the staff who responded to calls, they were physicians, pharmacists, nurses, or a combination of them. More precisely, physicians were found in 55.6% of EMR PCs staff, 66.7% were pharmacists and clinical pharmacists, and 22% involved nursing staff. Furthermore, 35% of PCs had training programs, whereas the rest had self-training or no training at all for their staff who received the calls.

Concerning the main substance categories of exposure, drugs, households, and pesticides were common in all EMR PCs data. While other categories like plants, scorpion stings, and snake bites showed

fluctuations according to their abundance in each country. As for the PCs' working hours, all of them provide their services over 24 hours, except three PCs: 16 hours, 14 hours, and 8 hours a day.

As for who the service is provided to, only one poison center did not provide it to the public, whereas the rest of the PCs provided the service to both the public and healthcare providers. This service is free for callers in all EMR PCs.

3.2. *History of the EMR Poison Centers*

The results of our research revealed a total of 23 PCs present in 14 of the 22 EMR countries. Data were obtained from a questionnaire, a literature review [4, 6-9, 22-25], and direct personal communication with representatives at the related poison centers (Saint Joseph University PC in Lebanon, Oman PC, Aga Khan University Hospital in Pakistan, Abu Dhabi PC, Ministry of Health/Dubai PC). For convenience, and in order to study whether there was a relationship between the seniority of a poison center and the services it provided, the time period between the establishment of the first and the last poison center per country in the EMR was classified into three eras: The first era can be considered before 1990, and countries in this period included Egypt, Iran, Morocco, Saudi Arabia, and Tunisia. The second era (1990–2005) included Jordan, Iraq, Lebanon, Pakistan, and the United Arab Emirates, while the third era (2006–2020) included Oman, Palestine, and Qatar. Information on the year of establishment of the Syrian poison center could not be found, although it is listed in the WHO directory of EMR PCs.

As for the exact number of poison centers required to serve a country, the WHO guidelines state, "Generally speaking, a poison information center should serve a population of 5-10 million, but a proliferation of centers should be avoided" [26]. According to this, and in order to estimate the number of PCs needed in the countries of the region, a conservative rate of one poison center per 10 million people was used. Table 1 shows the actual number of functioning and required PCs in each EMR country according to the WHO directory. In order to meet the challenge, 54 additional PCs would need to be established in the region.

Table 1. Number of poison centers per EMR country.

No.	Country	Population in Thousands (World Bank)]27[2020	Number of Poison Centers Needed	Actual Number of PCs (WHO Directory) [28]
1	Afghanistan (AFG)	38,928.34	4	0
2	Bahrain (BAA)	1701.58	1	0
3	Djibouti (DJI)	988.00	1	0
4	Egypt (EGY)	102,334.40	10	2
5	Iran (IRN)	83,992.95	8	41
6	Iraq (IRQ)	40,222.50	4	1
7	Jordan (JOR)	10,203.14	1	1
8	Kuwait (KUW)	4270.56	1	0
9	Lebanon (LEB)	6825.44	1	1
10	Libya (LIB)	6871.29	1	0
11	Morocco (MOR)	36,910.56	4	1
12	Oman (OMA)	5106.62	1	1
13	Pakistan (PAK)	220,892.33	21	2
14	Qatar (QAT)	2881.06	1	1
15	Saudi Arabia (SAA)	34,813.87	3	5
16	Somalia (SOM)	15,893.22	2	0
17	Sudan (SUD)	43,849.27	4	0
18	Syria (SYR)	17,500.66	2	1
19	Tunisia (TUN)	11,818.62	1	1
20	United Arab Emirates (UAE)	9890.40	1	1
21	West Bank and Gaza (OPT)	4803.27	1	1
22	Yemen (YEM)	29,825.97	3	0

According to the WHO directory and as can be seen from the actual number of PCs in the 22 EMR countries in Table 1, around 41% of countries met the minimum number of poison centers required, whereas 36% had no PCs at all, and 23% partially met the requirements, with fewer poison centers than the required number.

3.3. *Data Collection Parameters of the EMR Poison Centers*

The results from the questionnaire and the eligible retrieved studies [4,6-10,12,18,21] during the literature search showed that the PCs in the EMR document and analyze the same seven parameters: Age, gender, reason for exposure, route of exposure, clinical effects, case management site, decontamination procedures, and antidotes used (Table 2).

Table 2. Parameters studied according to the questionnaire and selected published studies from poison centers describing a general pattern of poisoning in EMR countries.

Parameter	EGY	IRN	IRQ	JOR	LEB	MOR	OMA*	PAK	PAL	QAT	SAA	SYR*	TUN	UAE*
Site of the caller	x		x	x	x	x			x	x	x		x	
Age and gender of the person and the type of toxin	x	x	x	x	x	x		x	x	x	x		x	
Route of exposure	x	x	x	x	x	x			x	x	x		x	
Time of hospitalization								x						
Recommended management	x	x	x		x	x			x	x	x		x	
Predicted outcome	x		x	x	x	x		x	x	x	x		x	
Reason for exposure	x	x	x	x	x	x			x	x	x		x	
Type of call	x		x	x					x	x	x		x	
Signs and symptoms	x	x	x			x			x	x	x		x	
Top types of toxins in humans	x			x	x	x				x	x		x	
Site of exposure	x		x			x			x	x	x		x	
Antidotes given and death-related offending agents	x	x	x			x			x	x	x		x	
Site of management, no. of substances per exposure, and % of fatalities per toxin		x								x				

* Data not available.

It was found that the subcategories were not similar within the same parameter. For example, age subgroups were defined differently by each poison center: The Jordanian poison center divided the parameter into eight age subgroups: ≤5 years old, 6–12 years, 13–19 years, 20–29 years, 30–39 years, 40–49 years, 50–59 years, and ≥60 years [8]; the Egyptian poison center divided it into five subgroups: <7 years, 7–15 years, 15–25 years, 25–40 years, and >40 years [10]; and the Moroccan poison center used seven subcategories: up to 4 weeks post birth, 4 weeks to 12 months, 1–4 years, 5–14 years, 15–19 years, 20–74 years, and >75 years [4].

The reason for exposure is another parameter that is handled differently by each poison center. According to the 2020 AAPCC annual report [29], this parameter was categorized into five major groups: Unintentional (general, environmental, occupational, therapeutic error, misuse, bite/sting, and unknown), intentional (suspected suicide, misuse, abuse, and unknown), adverse reaction (drug and other), other (malicious and withdrawal), and unknown. Poison centers in Lebanon and Qatar were the only ones that adopted the AAPCC categorization; the rest defined it without subcategorization, and their definitions differed.

A comparison was made between these 13 parameters and those used by 11 PCs, available data from the 23 different PCs in the EMR. The level of compliance of the PCs in the EMR with the NPDS

was calculated, based on the number of parameters each center used: Seven EMR PCs had compliance above 90%, while four had compliance below 90%.

3.4. ***Scope of Services of the EMR Poison Centers***

Regarding the scope of services provided by the 23 EMR PCs, the literature search showed data for only 10 (around 43.5%). Four PCs (in Iraq, Jordan, Morocco, and Palestine) provided both poison information and toxicology laboratory services, and three (in Egypt, Saudi Arabia, and Tunisia) provided all three of the WHO-listed functions; the remaining three provided one or two services (Table 3). No data was found regarding the scope of poison centers in Lebanon, Oman, and the United Arab Emirates.

Table 3. Scope of services provided by the EMR PCs based on the questionnaire and selected published studies [9,25,31,32] in reference to the new WHO new guidelines (2020).

#	Function of PC per WHO Guidance	Country/Name of Poison Center
1	Poison information	Qatar*/Qatar Poison Center*
2	Poison information and toxicology laboratory services	Morocco/Moroccan Poison Control Centre
		Jordan/National Drug and Poison Information Center
		Iraq/Baghdad Poisoning Control Center
		Palestine/Poison Control and Drug Information Center (PCDIC)
3	Clinical and toxicology laboratory services	Iran/Loghman-Hakim Drug and Poison Information Center (LHDPIC) * Pakistan/Aga Khan University Hospital, Karachi
4	Poison information and clinical and toxicology laboratory services	Egypt/Poison Control Center of Ain Shams University Hospitals (PCCA)
		Saudi Arabia/King Saud University Drug and Poison Information Center
		Tunisia/Tunisian Poison Center

* Only qualitative assessment tests are available according to the reference mentioned.

4. DISCUSSION

A lack of public knowledge about the danger of poisons and the unavailability of poisoning preventive measures, such as those provided by poison centers, could be the reason behind the increasing morbidity and mortality due to poisoning in some countries of the region. Furthermore, the inability of treating physicians to access the required information about first aid and the management of poisoning victims is another factor that should not be ignored.

Poison centers have been established around the world to play a unique and vital role in both direct patient care and public health. The *oldest globally established and recognized poison control center* was in the USA in 1953 [33]. Whereas the first poison center in EMR was established in Egypt in the late 1970s [22]. The USA's early establishment of PCs is a contributing factor that poison centers in the USA are the pioneers in poison center services, leading to more profound and mature PC services compared to those in the rest of the world, including EMR.

Eastern Mediterranean region poison centers were found in 14 of the 22 countries. This number is considered low relative to the total population of the EMR. Although some of these PCs are not fully functioning and have poor reporting systems, which limit their benefit for both patients and policymakers, their existence is considered a strength in the EMR.

As for the structure of EMR PCs, there were no major differences in the qualifications of staff answering calls, working hours, to whom services are provided, and the main substances of categories of exposure. When comparing EMR PCs with PCs

in the USA, there were differences in the qualifications of staff who answered calls. In the USA, only registered nurses and pharmacists receive the calls with ongoing training programs [29], whereas in EMR PCs, physicians and pharmacists are the main receivers with limited training programs in many PCs. Differences were also found concerning the main substance categories of exposure between the USA and EMR PCs. In the USA, there is a more detailed substance categories of exposure [29]. Types of drugs are classified as analgesics, antihistamines, and antidepressants. In addition, different categories are mentioned, like cosmetics/personal care products, foreign bodies, alcohols, and chemicals, among others.

In most EMR PCs, there was standardization of data entry of the main parameters within their enquiry databases regarding the general pattern of poisoning in the region, to enable comparisons between elements in these PCs and those used in the NPDS system. Standardizing and harmonizing data collection is expected to improve the quality of records at each poison information center and their utilization for poison surveillance. Moreover, internationally harmonized data would facilitate data comparisons among PCs, which would enrich the toxicological information about globally hazardous materials.

On the other hand, varying subcategories of some of the main parameters, such as patient age, were in use in most EMR PCs. Having a unified and standardized categorization of such parameters among countries would definitely highlight certain aspects, such as correlations between age group subcategories, type of substance, and circumstance of exposure. For example, a correlation between suicidal attempts and specific age groups was reported in developed countries [34]. Standardization of data collection for all EMR PCs, along with proper data analysis, would enrich the related literature and assist EMR public healthcare authorities in endorsing suitable measures to prevent certain types of poisoning and educate the general population regarding the possible circumstances.

To overcome the variation among PCs around the world, a consensus is needed regarding adopting a predetermined standardized coding system for nomenclature, a classification of substances, and benchmarks from internationally approved systems such as NPDS. This is expected to hinder the use of improper synonyms or misspellings that could have a negative impact on data analysis. Eventually, this will support EMR PCs to utilize the collected data to serve all stakeholders, depending on their function.

With reference to the services provided by EMR PCs listed in Table 3, and considering this region comprises mainly metropolitan cities with a high incidence of poisoning with chemicals and other hazardous agents, accompanied by huge amounts of information with which to identify these agents and access to data, it might be reasonable to consider that the provision of poison information to the public and healthcare professionals is the most important function of PCs in this region. Furthermore, no relationship was found between the seniority of a poison center and the services it provides.

5. CONCLUSIONS

Poison Centers in the EMR need further strengthening in terms of human capital, training in toxicology, and financial support, among other areas. Cooperation among EMR countries that have PCs with those nearby that do not is essential in order to provide support whenever needed. This can be achieved by having standardized regional protocols for the diagnosis and treatment of poisoning, as well as the contribution of antidotes to those in need; like the serious poison exposure incidents related to thallium and botulism that occurred lately in two EMR countries, where the Center for Environment Health Action (CEHA) office in Amman collaborated to extend the search for available antidotes.

Finally, it is suggested to organize a WHO-supervised workshop for all EMR PCs to elucidate their weaknesses, strengths, and challenges. Some of the expected outcomes are the adoption of standardized data collection methods, regulating cooperation among EMR poison centers, and supporting countries with no poison information centers.

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Appendix

Poison Control Centers Questionnaire

This questionnaire is dedicated to poison centers in the Eastern Mediterranean Region. It is to be filled by the director of the poison center or a senior poison information specialist.

Please fill out the questionnaire, which aims at collecting data needed for our research entitled " Poison centers in the Eastern Mediterranean Region: history, scope of services, and their strengths and weaknesses as public healthcare providers". Kindly note that all data will be kept strictly confidential and only used for research purposes.

Poison Center basic information:

1. Name of Poison Center
   ……
   ……
2. Year of establishment
   ……
3. Host of poison center once established
   ……
   ……
4. Number of current staff
   ……
5. What types of staff routinely deal with poison information enquiries at the center (Nurses, physicians, pharmacists, and others (please specify)
   ……
   ……
6. Is there any trainee program for your staff (related to your staff who answer the calls)?
   ……
   ……
7. What services does your center provide (Kindly list all that apply)?
   Poison information service by telephone, Poisoning treatment unit, and
   Analytical toxicology laboratory
   …….. ……
   ……
8. What are the hours of operation of your information service?
   ……
9. How many calls do your poison center have to answer? Have the number of inquiries increased during the last years?
   ……
   ……
10. To whom your poison center provides the service? Public or healthcare providers or both?
    ……
    ……
11. To the best of your knowledge, dose your country have more than one poison center? If yes, kindly list them
    ……
    ……
12. How is the financial situation of your poison center? Do the callers have to pay for advice?
    ……
    ……

Data collection information:

13. What are the main substance categories of exposure?
    ……
    ……
    ……

14. Kindly highlight any of these parameters that is included in your data collection report form

Information requests to PCs
Exposure cases logged at PC
Age
Gender
Caller and exposure sites
Reason of exposure
Route of exposure
Clinical effects
Case management site
Medical outcome
Decontamination procedure
Specific antidotes
Top substances in human
Others:……
……
……

15. Kindly list your parameter subcategories (if included in your data collection) for the following parameters:
Age group, Reason for exposure
For example- Age group: ≤ 5 years old, 6-12 years, 13-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and ≥ 60 years
Age group:
……
……Reason of exposure:
……
……

Thank You

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نطاق الخدمات ومعايير جمع البيانات لمراكز السموم في منطقة شرق البحرالأبيض المتوسط؛ دراسة مقارنة

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الملخص

الخلفية: تم إنشاء مراكز السموم في بعض دول شرق البحر الأبيض المتوسط؛ انما لم يتم دراسة تاريخها ونطاق خدماتها و معايير جمع البيانات لديها.

الأهداف: التحقق مما إذا كانت مراكز السموم في منطقة شرق البحر الأبيض المتوسط تقدم خدمات موحدة ومنسقة مقارنة بمراكز السموم في البلدان المتقدمة.

الطرق: تم استخراج البيانات المطلوبة من الاستبيان الذي تم توزيعه على مراكز السموم في منطقة شرق البحر الأبيض المتوسط ومن المقالات المنشورة خلال الفترة 1995–2021 بواسطة مراكز السموم في منطقة شرق البحر الأبيض المتوسط.

النتائج: تم العثور على ما مجموعة 23 مركز للسموم في 14 دولة من أصل 22 دولة في منطقة شرق البحر الأبيض المتوسط، وقد شاركت معظمها في إدخال البيانات الخاصة بمعايير التسمم الرئيسية. تم توثيق نطاق الخدمات من قبل 10 مراكز للسموم في بلدان منطقة شرق البحر الأبيض المتوسط. قدمت ثلاثة مراكز للسموم فقط، والتي تقع في مصر والمملكة العربية السعودية وتونس، جميع الخدمات الرئيسية المدرجة في قائمة منظمة الصحة العالمية، في حين قدمت أربعة مراكز للسموم معلومات عن السموم والخدمات المختبرية، وقدم الباقي خدمة واحدة أو اثنتين.

الاستنتاج: 63% فقط من دول منطقة شرق البحر الأبيض المتوسط لديها مركز للسموم، ويفتقر معظمها إلى الوظائف والخدمات التي ترتقي الى المستوى المطلوب كمقدمي خدمات الصحة العامة. ان التعاون بين مراكز السموم في دول منطقة شرق البحر الأبيض المتوسط وشمال أفريقيا يعد أمرًا ضروريًا لتحديد نقاط الضعف والقوة والتحديات.

الكلمات الدالة: مراكز السموم؛ خدمات؛ تسمم؛ تنسيق البيانات وتوحيدها؛ دول شرق البحر الأبيض المتوسط.