Revista ARACÊ
ISSN: 2358-2472

ACCURACY OF INFORMATION ON SCORPION ACCIDENTS: A STRATEGY TO COMBAT DISINFORMATION

PRECISÃO DAS INFORMAÇÕES SOBRE ACIDENTES COM ESCORPIÕES: UMA ESTRATÉGIA DE COMBATE À DESINFORMAÇÃO

PRECISIÓN DE LA INFORMACIÓN SOBRE ACCIDENTES DE ESCORPIÓN: UNA ESTRATEGIA PARA COMBATIR LA DESINFORMACIÓN

https://doi.org/10.56238/arev7n7-001

Submitted on: 06/01/2025 **Publication date:** 07/01/2025

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ABSTRACT

New information and communication technologies have enabled unparalleled access, production, and dissemination of information. However, However, the veracity, completeness, and intelligibility of this information can be questionable. Misinformation concerning health-related topics can cause harm to individuals and communities. Assessing the quality of health information on the internet can be a critical approach to adress this issue. This article presents an instrument for evaluating the accuracy of information on scorpion accidents, a growing problem in Brazil, as revealed by the results of the evaluation of information on scorpion accidents available on the Ministry of Health's "Health A-Z" website. The instrument consists of 21 indicators distributed in the dimensions of prevention, symptoms, diagnosis and treatment of scorpion accidents. The results indicate that 43% of the information available on the Ministry of Health's website complies with the indicators constructed.

Keywords: Evaluation. Disinformation. Accidents. Scorpions. Internet.

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ISSN: 2358-2472

RESUMO
As novas tecnologias de informação e comunicação têm permitido o acesso, a produção e a disseminação de informações sem precedentes. No entanto, a veracidade, a integralidade e a inteligibilidade dessas informações podem ser questionáveis. A desinformação sobre tópicos relacionados à saúde pode causar danos a indivíduos e comunidades. Avaliar a qualidade das informações de saúde na internet pode ser uma abordagem crítica para lidar com essa questão. Este artigo apresenta um instrumento para avaliar a precisão das informações sobre acidentes escorpiônicos, um problema crescente no Brasil, conforme revelado pelos resultados da avaliação das informações sobre acidentes escorpiônicos disponíveis no site "Saúde de A a Z" do Ministério da Saúde. O instrumento é composto por 21 indicadores distribuídos nas dimensões de prevenção, sintomas, diagnóstico e tratamento de acidentes escorpiônicos. Os resultados indicam que 43% das informações disponíveis no site do Ministério da Saúde estão em conformidade com os indicadores construídos.

Palavras-chave: Avaliação. Desinformação. Acidentes. Escorpiões. Internet.

RESUMEN
Las nuevas tecnologías de la información y la comunicación permiten acceder a la información, producirla y compartirla de forma inconmensurable. Esta información puede ser incorrecta, incompleta o incomprensible. En el ámbito de la salud, la desinformación puede perjudicar a individuos y comunidades. Evaluar la calidad de la información sanitaria en Internet es una forma de combatir este problema. Este artículo presenta una herramienta para evaluar la exactitud de la información sobre accidentes con escorpiones, un problema creciente en Brasil, como revelan los resultados de la evaluación de la información sobre accidentes con escorpiones en el sitio web "Health A-Z" del Ministerio de Salud. La herramienta consta de 21 indicadores distribuidos en las dimensiones de prevención, síntomas, diagnóstico y tratamiento de los accidentes por escorpión. Los resultados indican que el 43% de la información disponible en el sitio web del Ministerio de Salud cumple con los indicadores construidos.

Palabras Clave: Evaluación. Desinformación. Accidentes. Escorpiones. Internet.

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ISSN: 2358-2472

INTRODUCTION

New information and communication technologies have allowed access, production and dissemination of content on various subjects from anywhere (Pereira Neto & Flynn, 2020).

Mobile devices have become ubiquitous, enabling individuals to easily access an extensive array of information. The volume of information available on the Internet is immeasurable and practily covers any subject, and individuals can quickly obtain them. Without digital media, a significant portion of information would not be accessible (Pereira Neto et al., 2023). Health is one of the main topics searched for on digital media. Many users turn to websites, blogs and social media platforms for information about their illness or health condition, or to find out more about diet, physical activity and other health-related topics (Barbosa et al., 2023). The quality of the information is crucial, as it directly impacts patient adherence to treatment, effective self-care practices, and the adoption of a healthier lifestyle (Eysenbach, 2003). Accurate health-related information facilitates the development of skills that empower citizens to make informed decisions over their health and self-care (Albarrak et al., 2021). The accessibility of reliable, scientifically sound, and comprehensible online health information can play a pivotal role in self-care practices, reducing service costs, preventing diseases, and promoting health. It can empower citizens to learn about and possibly adopt preventive measures recommended by science (Pereira Neto et al., 2023).
However, the ease with which information can be produced on digital media also enables the dissemination of outdated, incomprehensible and even incorrect information (Caled & Silva, 2021).

Wardle and Derakshan (2017) have identified an “information disorder”, caused by new information and communication technologies. According to these authors, there are three types of “information disorder”: 1) “Mis-information” – defined as an information that is untrue, but lacks the intent to cause harm; 2) “Dis-information” – characterized as false information deliberately created to harm a person, organization, social group or a country and, 3) “Malicious Information” (“Mal-information”) – defined as a information that is true, but intentionally distorted to cause harm (Wardle and Derakshan, 2017).
Thus, we can conclude that the “information disorder” makes up a complex scenario, particularly in the health-related context, where inadequate and incomplete information circulates without scientific basis, potentially causing adverse effects to citizens and communities (Galhardi et al., 2020).

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There are at least three approaches to addressing disinformation, one of which is fact-checking. This approach entails checking the veracity of information, validating the level of veracity and thus correcting erroneous information (Fonseca et al., 2018). Another approach is referred to as digital literacy. This highly didactic activity aims to develop individual abilities to recognize false content and to deal critically and creatively with the information available on digital media (Becker et al., 2020).

Information quality assessment represents a third approach.

The methodological proposal presented in this article will assess the accuracy of information on scorpion accidents available on the Ministry of Health's Health A-Z Portal, using as reference for the evaluation the most up-to-date scientific evidence on the subject. This portal was chosen because it is an official health information source for the Brazilian government. It is “a glossary of the main themes, actions and public policies of the Ministry of Health in the prevention and promotion of health in Brazil” (Ministry of Health, 2024a). The choice of scorpionism is substantiated by the fact that this disease has seen the greatest growth in its geographical distribution in recent years among accidents caused by venomous animals in Brazil and globally (Souza, 2018; Brasil, 2023). Accidents involving scorpions are subject to mandatory reporting to health authorities and have shown consistent growth over time. When compared to other neglected tropical diseases reported in the Notifiable Diseases Information System (SINAN), scorpionism has a higher incidence, constituting a significant neglected health problem (Guerra Duarte et al., 2023).

According to the Epidemiological Bulletin of the Ministry of Health (MS), it is estimated that there are approximately “1.2 million scorpion accidents annually and around 3,250 deaths worldwide”, especially among children and in tropical areas (Brasil, 2024b). In 2023, SINAN recorded 200,764 scorpion accidents in the country. These figures correspond to 62.83% of all records of venomous animals (Brasil, 2024b).

The heightened epidemiological significance of scorpionism and the consequent media visibility of this ailment may result in the population's growing interest in online information about scorpions, their venom and the accidents they cause. This justifies the necessity of evaluating the accuracy of the information available on the internet on these subjects.

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METHODS

In November of 2024, an analysis was conducted of the “Scorpion Stings” page on the Dynamed website. It is divided into 10 subsections: “Overview and Recommendation”; “Related Topics”; “General Information”; “Epidemiology”; “Etiology and Pathogenesis”; “History and Physical”; “Diagnosis”; “Management”; “Complications”; “Prognosis, Prevention, and Screening” (DynaMed, 2024).

This last section provides a comprehensive overview of scorpion stings, encompassing the diverse types of venoms and scorpion species, poisoning symptoms, diagnostic tests for patients with systemic poisoning, prognosis methods, and guidelines for diagnosis and treatment. It also includes information on available treatments, such as antivenoms and other proven medications, as well as potential side effects associated with these therapies.

The information in this section of DynaMed served as the basis for the creation of indicators used in evaluating the accuracy of information available on the Health A-Z Portal regarding scorpion accidents.

Using the information colleted from this section, indicators were constructed and grouped according to the full cycle of scorpionism, which includes prevention (P), diagnosis (D), symptoms (S), and treatment (T) of scorpion accidents.

An instrument was developed to evaluate the information available on scorpion accidents on the Health A-Z Portal of the Ministry of Health. This database is organized in an alphabetical index, including a section titled “Accidents with Poisonous Animals.” On its opening page, a conceptual distinction is made between poisonous and venomous animals and the importance of these accidents for public health. It is subdivided into six categories of accidents: “Bee Accidents”; “Spider Accidents”; “Caterpillar Accidents”; “Snakebite Accidents”; “Jellyfish or Portuguese Man O' War Accidents”; and “Scorpion Accidents.”

The “Scorpion Accidents” page is composed of four sections. The first contains general information that defines scorpion accidents. The second part presents the main species of the genus *Tityus* found in Brazil and their respective locations, namely: Yellow

Scorpion (*T. serrulatus*), Brown Scorpion (*T. bahiensis*), Northeastern Yellow Scorpion (*T. stigmurus*), and Amazon Black Scorpion (*T. obscurus*).

The third section addresses symptoms, prevention, and treatment of scorpion accidents. The fourth section contains a list of reference hospitals for antivenom treatment for accidents caused by poisonous animals, organized by state. At the bottom of the page dedicated to

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ISSN: 2358-2472

scorpionism, there are four boxes titled “Epidemiological Situation,” “Epidemiological Bulletins,” “Publications,” and “Frequently Asked Questions.” Each box is subdivided and offers various types of information and formats. Thus, it is a virtual environment filled with useful information, updated in 2024. The present article will focus on the information available in the section dedicated to “Scorpion Accidents.”

RESULTS

One definition of misinformation is associated with the concept of false or erroneous information that is not intentionally disseminated to cause harm (Wardle & Derakhsham, 2018). This aspect was not identified on the Health A-Z portal. Regarding the Prevention component, the Dynamed Plus page on scorpion stings has the following wording:

> “[...] keeping the surroundings of the home clean [...] avoid walking barefoot, especially at night [...] not picking up scorpions (dead or alive); protecting hands with gloves and wearing boots when working outside and clearing camp; checking clothing and shoes for scorpions prior to wearing and inspecting camp area prior to set up with ultraviolet lamp” (DynaMed, 2024).

The evidence gathered on scorpion sting prevention available on DynaMed plus is based on the studies carried out by Godoy et al. (2020), Abroug et al (2020) and Bomba et al. (2020). They have been transformed into eight indicators:

P 1 - Keep your surroundings clean;

P 2 - Avoid walking barefoot, especially at night;

P 3 - Do not pick up scorpions with your hand (dead or alive);

P 4 - Protect your hands with gloves and wear boots when working outside the home;

P 5 - Check for scorpions before putting on clothes or shoes;

P 6 - Inspect the countryside with an ultraviolet lamp;

The use of creolin and other chemical substances for the control or prevention of scorpion accidents is a recommendation in Dynamed. In Brazil, the “Manual of Efficacy Tests for Disinfectant Products” published by Brazilian Health Regulatory Agency (Anvisa) (2009) does not recommend any chemical product for this purpose. For this reason, this indicator was not included in this assessment.

SYMPTOM

In order to develop indicators related to symptoms, a review of the sections “Overview and Recommendations,” “Background,” and “Clinical Presentation” on the Dynamed Plus

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page dedicated to “Scorpion Stings” was conducted. The following information is provided by these sections:

> “[...] pain from a scorpion sting is immediate and intense […] typically persists for 10-15 hours but may last up to 24 hours […] pain may be the only clinical sign of a scorpion sting. […] Envenomation may be more severe in children due to their smaller bodies, leading to higher concentrations of toxin in the bloodstream” (DynaMed, 2024).
> “[…] About 90%-95% of scorpion stings result in only local reactions, such as pain, erythema, and paresthesia […] Most scorpion stings (about 90%-95%) are dry or involve just a small amount of injected venom, resulting in localized pain that resolves within 24 hours […] Severe systemic scorpion envenomation can be a life-threatening emergency, as scorpion toxins cause autonomic nervous system dysfunction by stimulating both the sympathetic and parasympathetic nervous systems and activating the coagulation cascade. […] The onset of systemic envenomation symptoms is typically ≥ 2 hours after the sting. […] There is no specific test to diagnose a scorpion sting” (DynaMed, 2024).

These findings are based on studies by Ibister and Bawaskar (2014), Godoy et al. (2021), Abroug et al. (2020), and Chippaux and Goyffon (2008). The data was transformed into seven indicators of accuracy for information regarding the symptoms of scorpion accidents, as follows:

S1-The pain from a scorpion sting is immediate and intense.

S2-The pain from the sting typically persists for 10 to 15 hours, but may last up to 24 hours.

S3-Pain may be the only symptom of a scorpion sting.

S4-Envenomation may be more severe in children due to their smaller body size, which leads to a higher concentration of venom in the bloodstream.

S5-Venom injection does not occur in most scorpion stings (about 90%-95%). In many cases, only a small amount of venom is injected, causing localized pain, erythema, and paresthesia that resolve within 24 hours.

S6 - Severe scorpion envenomation can require emergency treatment, as the venom affects the nervous system and blood coagulation.

S7 - The onset of symptoms from severe envenomation typically occurs about (≥) two hours after the sting.

DIAGNOSIS

The development of indicators related to diagnosis was informed by a comprehensive review of the Dynamed Plus information, with a particular focus on the “Testing Overview”, which is based on studies by Ibister and Bawaskar (2014) and Godoy et al. (2021).

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> "[...] diagnostic testing is usually only performed in patients with moderate-to-severe scorpion envenomation, and there is no specific test to diagnose a scorpion sting. Testing in patients with moderate-to-severe envenomation; blood tests (such as kidney function testing, assessment of pancreatic and cardiac biomarkers, and markers of muscle injury) can be used to monitor for complications: echocardiography should be performed when possible to assess for cardiac complications, and electrocardiogram can be used to confirm cardiac abnormalities; chest X-ray should be performed to assess for pulmonary edema" (DynaMed, 2024).

The content was transformed into three accuracy indicators for information regarding the diagnosis of scorpion accidents, as follows:

D1 - Diagnostic tests are generally performed only in patients with moderate-to-severe scorpion envenomation.

D2 - In patients with moderate-to-severe envenomation, blood tests (such as kidney function tests, assessment of pancreatic and cardiac biomarkers, and markers of muscle injury) can be used to monitor complications; echocardiography should be performed when possible to assess for cardiac complications, and electrocardiogram can be used to confirm cardiac abnormalities; chest X-ray should be performed to assess for pulmonary edema.

D3 - There is no specific test to diagnose a scorpion sting.

TREATMENT

For the development of indicators related to treatment, a review of the "Management" section on the Dynamed Plus page was conducted. This section includes the following information:

> "[...] cleaning the sting site [...] antiemetics (such as ondansetron and metoclopramide) in patients with severe vomiting […] tetanus prophylaxis as needed […] pain management with ice packs, acetaminophen, nonsteroidal anti-inflammatory drugs, or local anesthetic agents [...] Management of scorpion stings varies by the severity of envenomation" (DynaMed, 2024).

This information is primarily based on two important studies: Abroug et al. (2020) and Isbister and Bawaskar (2014). Based on this content, a set of five indicators was developed concerning the treatment of scorpion stings:

T1 – Clean the sting site.

T2 – Use antiemetic medications to alleviate patients with severe vomiting.

T3 – Administer tetanus vaccination, if necessary.

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T4 – Control pain with ice packs, analgesics, anti-inflammatory drugs, or local anesthetic agents.

T5 – Management of scorpion stings varies according to the severity of the envenomation.

From these indicators, an instrument to evaluate the accuracy of online information about scorpion accidents was developed, containing six indicators on prevention, three on diagnosis, seven on symptoms, and five on treatment. These indicators represent, in the authors' view, the minimum, correct, and updated information that a health website should provide when presenting information about scorpion accidents.

The results will be presented following the indicators mentioned above, according to the four dimensions defined for scorpion accidents. It was assessed whether the correct and up-to-date information obtained from DynaMed Plus was presented completely (C), incompletely (I), incorrectly (E), or if it was absent (A). Each response was assigned a score to better assess the evaluation outcome. Complete information received 10 points; incomplete information, 5 points; and absent or incorrect information received no points.

Table I - Prevention of Scorpion Accidents

Constructed Indicator with DynaMed	Information on the Health A-Z Portal	Result	Score
P1 – Avoid walking barefoot, especially at night;	Use shoes and leather gloves when cleaning gardens and yards.	C	10
P2 – Keep the surroundings of the house clean;	Keep gardens and yards clean; avoid accumulating debris, dry leaves, household waste, and construction materials near homes.	C	10
P3 – Do not pick up scorpions with your hands (alive or dead).	-	A	0
P4 – Protect hands with gloves and wear boots when working outside the house.	Avoid putting hands without gloves into holes, under stones, rotten logs, and railway ties.	C	10
P5 – Check for the presence of scorpions before putting on clothes or shoes.	Shake and inspect clothes and shoes before wearing them, as scorpions may hide in them and sting when compressed against the body.	C	10
P6 – Inspect the area with an ultraviolet lamp.	-	A	0
Total points for the Prevention dimension	-	40/60	40

Legend:

- **C** (Complete) = 10 points
- **I** (Incomplete) = 5 points
- **E** (Incorrect) = 0 points
- **A** (Absent) = 0 points

Source: Prepared by the authors.

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The Health A-Z website, developed by Brazil's Ministry of Health, mentions a range of prevention strategies that are also available on the DynaMed platform. The recommendations encompass various practices, such as the storage of waste in closed containers, the utilization of specialized pesticides for cockroach control, the maintenance of clean gardens and yards free of debris, and the prevention of leaf accumulation in proximity to residences. The website also advises wearing shoes and gloves when perform during outdoor cleaning activities, checking clothes and shoes before wearing them, and avoiding contact with holes, stones, and rotten logs. Other important recommendations are sealing gaps in doors, windows, and walls, keeping beds and cribs away from walls, and ensuring that bed linens and mosquito nets do not touch the floor. Additionally, it is crucial to protect natural predators of scorpions, such as nocturnal birds (like owls and nightjars), lizards, and frogs. (Brazil, 2024).

There are two notable omissions concerning prevention on the Health A-Z website. DynaMed emphasizes the nocturnal behavior of scorpions and recommends: "Avoid walking barefoot, especially at night." It also suggests using ultraviolet lamps to inspect the campsite area before setting up. These preventive measures help people locate scorpions at night. According to Gálvez et al. (2020), most scorpion species exhibit fluorescent properties under violet light.

Table II - Symptoms of Scorpion Accidents

Indicator Constructed with DynaMed	Information on the Health A-Z Portal	Result	Score
S1 – The pain from a scorpion sting is immediate and intense.	"Local manifestations – immediate pain in nearly all cases, which may radiate to the limb and be accompanied by paresthesia, erythema, and local sweating."	C	10
S2 – In many cases, only a small amount of venom is injected, causing localized pain, erythema, and paresthesia that resolves within 24 hours.	-	A	0
S3 – The pain from the sting typically persists for 10 to 15 hours but may last up to 24 hours.	"In general, the most intense pain occurs in the first few hours after the accident."	I	5
S4 – Pain may be the only symptom of a scorpion sting.	-	A	0
S5 – Envenomation may be more severe in children due to their smaller body size, leading to higher venom concentration in the bloodstream.	"Children are the most susceptible group to severe systemic envenomation." Symptoms in children: profuse sweating, psychomotor agitation, tremors, nausea, vomiting, salivation, hypertension or hypotension, arrhythmia, congestive heart failure, acute pulmonary edema, and shock."	C	10

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Indicator Constructed with DynaMed	Information on the Health A-Z Portal	Result	Score
S6 – No venom injection occurs in most scorpion stings (about 90%-95%). In many cases, only a small amount of venom is injected, causing localized pain, erythema, and paresthesia that resolve within 24 hours.	-	A	0
S7 – Severe scorpion envenomation may require emergency treatment as the venom affects the nervous system and blood coagulation.	-	A	0
Total points for the "Symptoms" dimension	-	25/70	25

Legend:

- **C** (Complete) = 10 points
- **I** (Incomplete) = 5 points
- **E** (Incorrect) = 0 points
- **A** (Absent) = 0 points

Source: Prepared by the authors.

Table III shows the results obtained from the application of the seven indicators developed for the Symptoms of Scorpion Accidents dimension. Regarding the accuracy of the information available on the Health A-Z portal, the application of Table III demonstrated an alignment between the number of pieces of information covered by the constructed indicators (S1 and S5). Specifically, 100% of the information available on the Health A-Z portal corresponded to the main scientific evidence, while the missing and incomplete information (S2, S3, S4, S6, S7) demonstrated a gap in important details for patients who have suffered accidents, particularly concerning the presence, scope, and duration of pain, as well as the general clinical changes caused by envenomation, as symptoms. In the absence of information addressing these indicators, the score of the Health A-Z portal in the Symptoms of Scorpion Accidents dimension was **35.71%**.

Table III - Diagnosis of Scorpion Accidents

Indicator Constructed with DynaMed	Information on the Health A-Z Portal	Result	Score
D1 – Diagnostic tests are generally only performed on patients with moderate to severe scorpion envenomation.	-	A	0
D2 – Tests in patients with moderate to severe envenomation: blood tests (such as kidney function tests, assessment of pancreatic and cardiac biomarkers, and markers of muscle injury) can be used to monitor complications: echocardiography should be performed when possible to assess cardiac complications, and electrocardiogram can be	"Some complementary tests are useful for assisting in the diagnosis and monitoring of patients with systemic manifestations, such as electrocardiogram, chest X-ray, echocardiography, and biochemical tests."	C	10

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Indicator Constructed with DynaMed	Information on the Health A-Z Portal	Result	Score
used to confirm cardiac abnormalities; chest X-ray should be performed to assess pulmonary edema.			
D3 – There is no specific test to diagnose a scorpion sting.	"The diagnosis of scorpion envenomation is primarily clinical-epidemiological, with no routine laboratory tests used to confirm the circulating venom."	C	10
Total points for the Diagnosis dimension	-	20/30	20

Legend:

- **C** (Complete) = 10 points
- **I** (Incomplete) = 5 points
- **E** (Incorrect) = 0 points
- **A** (Absent) = 0 points

Source: Prepared by the authors.

Table III summarizes the results obtained from the utilization of the three indicators developed for the "Diagnosis of Scorpion Accidents" dimension. It shows that, out of the three indicators established for diagnosing scorpion accidents, two were fully covered by the available information on the evaluated portal (D2 and D3). These indicators addressed the useful tests for monitoring the injured patient and the absence of a specific test to diagnose envenomation in scorpion accidents, resulting in a score of **20/30**. The site showed a lack of information for **D1**, regarding diagnostic tests for patients in severe condition, representing a **67%** shortfall in information compared to what was recommended by the evaluation instrument. Adequate diagnosis is crucial, as it guides the management of complications following scorpion envenomation. The treatment of patients with severe clinical manifestations is predicted on the early recognition of the sting, administration of antivenom, and cardiorespiratory and systemic support (Godoy et al., 2021).

Table IV - Treatment of Scorpion Stings

Indicator constructed with Dynamed	Information on the Health A-Z Portal	Result	Score
T1 – Clean the sting site	-	A	0
T2 – Use medications to alleviate patients with severe vomiting	-	A	0
T3 – Vaccinate against tetanus, if necessary	-	A	0
T4 – Control pain with ice packs, pain relievers, anti-inflammatory drugs, or local anesthetic agents	-	A	0
T5 – The treatment of scorpion stings varies according to the severity of the envenomation. The scorpion antivenom (Centruroides) immune F(ab)2 (Anascorp) is FDA-approved for the treatment of patients with clinical signs of	The amount of vials and the type of serum depends on the patient's clinical condition. "Specific treatment is done with the Scorpion Antivenom, preferably, or in its absence, with the Antiarachnid Serum	C	10

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Indicator constructed with Dynamed	Information on the Health A-Z Portal	Result	Score
Centruroides scorpion envenomation. Dosage and administration: Initial dose: 3 vials of antivenom diluted to a total volume of 50 mL in 0.9% sodium chloride (normal saline [NS]), administered intravenously over 10 minutes. Additional doses (if necessary): 1 vial diluted to a total volume of 50 mL in NS, administered IV over 10 minutes at 30-60 minutes intervals. Monitor patients closely during and up to 60 minutes after the completion of the infusion to determine if clinically important signs of envenomation have resolved.	(Loxosceles, Phoneutria, and Tityus). Serums should be administered in a hospital setting under medical supervision."		
Total points for the Treatment dimension	-	10/50	10

Legend: Complete (C-10); Incomplete (I-5); Incorrect (E–0); Absent (A-0)
Source: Prepared by the authors

Table IV highlights the results obtained from the application of the five indicators developed for the Treatment dimension of scorpion stings (T1-T5). It shows the absence of information corresponding to the constructed indicators (T1, T2, T3, and T4). For indicator (T5), the information available was evaluated as complete, as it emphasized the use of scorpion antivenom serum and, in the absence of it, the use of antiarachnid serum, due to its neutralizing potential against the venom of scorpions of the genus *Tityus*. Interestingly, the Dynamed portal highlighted the benefits of using antivenom serum as a viable treatment option for scorpion stings in cases of moderate envenomations, with its benefits being questioned in cases of severe envenomation. Overall, the Health A-Z portal did not cover 4 of the 5 constructed indicators, resulting in a score of 10/50.

Table V shows the overall scores from the assessment of accuracy conducted in the Health A-Z portal using the proposed instrument.

Table V - Final Evaluation of the Accuracy Conformity Degree of the Information Obtained by Analyzing the Section on Scorpion Stings in the Health A-Z Portal Using the Evaluation Instrument Proposed in This Article.

Dimensions Evaluated	Complete Information (C)	Incomplete Information (I)	Incorrect Information (E)	Missing Information (A)	Conformity Degree per Dimension
Prevention	4	0	0	2	4/6
Symptom	2	1	0	4	2/7
Diagnosis	2	1	0	0	2/3
Treatment	1	0	0	4	1/5
Total	9/21 (43%)	2/21 (9.5%)	0/21 (0%)	10/21 (48%)	9/21 (43%)

Source: Elaborated by the authors

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ISSN: 2358-2472

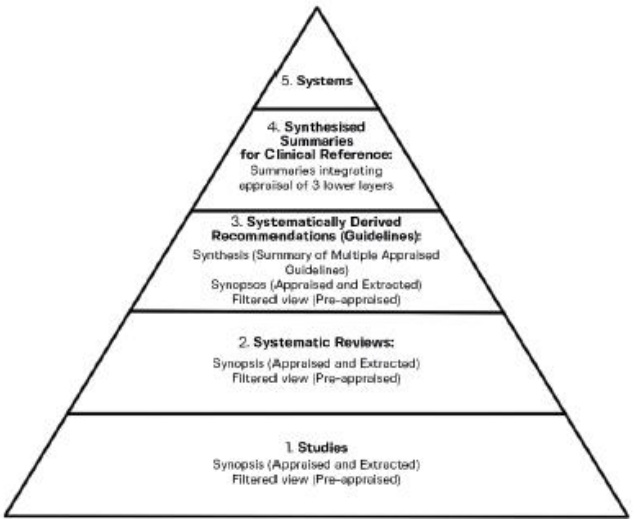
DISCUSSION

In a context of increasing internet connectivity among individuals, the Health A-Z portal aims to provide optimized access to health-related information. An evaluation of the portal's content reveals a notable discrepancy between the information provided on this portal regarding scorpion stings and the indicators derived from evidence-based medicine methods.

Paolucci et al. (2021) propose the use of the best and most current scientific evidence available to assess the accuracy of online health-related information. These authors argue that the expert consensus-based method, previously used as a reference for evaluating accuracy, has limitations because the information, opinions, and practices of professionals may be outdated. For this reason, they suggest that the accuracy of information should be assessed according to the principles of Evidence-Based Medicine (Paolucci et al., 2021).

Alper and Haynes (2016) developed a pyramid model grounded in “Evidence-Based Medicine” to guide health professionals and researchers in the search and selection of information. At the first level of the pyramid, with original studies at the foundation of the pyramid. The second level comprises systematic reviews, while the third level encompasses guidelines. At the fourth level of the pyramid, there are “synthesized summaries” that incorporate the three lower levels.

Figure 1 - Pyramid of Evidence



Source: Alper and Haynes (2016)

Several authors have conducted studies with the aim of evaluating the quality of medical platforms available on the web that provide high-quality information anchored in

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"Evidence-Based Medicine." The study by Prorok et al. (2012) used the following criteria to assess such services: the timeliness of content updates, breadth of coverage, and the quality of the evidence provided. The analysis encompassed ten online medical text services, using the aforementioned criteria for evaluation. A ranking based on a scale from 1 to 10 for each of the three observed criteria was created. The Dynamed Plus service received the best overall rating and was placed at the top of the ranking developed by Prorok et al. (2012).

Kwag et al. (2016) undertook a similar investigation. For the evaluation of the quality of medical platforms available on the web, the authors used three criteria: rapid accessibility, comprehensiveness, and periodic updates. Best Practice, DynaMed, and UptoDate scored the highest in all dimensions (Kwag et al. 2016).

A study by Bradley-Ridout et al. (2021) compared the tools UpToDate and DynaMed, analyzing accuracy, response time, confidence, and user satisfaction. Although UpToDate was preferred, the accuracy of responses was equal for both. The study also revealed that all the articles on UpToDate had conflicts of interest, while DynaMed's articles did not. Thus, DynaMed is suitable for evaluating health websites as it provides updated, evidence-based clinical information (Paolucci et al. 2021).

Regarding the assessment of the Health A-Z portal, it was defined as incorrect information the content that contradicts the information provided by the instrument's indicators. Therefore, it is observed that the Ministry of Health does not offer incorrect health information. According to Heaton (2011), the absence of incorrect information can prevent the making of wrong decisions that could potentially cause severe harm to citizens' health. Regarding missing information, the Health A-Z portal does not provide information related to nine of the 21 indicators in the evaluation instrument (48%), a concerning result given the 149% increase in these incidents over the last ten years (Brazil, 2024).

The absence of relevant information on this portal may hinder efforts to mitigate scorpion accidents, as Andrade et al. (2020) have warned. These authors affirm that health communication actions, including the availability of accurate information, are essential for overcoming health problems (Andrade et al., 2020).

In the present study, the dimension of prevention exhibited the highest compliance, with indicators P1, P2, P4, and P5 fully addressed. These indicators offer relevant information regarding the cleanliness of environments and the use of personal protective equipment. However, upon assessing the accuracy of the information for indicators P3 and

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P6. These indicators provide more information on the nocturnal behaviors of scorpions, their fluorescent properties when exposed to UV light, and the importance of proper handling by non-professionals. The absence of this information on the Health A-Z portal suggests an informational fragility that, as shown by Paolucci et al. (2022), could lead users to make wrong decisions.

Regarding indicator P1, the available evidence suggests the use of creosote and pest control for scorpion population control. According to the guidance provided by DynaMed, based on a study by Godoy et al. (2021): “Periodically fumigate areas prone to harbor them, especially drains and grates. Creosote repels them” (DynaMed, 2024). However, it should be noted that in Brazil such practices are legally prohibited (ANVISA, 2010). Therefore, the Health A-Z portal only refers to pesticide treatment for combating other insects in the scorpion's food chain, including cockroaches. In the context of P1 indicator, the information provided by the Ministry of Health does not focus on scorpions as the target of pest control.

It should be noticed that the Ministry of Health website offers other prevention guidelines for scorpion accidents, such as: avoiding dense foliage, keeping vacant lots clean, using door and window thresholds, and keeping beds and cribs away from walls. These pieces of information did not become indicators because they are not included in DynaMed.

In the analysis of the symptoms dimension, it was observed that the data provided by the Ministry of Health attained a second-level accuracy of 50%, as evaluated by the evaluation instrument. This dimension exhibited the availability of precise information concerning indicator S1, which refers to the intense pain associated with a scorpion sting. The information concerning indicator S4, which refers to the severity of poisoning in children, was also found to be accurate. These observations align with the findings reported in Godoy et al. (2020), Abroug et al. (2020), and Bomba et al. (2020). However, the Health A-Z portal did not provide information on the duration of pain from a sting (S2) or regarding the fact that pain is the only symptom of poisoning considered to have localized effects, as evidenced by Chippaux and Goyffon (Chippaux & Goyffon, 2008) and used as a reference in DynaMed.

An examination of the symptom information reveals that this section of the website lists the systemic manifestations related to scorpion sting poisoning. The information provided is characterized by a high degree medical complexity, using technical terms that

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may be incomprehensible to users without a healthcare professional background. They are presented as follows: **Local manifestations** – immediate pain in nearly all cases, possibly radiating to the limb and accompanied by paresthesia, erythema, and local sweating. Generally, the most intense pain occurs in the first hours after the accident. **Systemic manifestations** – within minutes to a few hours (two to three), mainly in children, the following symptoms may arise: profuse sweating, psychomotor agitation, tremors, nausea, vomiting, sialorrhea, hypertension or hypotension, arrhythmia, congestive heart failure, acute pulmonary edema, and shock. The presence of these manifestations indicates a suspected scorpionism diagnosis, even in the absence of a sting history or animal identification (Brazil, 2024). It is noteworthy that the terms highlighted in this section may present a significant challenge to the comprehension of the average citizen.

In the **diagnosis dimension**, the compliance rate was very low (25%), with the only accurate information being the absence of a specific test for diagnosing a scorpion sting. Therefore, the information available on the portal aligns with the findings of the study by Isbister and Bawaskar (2014), which was referenced in DynaMed. The other two indicators were missing from the portal. One of them is based on a study by Isbister and Bawaskar, which finds that 90-95% of scorpion stings do not involve venom injection or only involve a minimal amount that causes mild local pain (Isbister & Bawaskar, 2014). The second indicator refers to the main clinical manifestaions induced by scorpion venom in the nervous, cardiovascular, digestive, and respiratory systems, along with the associated life-threatening risks (Godoy et al., 2021). However, the information related to the average time for the onset of symptoms following scorpion envenomation is also missing on the portal (Godoy et al., 2021).

Although the Health A-Z portal included the best scientific evidence by stating the absence of a specific diagnostic test for scorpion poisoning, the website still suggests conducting complementary tests considered useful for assisting in the diagnosis and monitoring of patients with systemic manifestations, such as electrocardiograms, chest X-rays, echocardiography, and biochemical tests. However, within the DynaMed Plus evidence, these diagnostic tests are indicated only for moderate or severe envenomations. The available evidence in DynaMed Plus does not suggest these tests in a generalized manner (Godoy et al., 2021). Therefore, this indicator was not included in our evaluation.

The evaluation of information accuracy in the **treatment dimension** revealed a significant absence of information that aligned with the four indicators established for this

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dimension. These indicators were based on the evidence presented in the DynaMed portal, supported by the findings of Godoy et al. (2021), and encompasses important aspects such as the importance of cleaning the sting site (T1), the use of medication to relieve vomiting in critically nauseated patients (T2), vaccination of patients against tetanus, when necessary (T3), and the management of pain through therapeutic and pharmacological means (T4).

The evaluated website presents a table describing variations in patient care according to the degree of envenomation (T5). This aligns with the studies by Isbister and Bawaskar (2014) and Abroug et al. (2020), referenced by DynaMed on their webpage.

The Ministry of Health has issued a specific recommendation for the treatment of envenomated patients, which is the administration of Antiscorpion Serum. The site details the treatment, preferably using the aforementioned serum, or, in its absence, Antiarachnid Serum, which also protects against venom from spiders of the Loxosceles and Phoneutria genera, as well as scorpions of the Tityus genus (Oliveira et al., 2018). The Health A-Z portal states thar the serums must be “administered in a hospital environment and under medical supervision” (Brazil, 2022). However, the scientific evidence from DynaMed Plus recommends the use of Antiscorpion Serum for all three levels of envenomation: mild, moderate, and severe.

The findings of this study suggest that, in congruence with the outcomes of other analyses that have examined the precision of health-related information disseminated via the internet, the scorpionism segment of the Health A-Z portal exhibits deficiencies in certain domains.

The results from the accuracy assessment are also consist with the findings of Paolucci et al. (2022) and Pereira Neto et al. (2023 These studies evaluated the quality of information on health websites concerning tuberculosis and leishmaniasis and found similar results. In the tuberculosis research, 43 indicators of information accuracy were applied to the tuberculosis page in the Health A-Z glossary on the Ministry of Health's portal. The information was considered 'incorrect' in one indicator, 'missing' in 29, 'incomplete' in 11, and 'complete' in only two indicators. The authors found a significant amount of incomplete information according to the scientific evidence available on DynaMed.

Paolucci et al. (2022) state that there was a lack of information across all five dimensions defined for tuberculosis. Regarding prevention, there is a absence of

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information on the BCG vaccine. Additionally, there is no prevention information for populations at risk of tuberculosis, including individuals living with HIV, children, and caregivers. Regarding transmission, no information was found on risk factors for children or drug-resistant tuberculosis infections. Furthermore, information on specific symptoms for children is also missing, as well as data on people living with HIV and drug-resistant tuberculosis. Notably, treatment information for the general population, HIV-positive individuals, and drug-resistant tuberculosis treatment is also lacking (Paolucci et al. 2022:948). These findings are consistent with the results of the evaluation of the Scorpion Accident website on the Health A-Z portal. When assessing the Ministry of Health website, it is observed a high index of missing information: 10/21, 48%, across the four dimensions of scorpion accident-related harms.

Regarding Leishmaniasis, the research evaluated the accuracy of the websites from four international non-governmental organizations and the Ministries of Health of Brazil and India: the Médicos Sem Fronteiras (MSF) website, the Drugs for Neglected Diseases initiative (DNDi), the Health A-Z website, and the National Institute of Health and Family Welfare (NIHFW), a Ministry of Health and Family Welfare (MoHFW) agency in India. The results of this study indicated serious issues regarding the low accuracy of information on Transmission; Symptoms and Diagnosis; Prevention and Control in Endemic Areas; and Treatment. All four institutions showed results below 50% for the accuracy indicator (Pereira Neto et al., 2023).

The findings from the studies conducted by Paolucci et al. (2022) and Pereira Neto et al. (2023) are consistent with those reported in this article. It is evident that the compliance level concerning the minimum accuracy information quality criteria on the Ministry of Health's Scorpion Accident Website is comparable to that observed on the websites of international government institutions and the Ministry of Health of Brazil.

FINAL CONSIDERATIONS

This study introduced an instrument composed of indicators capable of assessing the scientific accuracy of information available on websites about scorpion accidents. This instrument can be used to evaluate the accuracy of information on any scorpion accident-related website, providing an objective means of analyzing the quality of the content offered. When evaluating the Health A-Z Portal, it was observed that the site does not contain incorrect information; however, it exhibited a 43% compliance level with the best scientific

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evidence available. This result highlights the need for continuous improvement in updating online information, ensuring the inclusion of up-to-date and complete scientific evidence.

The present study suggests that evaluating Brazilian government websites can facilitate the identification of significant gaps in the information provided, which can affect the quality of decisions made by citizens regarding the prevention and treatment of scorpion accidents. Therefore, it is essential that public portals, such as the Health A-Z website, focus on improving the accuracy of information by maintaining regular updates based on the best and most recent available scientific evidence. This approachh as the potential to enhance the effectiveness of responses to misinformation in public health, ensuring that citizens have access to accurate and relevant information. This can positively impact the reduction of scorpion-related accidents and complications associated with them.

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