



## Original article

## Physicians' knowledge and practice concerning diagnosis and management of anaphylaxis: The situation in Egypt



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## ABSTRACT

**Introduction:** Early recognition of an anaphylaxis event is crucial for instituting lifesaving management. We sought to explore knowledge and practice towards anaphylaxis in a sample of physicians from ten Egyptian governorates.

**Methods:** An eighteen question-based questionnaire was developed by expert allergists to evaluate the knowledge and practice towards anaphylaxis, based on the World Allergy Organization guidelines for the assessment and management of anaphylaxis. The questionnaires were distributed, and the answered forms collected via emails, and data were tabulated, and analysed.

**Results:** In this cross-sectional study, a total of 242 physicians completed the survey (183 (75.6%) paediatricians, 32 (13.2%) internists, 22 (9.1%) intensivists and five (2.1%) anaesthetists). Only 91 participants (37.6%) identified all the four proposed anaphylaxis clinical scenarios while 70, 45 and 36 identified three, two and one scenario, respectively. Loss of consciousness and abdominal symptoms were not recognised as possible presentations of anaphylaxis by 64.5% and 80.2% of the participants, respectively. Epinephrine was considered the first line treatment by 98 (40.5%), corticosteroids by 77 (31.8%) and antihistamines by 25 (10.3%). 75 (31%) responders identified the right dose of epinephrine while 119 (49.2%) identified the proper route. Concerning practice, 83 physicians (39.2%) used epinephrine for all cases of anaphylaxis, 88 (41.5%) used it for refractory cases only whereas 41 (19.3%) did not use epinephrine at all.

**Discussion:** Our survey shows that the knowledge of Egyptian physicians and their practice towards anaphylaxis are still inadequate. The current situation reinforces the need to disseminate and encourage the adoption of the international guidelines for anaphylaxis diagnosis and treatment.

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## African relevance

- Allergic disorders are increasing worldwide with problems of under-reporting of cases and scarcity of allergists in African countries.
- Anaphylaxis is a potentially fatal allergic disorder with significant morbidity and mortality if left untreated.
- Assessment of physician knowledge and practice towards anaphylaxis in African countries is crucial to guide physicians' training and address educational needs.
- Awareness and accurate understanding of anaphylaxis will help decreasing its related mortalities and morbidities

## Introduction

Anaphylaxis is recognised as a severe, systemic hypersensitivity reaction characterised by rapid onset and the potential to endanger life through airway, breathing, or circulatory problems [1]. The lifetime risk of symptoms suggestive of anaphylaxis in the general population, as reported by members of the public, is at least 1.6% [2]. The highest hospital admission rates for food-induced anaphylaxis occur in very young children aged 0–4 years; however, the rate of increase in older children is accelerating [3]. Foods, stinging insect venoms, and drugs are major inducers of anaphylaxis [2].

Early recognition of an anaphylaxis event is crucial for instituting lifesaving management and relies on identification of the typical pattern of clinical features with rapid progression of symptoms, often occurring minutes to hours following exposure to a preceding trigger [4]. Therefore, the diagnosis of anaphylaxis rests primarily on a detailed history of the episode, and all exposures and events in the hours preceding the onset of symptoms. Three clinical scenarios were proposed in 2006 and later illustrated by Simons and co-workers [5] in 2011.

First-line treatment for anaphylaxis is intramuscular adrenaline. Removing the trigger should be sought whenever possible. Calling for help, correct positioning of the patient, high-flow oxygen, intravenous fluids and inhaled short-acting bronchodilators are among the second lines of intervention. Long-term management includes provision of an individualised management plan, venom immunotherapy, drug desensitisation, training and psychological support [6].

Previous studies have demonstrated lack of knowledge regarding anaphylaxis and uncertainty with respect to the choice of the first line drug for treating this emergency condition among health care professionals [7]. Given the rising prevalence of food allergies in children, identifying and addressing the gaps in knowledge about anaphylaxis management becomes a necessity. Hence, this study was conducted to assess the knowledge and practice of health care providers in different governorates of Egypt.

## Methods

This quantitative cross-sectional study was carried out over a period of twelve months. The study was performed in the form of an email-based survey. The questionnaire in this survey was comprised of eighteen questions developed to evaluate the knowledge and practice of a sample of Egyptian physicians concerning anaphylaxis.

Design of the questionnaire: The questionnaire was comprised of three parts. The first section was concerned with the demographic data of the participant, namely the age, governorate, scientific degree, specialty, duration of practicing as a physician. The second and third sections of the questionnaire focused on the knowledge and practice concerning diagnosis and management of anaphylaxis and the use of epinephrine. Some questions concerning epinephrine were repeated in both sections in order to discover gaps between knowledge and what is actually practiced.

The knowledge about clinical presentations of anaphylaxis was examined using four different true clinical scenarios proposed based on literature review [5]. Open and closed ended questions were used. In

multiple choice questions, more than one answer can be selected.

Preparation of the questionnaire and definition of correct responses were based on The World Allergy Organization guideline for the assessment and management of anaphylaxis [5]. Since no validated survey instrument exists, this questionnaire was developed by expert allergists in view of previously published data. Expert allergists were certified consultants in the field of allergy with well recognised clinical, research and educational activities on the national and international levels.

The questionnaire was pre-tested on 30 physicians of different ages regardless of their level of training and experience before the initiation of the study to confirm understanding of text. Afterwards, modifications were made prior to the use of the final form. Modifications were needed in the formulation of the clinical scenarios of anaphylaxis, making them clearer with a less confounding picture.

For sample size, after reviewing the relevant international publications, a convenience sample size of 300 physicians was sought. 300 physicians were contacted (out of approximately 200,000 physicians in Egypt) of different specialties (paediatricians, internists, intensivists, anaesthetists, and postgraduate medical students affiliated to the Ministry of Health hospitals) in ten out of 27 Egyptian governorates. Participants with less than six months of clinical practice were excluded from the study.

The main investigator (Z.E.) sent an electronic form of the questionnaire to site investigators in the ten governorates (Cairo, Alexandria, Suez, Sharqia, Daqahlia, Menufia, Gharbia, Assuit, Beni-Sueif and Luxor), and they forwarded the questionnaire to the medical care providers in their governorates. The questionnaires were distributed via emails to be answered at the participants' convenience as a self-completed email survey. The answered forms were sent back in the same way. Received responses were gathered and data were compiled in an Excel spreadsheet.

Data were analysed using IBM® SPSS® Statistics version 23 (IBM® Corp., Armonk, NY). Categorical variables were presented as number and percentage. Associations between dichotomous variables were examined using the phi coefficient of association ( $\phi$ ). The Goodman and Kruskal tau ( $\tau$ ) was used to test association between nominal variables on multiple levels. Association between ordinal variables was tested using Kendall's tau-b ( $\tau$ ). Ordinal-nominal associations were tested using Rank biserial correlation. The Bonferroni method was used to adjust the critical p-value for the number of comparisons. Considering 8 repeated tests for association, the critical p-value was adjusted to  $p < 0.00625$  in order to maintain the alpha error at  $< 0.05$ .

The study was approved by the Clinical Research Ethics Committee of the Department of Paediatrics, Faculty of Medicine, Ain Shams University. No informed consent was required as the participants were reassured that their names and the names of their workplaces were not required and would not be referred to in the manuscript. The participants were noted that they can decide whether or not to answer the questionnaire without any drawbacks.

## Results

A total of 242 physicians from ten governorates completed the survey and their data were analysed: 71 (29.3%) from Cairo, 37 (15.3%) Alexandria, 18 (7.4%) from Suez, 65 (26.5%) from four governorates in Delta region (Sharqia, Daqahlia, Menufia, Gharbia) and 51 (22.3%) from Upper Egypt governorates (Assuit, Beni-Sueif, Luxor). Out of those 242 physicians, 136 (56.2%) were university-affiliated (Tertiary University hospitals) while 106 (43.8%) were affiliated to Ministry of Health hospitals. The median age of the responders was 31 years (IQR: 29–36; range: 24–70 years). The median duration of clinical practice was six years (IQR: 3.5–11 years; range: 0.5–48 years). Concerning their academic degrees, 170/242 (70.2%) completed their postgraduate studies [Diploma/M.Sc. degree  $n = 118$  (48.8%), and doctorate degree or Ph.D.  $n = 52$  (21.5%)]. According to their specialties, 183 (75.6%) were

paediatricians, 32 (13.2%) internists, 22 (9.1%) intensivists and five (2.1%) were anaesthetists. Among the responders, 88 (36.4%) received formal anaphylaxis training.

To investigate physicians' knowledge about diagnosing anaphylaxis, we included questions about possible presenting symptoms and signs. Skin manifestations (urticaria/angioedema-flushing) were the most reported (68.2%), followed by acute onset respiratory manifestations in 63.2% (wheeze, stridor and/or dyspnoea). Failure to recognise loss of consciousness and abdominal symptoms among the possible presentations of anaphylaxis was noticed in 64.5% and 80.2% respectively. Combinations of two or more of the aforementioned symptoms were selected by 62.8% of the responders.

As mentioned above, recognition of anaphylaxis was explored using four true clinical scenarios and the participants were asked to choose all the possibly true ones. Ninety-one participants (37.6%) identified the four proposed scenarios, while the majority (62.4%) did not choose the four scenarios altogether: 36 (14.9%) identified one scenario only, 45 (18.6%) identified two out of four true scenarios, and 70 (28.9%) chose three. The postulated scenarios and the physicians' responses are shown in Table 1.

Of the responders 212/242 (87.6%) encountered anaphylaxis cases during their clinical practice, with a median number of four cases (IQR: 2–10). 66 physicians (27.3%) identified the anaphylaxis cases as related to food, 193 (79.8%) to drugs, 127 (52.5%) to blood products while four physicians (1.7%) reported anaphylaxis without identifiable cause. Anaphylaxis related mortality was reported by 74 (30.6%) physicians with a median number of deaths of one case (IQR: 2, range: 1–5 cases).

Concerning physicians' knowledge towards anaphylaxis treatment, only 98/242 (40.5%) considered epinephrine as the first line treatment, whereas 77 (31.8%) believed it to be steroids and 25 (10.3%) antihistamines (Fig. 1). Only 75/242 (31%) responders could identify the right dose of epinephrine, 119 (49.2%) could identify the proper route, 125 (51.7%) considered it safe to repeat the epinephrine dose if needed during an event of anaphylaxis.

Anaphylaxis treatment was practiced by responders as follows: 83 physicians (39.2%) used epinephrine for all cases of anaphylaxis, 88 (41.5%) used it for refractory cases only; whereas 41 (19.3%) did not use epinephrine at all. All respondents used steroids in anaphylaxis treatment and the preparations most used were hydrocortisone (36.8%) followed by dexamethasone (24%). The responses to practice related questions are shown in Table 2.

We found a significant difference among participants from different geographical areas as regards their ability to identify different scenarios of anaphylaxis ( $\tau = 0.136$ ,  $p = 0.0058$ ), where 43.1% of the participants from Delta region could identify the four proposed scenarios followed by 39% of the participants from Cairo, while the lowest percentage was among those from upper Egypt (17.6%). Otherwise, the responders from the studied geographical areas were comparable.

Both university and non-university affiliated participants showed comparable patterns of knowledge and clinical practice towards anaphylaxis. The academic degree and the physician specialty had their impact on knowledge about the treatment of anaphylaxis, where 55.5% of those with Ph.D. versus 41.5% with Master/Diploma degree and

27.8% of those with Bachelor degree considered epinephrine as the first line of treatment of anaphylaxis ( $r_{rb} = 0.213$ ,  $p = 0.001$ ). The identification of the proper dose of epinephrine was more common among anaesthetists (37%) and paediatricians (35%) versus internists (3.1%),  $r_{rb} = 0.056$ ,  $p = 0.001$ .

When we investigated the impact of physician's age on the knowledge and practice of anaphylaxis, we noticed a significant steady rise in of the recognition of epinephrine as the first line treatment for anaphylaxis with increasing age ( $r_{rb} = 0.202$ ,  $p = 0.002$ ), whereas in clinical practice, although the actual use of epinephrine showed an overall rising trend, yet this was not statistically significant ( $\tau = 0.135$ ,  $p = 0.009$ ) (Fig. 2). Furthermore, younger physicians more frequently considered anaphylaxis to present with skin changes only ( $r_{rb} = -0.219$ ,  $p = 0.001$ ) contrary to older physicians who more frequently considered anaphylaxis to present with combinations of features and not necessarily the skin ( $r_{rb} = 0.227$ ,  $p < 0.001$ ) (Fig. 3). Also, it was noticed that longer duration of practice (more than three years) had a positive impact on recognition of anaphylaxis presentation with combination of skin, respiratory, abdominal symptoms and/or fainting ( $r_{rb} = 0.246$ ,  $p < 0.001$ ) and on better identification of epinephrine as first line treatment of anaphylaxis ( $r_{rb} = 0.213$ ,  $p = 0.001$ ).

A big proportion of responders had not received training concerning anaphylaxis ( $n = 154/242$ ; 63.6%). This finding was constant among the different geographical locations covered in this survey, including Cairo (69% untrained) and Alexandria (67.6% untrained) which are the biggest two cities in Egypt, but was more prominent in the Suez Canal governorates (88.9% untrained), with comparable frequency of the training received among the studied governorates ( $r_{rb} = -0.129$ ,  $p = 0.045$ ) (Fig. 4). Receiving formal anaphylaxis training however, did not show significant impact on knowledge and practice towards anaphylaxis, although those who received training, more frequently identified epinephrine as the first line of treatment of anaphylaxis (48.9%), versus those who did not (35.7%), yet the difference did not reach statistical significance ( $r_{rb} = 0.129$ ,  $p = 0.045$ ). The trained physicians more frequently identified the four true proposed scenarios for anaphylaxis (43.2%) versus their non-trained peers (29.9%), but again not statistically significant ( $\phi = 0.143$ ,  $p = 0.026$ ).

## Discussion

The fatality of anaphylaxis is believed to reflect, to a considerable extent, the degree of awareness of physicians of the clinical presentations of anaphylaxis and its proper management. We sought to investigate a sample of physicians from ten Egyptian governorates for their knowledge and practice in anaphylaxis, aiming to assess the current situation and to aid the planning of future educational programs to improve medical care to patients.

The surveyed physicians reported diagnosing anaphylaxis cases at a median of four cases per physician. Published data and national surveys for the prevalence of anaphylaxis in Egypt are lacking. The responders incriminated drugs, blood products and food in descending order as the most common encountered causes of anaphylaxis. International data reports food as the most common elicitor in children, while drugs and venom as more frequent in adults [10–12].

The diagnosis of anaphylaxis rests on a timely recognition of the clinical manifestations. A third of the responders recognised beautifully all the four proposed true scenarios as pointing to a diagnosis of anaphylaxis (34.7%). However, the majority missed one or more of these scenarios. Such a gap in knowledge is believed to impact the outcome of cases, although local data are lacking. Skin manifestations were the most appealing to responders whereas fainting and abdominal symptoms were the least selected. Previous studies reported cutaneous symptoms to be absent or delayed in around 10% of adult cases and up to 18% in paediatric anaphylaxis reactions and several practitioners do not consider anaphylaxis diagnosis in the absence of cutaneous manifestations. With variable combination and severity of symptoms, the

**Table 1**  
Physicians' responses to postulated anaphylaxis scenarios.

Scenario	Number (percentage) of correct answers
Rapid onset of flushing and urticaria with stridor or abdominal cramping	165 (68.2%)
Rapid onset of urticaria/angioedema with drop of blood pressure after exposure to a likely allergen	199 (82.2%)
Occurrence of wheezing and abdominal cramping with vomiting after exposure to a likely allergen	119 (49.1%)
Sudden drop of the blood pressure after exposure to a confirmed allergen	137 (56.6%)

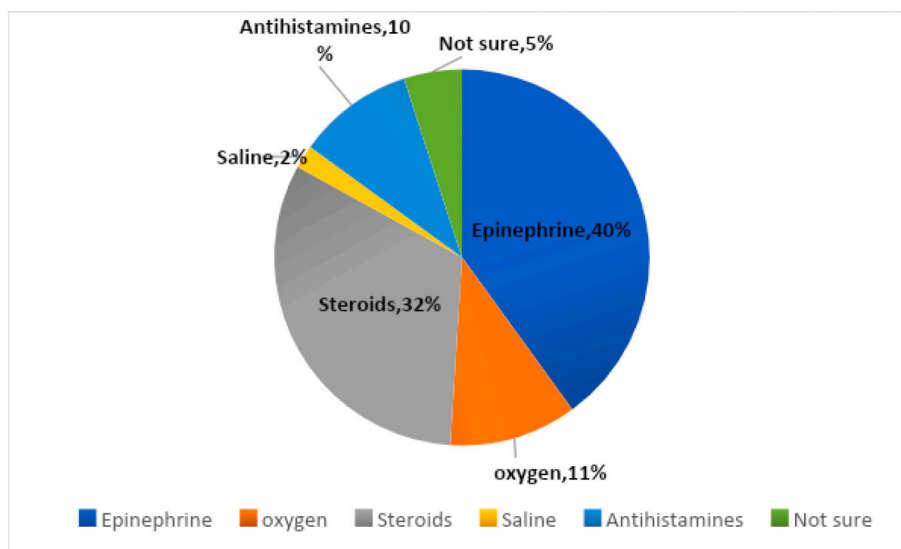


Fig. 1. Medications considered by participants as first-line treatment of anaphylaxis.

**Table 2**  
Patterns of clinical practice regarding management of anaphylaxis among participants.

Variable	Response	N	%
Encountered cases of anaphylaxis during course of clinical practice (n = 242)	No	30	12.4%
	Yes	212	87.6%
Frequency of anaphylaxis cases encountered during course of clinical practice quintile (n = 242)	0–1 case	49	20.2%
	2–3 cases	69	28.5%
	4–5 cases	41	16.9%
	6–10 cases	54	22.3%
	11–15 cases	29	12.0%
Treated anaphylaxis with epinephrine (n = 212)	No	41	19.3%
	Yes, to all cases	83	39.2%
	To refractory cases only	88	41.5%
Steroid preparation of choice if used (n = 212)	Hydrocortisone	78	36.8%
	Dexamethasone	51	24%
	Prednisone/ methylprednisolone	3	1.4%
	No specific form	80	37.8%
Frequency of anaphylaxis-related mortalities (n = 212)	Nil	138	65.1%
	1 case	48	22.6%
	2 cases	14	6.6%
	3 cases	7	3.3%
	4 cases	1	0.5%
	5 cases	4	1.9%

Description; Data are number (N) and column percentage (%).

diagnosis is even more challenging, with less recognition and wide differential diagnosis [13–16]. Furthermore, a large prospective cohort study stated that anaphylaxis presents as isolated respiratory or cardiovascular symptoms in 31% and 14% of cases respectively [17]. The availability and handiness of validated clinical criteria would be helpful to bridge this gap in clinical knowledge.

Among the responders, 40.5% could identify epinephrine as the first line treatment of anaphylaxis, with higher frequencies among the higher age groups and higher academic degrees. This reflects a build-up of knowledge and experience probably through exposure to continuous medical education and scientific meetings. In real life, 39.2% of responders reported using epinephrine for all encountered anaphylaxis cases, reflecting a match between knowledge and practice. Additionally 19.3% of the responders used epinephrine for refractory cases only. The underuse of epinephrine might be related to inadequate knowledge on the subject, fear of use, uncertainty of the correct dose (available in Egypt as ampoules of 1/1000, 1 mg/1 ml) and unavailability of self-

injectable epinephrine both in the market and at the medical insurance level. Recent studies showed that some physicians' misconceptions might hinder the use of epinephrine like the fear of its use in infants or cardiac patients or have the concept of using epinephrine in severe but not in mild or moderate cases [18–20]. These results point to the need for continuous education and monitoring of medical personnel. Effective training is expected not only to improve anaphylaxis management in emergency centre but also will improve patients' and parents' orientation and their capability of managing life threatening allergic reactions until they get access to medical care [21].

In the European anaphylaxis register for assessment of anaphylaxis treatment practices over ten years, intramuscular epinephrine was given only in 27.1% of anaphylaxis incidents despite clear recommendations [22]. Two surveys on anaphylaxis in India, in 2010 and 2015, showed that epinephrine was the first choice of 90.1% and 56.9% of participants respectively [23]. In a survey of Russian physicians' knowledge of diagnosis and management of food-induced anaphylaxis, only 29% of those making the correct diagnosis chose epinephrine intramuscular as first line treatment (10% of the responders), while higher percentages preferred intramuscular corticosteroids (37%) or chlorpheniramine (26%) [24]. Similar results were also observed in studies from South Korea [19], Turkey [25], Lebanon [26], while the performance was much better when selected specialties were surveyed including the emergency centre physicians [27–29], and allergy/immunology specialists [30], where the use of epinephrine as a first line treatment was applied in 70 to 98% of witnessed anaphylaxis events. Different educational programs among countries, availability of educational resources and different evaluation methods of physicians might also have their impact on the anaphylaxis knowledge and practice.

A significant proportion of responders in our study (31.8%) chose corticosteroids as first line of anaphylaxis treatment, and all of them used corticosteroids in their practice, despite their relatively delayed onset of action (30 min to 2 h for hydrocortisone). There is currently no evidence for the benefit of corticosteroids in management of anaphylaxis or even for prevention of late phase reaction. In a systematic review by Liyanage et al., corticosteroid use in emergency treatment of anaphylaxis averaged 67.9% and were claimed to reduce the length of hospital stay, but not the revisits to the emergency centre [31]. In their systematic analysis that included 31 appropriate studies, Alqurashi and Ellis, did not validate the effectiveness of corticosteroids in ameliorating severe anaphylaxis or in preventing biphasic reactions, and hence did not support their routine use [32].

Contrary to what we expected, the geographical location and being

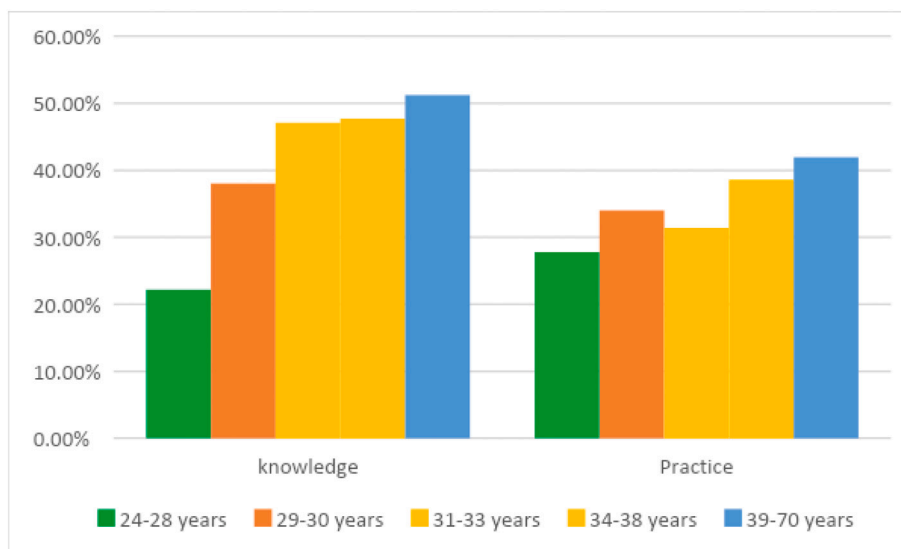


Fig. 2. Association between age of physicians and the use of epinephrine in anaphylaxis (knowledge and clinical practice).

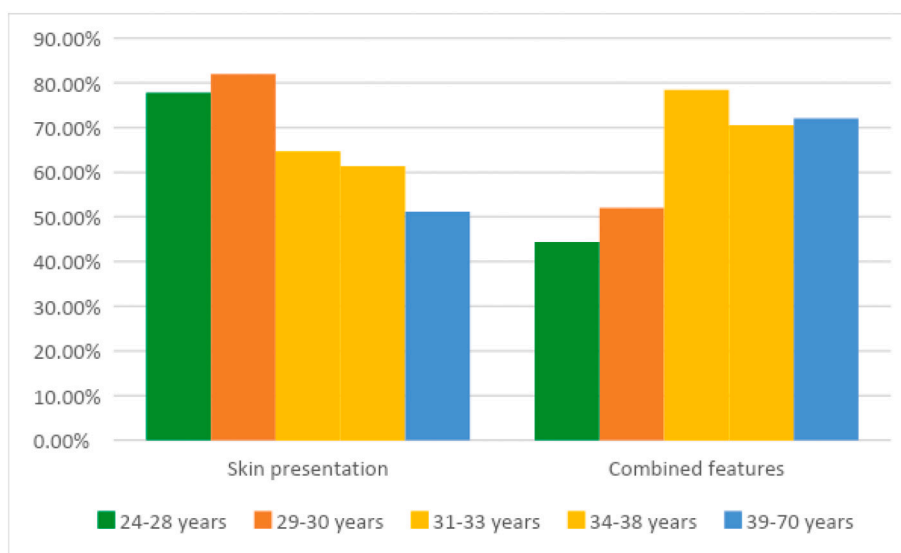


Fig. 3. Association between the age of physicians and their knowledge towards the clinical presentation of anaphylaxis.

university affiliated had not much influence on knowledge and clinical practice towards anaphylaxis, yet the academic degree did impact the knowledge about epinephrine. There have been increasing efforts, recently, by the Ministry of Health in Egypt to provide education and training to physicians, through establishing a national regulatory system for continuing medical education in addition to offering the Fellowship of Egyptian Board (FEB) program [33,34], but we have no previous data to compare to the current situation.

In conclusion, our survey shows that the knowledge of Egyptian physicians and their practice concerning anaphylaxis, although comparable to or even better than some regions in the world, are still inadequate, and there is a need to improve this situation. Despite increasing efforts, training is still inadequate with large sectors remaining untrained. Our work has some important limitations, including the small sample size and the use of a self-completed email survey method with its problems including unwillingness of some recipients to participate, internet and technical problems. The convenience sampling method with the non-random nature of study participants also limits the ability to generalise the results of the survey

to the health care workers population with the possibility of under/over representation. The lack of comparison among different specialties is another limiting factor. More studies are needed to tackle these points and to include data on referral of cases to allergists.

**Dissemination of results**

Results from this survey were shared with staff members at the data collection sites through an informal presentation in virtual medical staff meetings.

**Authorship contribution statement**

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: ZE contributed 30%; RE 25%; and SH, DH, IE, AA, MA, EE, AI, NO, WS, MA, AI, AS, AS contributed 3.5% each. All authors approved the version to be published and agreed to be accountable for all aspects



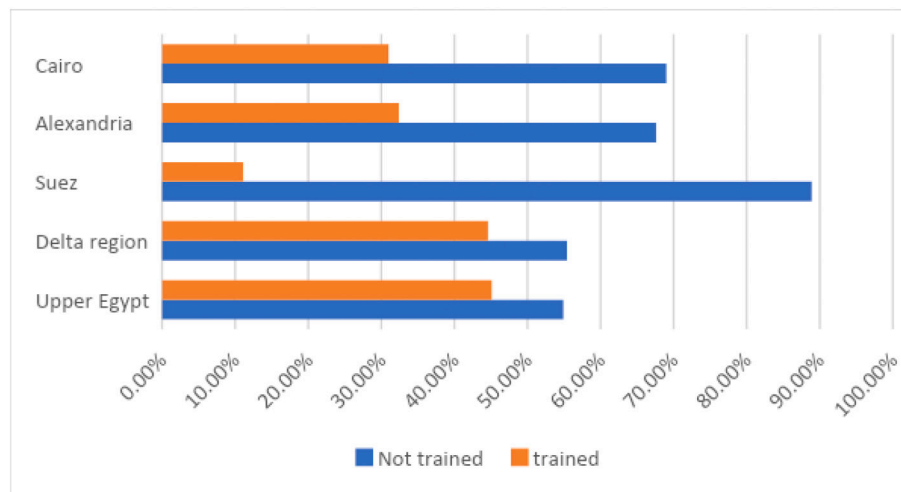


Fig. 4. Formal training for anaphylaxis among physicians from different geographical areas.

of the work.

#### Declaration of competing interest

None of the authors has a conflict of interest in relation to this manuscript.

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