



## Drug Allergy Knowledge and Attitude among Resident Physicians at Zagazig University Hospitals: A Cross-Sectional Study

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### ABSTRACT

**Background:** Drug allergy represents an important and growing public health problem worldwide. The clinical manifestations of drug allergy vary from mild to life-threatening reactions. **Objectives:** To measure the level of knowledge and attitude of the resident physicians towards drug allergy and to determine factors that influence them. **Methods:** A cross-sectional study was carried out among resident physicians at Zagazig University hospitals from February to April 2024. A self-administered questionnaire about knowledge and attitude towards drug allergy was completed by the study sample. **Results:** A total 248 residents were included in the current analysis; 146 medical specialties and 102 surgical specialties. The mean age was 29.1±1.8 years and 50.8% of the residents were females. Approximately 76% of the residents had insufficient knowledge and 49% had a negative attitude. In multivariate logistic regression of predictors of insufficient knowledge; shorter years of experience including <1 year, 1 to <2 years, 2 to <3 years (adjusted odds ratios [AOR] 10.31, 7.16, and 3.57, respectively), surgical specialties (AOR=3.38), lack of training in drug allergy (AOR=2.21), and not contributing to or observing any drug provocation test (AOR=5.72) were significantly independently associated with deficient knowledge. A statistically significant relation was found between attitude and dealing with patients who had drug allergy was found. **Conclusions:** Most of the resident physicians had insufficient knowledge about drug allergy while about half of them had a positive attitude. The research characterizes residents who are in need of specialized educational programs focusing on the mechanism, diagnosis, and management of drug allergies.

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### INTRODUCTION

Drug hypersensitivity reactions (DHRs) are significant, globally expanding public health issue. "The dose-independent, unpredictable, noxious, and unintended response to a drug taken at a dose normally used in humans" is the definition given by the WHO.<sup>1</sup> Drug allergy includes a spectrum of immunologically mediated DHRs with different mechanisms.<sup>2</sup> It is presented clinically with a wide range of manifestations ranging from mild to life-threatening. Cutaneous manifestations are

commoner than systemic ones or anaphylaxis.<sup>3</sup> Drugs have been reported as the main cause of anaphylactic deaths.<sup>4</sup> The actual incidence of DHR is unknown. However, the prevalence of ADRs (adverse drug reactions) varies between 15% and 25%, as reported in daily clinical work, while 7% to 13% of patients presented with severe reactions.<sup>5</sup> Around 20–25% of patients who manifested with ADRs showed unpredictable reactions.<sup>6</sup> All drugs have the potential to cause ADR, but not all of them

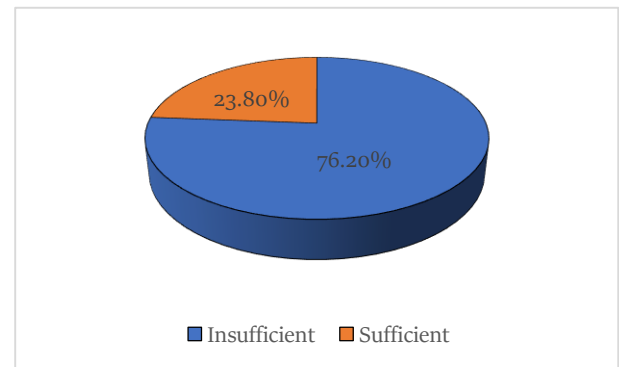
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are allergic in nature. Aspirin and non-steroidal anti-inflammatory drugs are the most common drugs that cause hypersensitivity. Additionally, antibiotics with reported allergy as penicillin and penicillin with clavulanic acid can produce allergy among patients with known allergy to beta-lactams.<sup>7</sup> The abundant non-specific drug allergy symptoms make the diagnosis challenging. A clinical diagnosis through careful history and physical examination is the best to rely on. Moreover, skin prick tests are required.<sup>5,6</sup> Proper management of DHR is crucial for patients. The first line in management is to avoid or discontinue the stimulant drug. Topical corticosteroids and oral antihistamines could be used as additional therapy. Systemic corticosteroids are essential in serious cases. The first treatment choice in anaphylaxis is injectable epinephrine.<sup>5</sup> Previous researches have shown that doctors had a low level of knowledge concerning drug allergies.<sup>8-10</sup> Adequate knowledge and attitude towards DHR diagnosis and management are crucial for saving lives and reducing treatment costs.<sup>9</sup> To the best of our knowledge, no research has been done at Zagazig University hospitals or even in Egypt to comprehensively examine resident physicians' knowledge and attitude towards drug allergy. The current study aims to measure the level of knowledge and attitude of the resident physicians towards drug allergy and to determine factors that influence them.

## METHODS

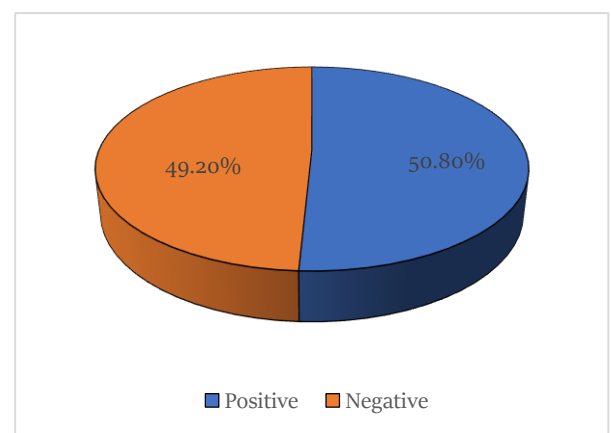
A cross-sectional study was carried out on resident physicians working at all departments in Zagazig University hospitals from February to April 2024. Using open Epi software program, sample size was calculated. Assuming the level of knowledge about drug allergy among resident physicians was 58.8%<sup>8</sup> and total number of resident physicians at Zagazig University hospitals was 560, sample size was calculated to be 225 at confidence level 95% and power of study 80%. Ten percent of sample was added to compensate for potential non-response, so a total of 248 physicians were recruited. A representative sample was selected from all departments in Zagazig University hospitals using the simple random technique method. Data collection was done using a self-administered questionnaire. The questionnaire was adopted from an earlier study done in China.<sup>9</sup> It was in English

language and was valid.<sup>9</sup> The questionnaire was distributed to experts from Community and Microbiology departments to test content validity. A



**Figure 1: Level of knowledge of studied respondents about drug allergy**

pilot study involving 30 physicians was performed to test the clarity and understanding of questions. The reliability of the knowledge and attitude sections was calculated using Cronbach alpha (0.72 and 0.74 respectively). Physicians in pilot study were excluded from the current study as no modifications were done. The questionnaire was in electronic form and distributed to the selected participants by E-mail.



**Figure 2: Attitude of studied sample about drug allergy**

There were three sections in the questionnaire. *Section 1* Background information: including age, gender, speciality, years of experience, receiving training in drug allergy, dealing with patients who had drug allergy. *Section 2* Knowledge section (14 questions): assess the knowledge of drug-induced anaphylaxis, the effector cell, time for drug hypersensitivity reactions, antibody mediates immediate drug hypersensitivity, clinical manifestation of drug allergy, drug recommended to

**Table 1: Relation between level of knowledge about drug allergy and baseline data**

	Total N=248	Insufficient N=189	p-value	COR (95% CI)	p
<b>Gender:</b>					
Female	126 (50.8%)	105 (83.3%)	0.007* <sup>§</sup>	2.23 (1.24-4.14)	0.007*
Male	122 (49.2%)	84 (68.9%)		1 (reference)	
<b>Age (year)</b>					
Mean ± SD	29.12 ± 1.82	29.36 ± 1.28	0.155 <sup>¥</sup>	0.91 (0.78-1.07)	0.25
<b>Year of experience</b>					
<1 year	27 (10.9%)	25 (92.6%)		9.03 (2.02-40.38)	<0.001**
1- <2 year	53 (21.4%)	47 (88.7%)		5.66 (2.2-14.55)	0.004*
2-3 years	75 (30.2%)	63 (84%)	<0.001** <sup>∞</sup>	3.79 (1.81-7.96)	<0.001**
3-5 years	93 (37.5%)	54 (58.1%)		1 (reference)	
<b>Specialty</b>					
Medical	146 (58.9%)	101 (69.2%)	0.002* <sup>§</sup>	1 (reference)	
Surgical	102 (41.1%)	88 (86.3%)		2.8 (1.44-5.44)	0.002*
<b>Not receiving training in drug allergy</b>					
	60 (24.2%)	40 (66.7%)	0.046* <sup>§</sup>	1.91 (1.01-3.63)	0.046*
<b>Not dealing with patients who had drug allergy</b>					
	167 (67.3%)	125 (74.9%)	0.47 <sup>§</sup>	1.27 (0.67-2.4)	0.471
<b>No contribution/observation to any drug provocation test</b>					
	161 (64.9%)	110 (68.3%)	<0.001** <sup>§</sup>	4.58 (2.06-10.18)	<0.001**

§ Chi square test, ¥ independent sample t test, ∞ Chi square for trend test, COR crude odds ratio, CI Confidence interval, \* $p < 0.05$  is statistically significant, \*\* $p \leq 0.001$  is statistically highly significant

perform an intradermal test before administration, and management for drug allergy. Questions were in the form of multiple choices and had 4 answers; only one is correct. A binary scale was used (wrong answer= 0, correct answer= 1). Total score ranged from 0 to 14. Having knowledge scores  $\geq 70\%$  was considered sufficient. *Section 3 Attitude section* (5 questions): assess the attitude concerning training requirements, tests for diagnosis, and quality of life affected by DHRs. It was measured by five Likert scale (strongly agree=5, agree=4, neutral=3, disagree=2, strongly disagree=1). Total scores ranged from 5 to 25 with scores  $\geq 70\%$  was considered positive attitude.

*Definition of exposures and outcomes:* The primary outcome of this study was measuring the knowledge and attitude of resident physicians as regard to drug allergy at Zagazig University hospitals and determining factors that influence them.

**Statistical analysis:** Data was entered and analyzed using the software SPSS (Statistical Package for the Social Sciences) version 26. Frequencies and

percentages were used to depict the categorical data. When applicable, the Chi square test and Chi square for trend test were used. The Kolmogorov-Smirnov test was employed to assess the data normality. The mean and standard deviation were used to display quantitative normally distributed data. For normally distributed data, the independent sample t test was used to compare quantitative variables. Binary logistic regression was used to identify risk factors associated with health problem. P value less than 0.05 was considered statistically significant.

## RESULTS

This study included 248 resident physicians; females represented 50.8% of them with mean age  $29.12 \pm 1.82$  years. Concerning years of experience, 37.5% of physicians worked for 3 to 5 years. About 59% of them worked for medical departments. About 24% of them received training in drug allergy specifically, 67.3% of physicians encountered with a patient had drug allergy and 64.9% had participated/observed to any drug provocation test (Table 1).

**Table 2: Items of knowledge about drug allergy (N=248)**

	N	%
Type of hypersensitivity to which drug-induced anaphylaxis belongs to	122	49.2
Factor that drug allergy does not relate to	107	43.1
Cells initiate drug induced anaphylaxis	179	72.2
Time needed for drug hypersensitivity reactions to occur after drug intake	211	85.1
Antibody induce drug hypersensitivity reactions	207	83.5
The most common clinical presentation of drug allergy	176	71.0
Diagnosis of drug allergy (gold standard)	112	45.2
Why to perform drug provocation test	31	12.5
The recommended screening test when drug hypersensitivity reactions were suspected	92	37.1
Time to perform skin test when drug allergy is suspected	79	31.9
Penicillin skin test is not recommended	43	17.3
Intradermal test is done by which drug	230	92.7
Crucial management of drug allergy	131	52.8
Anaphylactic shock is treated by which medication (first choice)	166	66.9

As regard overall knowledge about drug allergy, 76.2% had insufficient level of knowledge where 49.2% had negative attitude (Figure 1 and 2). There is statistically significant relation between level of knowledge and each of gender, years of experience, specialty, receiving education about drug allergy, and history of contribution/observation to any drug provocation test (Table 1). Female gender, years of experience <1years, 1 to <2 years, 2 to <3years, surgical specialties, not receiving education about drug allergy and negative history of contribution/observation to any drug provocation test significantly increased risk of insufficient knowledge by 2.23, 9.03, 5.66, 3.79, 2.8, 1.91 and 4.58 folds respectively (Table 1). There is no statistically significant association between level of knowledge and gender or dealing with patients who had drug allergy (Table 1). Regarding individual items of questionnaire to assess drug allergy, least questions received correct answers are why to perform drug provocation test (12.5%), those about situations penicillin skin test is not recommended (17.3%), time to perform skin test (31.9%), screening test recommended when DHRs were suspected (37.1%) then factors related to drug allergy (43.1%). While 92.7% gave correct answer about recommended drug to do intradermal test (Table 2). In multivariate logistic regression, the following were independent predictors of insufficient knowledge; shorter years of experience

including <1 year, 1 to <2 years, 2 to <3 years (adjusted odds ratios [AOR] 10.31, 7.16, and 3.57, respectively), surgical specialties (AOR=3.38), not receiving focused training in drug allergy (AOR=2.21), and not contributing to or observing any drug provocation test (AOR=5.72, Table 3). About 74% agreed that they must acquire training in drug allergy while about 62% agreed that before drug administration it is essential to perform in vivo or in vitro test of drugs. About 53% of them reported that they are dissatisfied with their knowledge. About 68.9% agreed that drug allergy negatively affects patients' quality of life and about half of them state that drug allergy is very common in clinical practice (Table 4). There is statistically significant relation between attitude of physicians and dealing with patients who had drug allergy. Not dealing with patients who had drug allergy non-significantly increases risk by (OR=4.84, Table 5). There is no statistically significant association between attitude and gender, age, years of experience, specialty, receiving education about drug allergy, knowledge level and history of participation/observation to any drug provocation test (Table 5).

## DISCUSSION

Drug allergy is a global public health issue. It can cause reactions that range from minor to fatal in their clinical manifestations. Majority of these symptoms are erratic and numerous, which render

**Table 3: Multivariate regression analysis of factors associated with insufficient knowledge drug allergy**

	$\beta$	p-value	AOR	95% C.I.	
				Lower	Upper
<b>Years of experience</b>					
<1 year	3-5 years	0.003*	10.310	2.161	49.190
1 - <2 year	3-5 years	<0.001**	7.162	2.521	20.351
2 - <3 years	3-5 years	0.002*	3.569	1.603	7.949
<b>Surgical specialty</b>					
	Medical specialty	0.001**	3.380	1.616	7.067
<b>Not receiving training in drug allergy</b>					
		0.794	0.042*	2.213	1.029
<b>No contribution/observation to any drug provocation test</b>					
		1.744	<0.001**	5.721	2.437

AOR adjusted odds ratio, CI Confidence interval, \* $p < 0.05$  is statistically significant, \*\* $p \leq 0.001$  is statistically highly significant

diagnosis difficult. It is unknown if evidence-based recommendations about DHRs are followed.

The current survey uncovers some gaps in respondents' knowledge about drug allergies, where lower percentage of resident physicians (23.8%) had sufficient level of knowledge and a near percent of them received training in drug allergy specifically. A similar level of knowledge was reported by another study in Saudi Arabia in 2021 among primary health care physicians in Taif city (26%).<sup>11</sup> Lower than other Turkish study conducted in 2020 among residents and interns which discovered that roughly (58.5%) had sufficient knowledge.<sup>8</sup> However, a lower level of knowledge was reported in a study carried out in Bali in 2021 where only (19.6%) of health care professionals had good knowledge.<sup>6</sup> Also another Malaysian study carried out in 2023 concluded that knowledge on drug allergy among doctors was poor.<sup>12</sup>

About half of resident physicians in the current study who were asked about their knowledge of the mechanisms underlying drug allergy, responded that type I hypersensitivity is drug-induced anaphylaxis. Research conducted in 2020 in India revealed a higher level of understanding, with almost 98% of HCPs correctly answering this question.<sup>13</sup> In this study, majority stated that effector cell was mast cells (72.2%). In contrast, research conducted in Bali in 2021 found a lower level of knowledge (45.8%).<sup>6</sup> The majority of the current participants had accurate knowledge of type I hypersensitivity mediated by IgE. Similarly, a

previous study revealed comparable results, where nearly 90% of medical professionals were aware that drug induced anaphylaxis occurred within six hours after drug administration.<sup>9</sup> This was consistent with our findings, which showed that roughly 85% of the physicians were aware. Frequent medication dosages are more likely to generate DHRs than a single large dosage.<sup>5</sup> In this study, a low proportion of resident physicians correctly answered questions about dosage. This was less than in research conducted in Central China, as 47% of HCPs reported knowing this.<sup>9</sup> Findings from our study revealed that it is crucial to improve the knowledge of resident physicians concerning the mechanisms of drug allergy.

The current study indicated that most resident physicians had good understanding of clinical symptoms of drug allergy. This study confirmed previous research showing that most HCPs were adequately knew the symptoms of drug allergies.<sup>6,13</sup> It is crucial to recognize the warning signs and symptoms of DHRs in order to save lives and avoid serious and severe reactions brought on by drug allergies.

In order to diagnose drug allergy, skin prick tests should be done at least one month following systemic allergic reactions as it may produce false negative results within four weeks after the reaction. Positive skin tests indicate presence of antigen specific IgE which helps diagnose a type I hypersensitivity reaction.<sup>14</sup> In this study, only (32%) correctly answered the time to do skin test, however,

**Table 4: Items of attitude about drug allergy**

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
<b>In your opinion, physicians must acquire training in drug allergy</b>	131 (52.8%)	52 (21%)	18 (7.3%)	26 (10.5%)	21 (8.5%)
<b>In your opinion, before drug administration it is essential to perform in vivo or in vitro test of drugs</b>	59 (23.8%)	94 (37.9%)	43 (17.3%)	27 (10.9%)	25 (10.1%)
<b>Do you think you are satisfied with your knowledge of DHRs</b>	8 (3.2%)	54 (21.8%)	54 (21.8%)	94 (37.9%)	38 (15.3%)
<b>In your opinion, patient's quality of life is affected negatively by drug allergy</b>	45 (18.1%)	126 (50.8%)	14 (5.6%)	1 (8.5%)	42 (16.9%)
<b>In your opinion, drug allergy is very common in daily practice?</b>	6 (2.4%)	117 (47.2%)	36 (14.5%)	45 (18.1%)	44 (17.7%)

about (41%) of HCPs in China in 2016 knew that.<sup>9</sup> This discrepancy may be related to the recommendation of skin tests in daily practice to predict drug allergy in China.<sup>9</sup> In contrast to a research conducted in Bali in 2021.<sup>6</sup> A higher percentage of our respondents knew to get a skin prick test when DHRs were suspected (28%). Only 4.2% of HCPs in China, correctly answered the question, and only 17.3% of participants in this study knew when a penicillin skin test was inappropriate to conduct.<sup>9</sup>

In addition, drug provocation testing, or DPT, is utilized to diagnose DHRs when history, skin tests, and in vitro investigations are insufficient.<sup>15</sup> Similar to this study, only (40%) of HCPs in a prior study correctly identified DPT as the gold standard test for drug allergy diagnosis.<sup>9</sup> Although 65% of survey participants reported having contributed to or observed any drug provocation test, the majority were unaware of its indications. These low levels of knowledge may be related to that DPT is potentially dangerous and require certified personnel to execute as stated by Joint Task Force on Practice Parameters.<sup>16</sup>

In this study, a greater proportion of resident physicians were aware that administering Penicillin should not come before an intradermal test. This was greater than the 85% of HCPs in India in 2020.<sup>13</sup> It is essential to increase resident physicians' understanding of DHR diagnostic tests.

For managing drug allergy, in this study, around (70%) of resident physicians knew that the best medication for treating drug allergy is epinephrine, which is greater than the results of a study on Armeni in 2022 that conveyed that only 66% of participants recognized this line of management.<sup>17</sup> Although, our results were lower than the HCPs in the United States (94%)<sup>18</sup> and in India (95%).<sup>13</sup> Enhancing resident physicians' understanding of how to properly treat acute anaphylaxis is crucial since failing to administer the recommended medication—epinephrine—raises the risk of death.<sup>19-21</sup> Avoiding medications that cause sensitization is seen to be the most important way to treat drug allergies.<sup>5</sup> We discovered that only roughly 50% of our participants possessed this information, which was less than the 62% of HCPs in China.<sup>9</sup>

Upon examining the variables linked to inadequate knowledge of drug allergy, we discovered that years of experience—less than a year, between one and two years, and between two and three years—significantly independently raise the risk by 10.3, 7.2, and 3.6 times, respectively. This could be because residents deal with more cases, gather more information, conduct more research, and make progress towards their master's degree preparations as time goes on. This result, however, disagreed with a Turkish study from 2020 that found resident experience had no discernible impact on knowledge scores.<sup>8</sup>

**Table 5: Relation between attitude about drug allergy and baseline data**

	Total N=248	Negative n=122	p-value	COR (95% CI)	p-value	
<b>Gender:</b>						
Female	126 (50.8%)	66 (52.4%)	0.308	1.3 (0.79-2.14)	0.308	
Male	123 (49.2%)	56 (45.9%)		1 (reference)		
<b>Age (year)</b>						
Mean ± SD	29.12 ± 1.82	29.28 ± 1.73	0.176	1.1 (0.96-1.27)	0.172	
<b>Year of experience</b>						
<1 year	27 (10.9%)	12 (44.4%)	0.626	1.11 (0.47-2.63)	0.816	
1 - <2 year	54 (21.4%)	18 (34%)		0.71 (0.35-1.44)		0.343
2-3 years	75 (30.2%)	53 (70.7%)		3.34 (1.75-6.36)		<0.001**
3-5 years	93 (37.5%)	39 (41.9%)		1 (reference)		
<b>Specialty</b>						
Medical	146 (58.9%)	76 (52.1%)	0.281	1 (reference)	0.281	
Surgical	103 (41.1%)	46 (45.1%)		0.76 (0.46-1.26)		
<b>Receiving training in drug allergy</b>						
	60 (24.2%)	23 (38.3%)	0.056	1.79 (0.99-3.24)	0.056	
<b>Dealing with patient had drug allergy</b>						
	167 (67.3%)	62 (37.1%)	<0.001**	4.84 (2.69-8.71)	<0.001**	
<b>Contribution/observation to any drug provocation test</b>						
	162 (64.9%)	73 (45.3%)	0.09	1.55 (0.92-2.63)	0.099	
<b>Insufficient knowledge</b>						
	190(76.3%)	98 (51.9%)	0.134	1.57 (0.87-2.84)	0.134	

§ Chi square test, ¥ independent sample t test, ∞ Chi square for trend test, COR crude odds ratio, CI Confidence interval, \* $p < 0.05$  is statistically significant, \*\* $p \leq 0.001$  is statistically highly significant

Our research revealed that surgical specialties significantly independently raise the likelihood of inadequate knowledge by around 3.4 folds. It could be because residents of medical branches deal with more drugs and experience drug allergy more likely. This was consistent with the results of a Turkish study in 2020 among residents, which found that residents in surgical departments had substantially lower knowledge scores than residents in medical departments. In line with the findings of this study, they also discovered that those who had not received any education regarding drug allergies had knowledge scores that were much lower.<sup>8</sup>

Regarding the attitude of our resident physicians about drug allergy, we found that approximately 50% of them had a favorable attitude towards drug allergy. However, in Taif City, Saudi Arabia, in 2021, just 18% of primary care doctors had a positive attitude on drug allergy.<sup>11</sup>

Furthermore, almost half of the study's resident physicians expressed dissatisfaction with their level of drug allergy knowledge and committed to pursue further training in the field of DHRs. This could be because just 23.8% of them knew enough about

drug allergies, although this relation could not be proven statistically. A Malaysian study published almost similar results in 2023.<sup>12</sup> This contrasted with two studies conducted in China in 2016<sup>9</sup> and Bali in 2021,<sup>6</sup> which found that a lesser number of HCPs (21.8 %) and (19.8%) were satisfied with their current level of knowledge and accepted advanced training. Additionally, a Turkish study in 2020 among residents and interns revealed that 92% of them believed that medical doctors should receive training on drug allergies, but just 17% of them were dissatisfied with their level of knowledge.<sup>8</sup> It is possible to interpret these results because there is broad support for any future training and education initiatives.

Only one fourth of our resident physicians concurred that conducting an in vitro or in vivo test is imperative prior to administering a medication. Low levels of awareness about diagnostic testing could be the cause of this. The HCPs in China in 2016 (62.5%),<sup>9</sup> Bali in 2021 (53%),<sup>6</sup> and Turkey in 2020 (38%)<sup>8</sup> were all higher than this result. Our results, however, were better than those of Malaysian doctors in 2023,<sup>12</sup> where only 19% of them agreed.

In our study, just eighteen percent of our resident physicians believed that drug allergies negatively impair patients' quality of life. This was lower than the percentage of doctors who agreed in a Malaysian study conducted in 2023 (46%)<sup>12</sup> and in Armeni in 2022 (53%).<sup>17</sup>

A survey conducted in Bali in 2021 with approximately 19% of health care professionals and a study conducted in Malaysia in 2023 with around 16 percent of doctors firmly agreed that drug allergies are highly frequent in regular clinical practice.<sup>6,12</sup> This exceeded what we discovered.

On studying relationship between attitude about drug allergy and some baseline data, a study conducted in KSA in 2021 demonstrated significant correlation between participant gender and attitudes. Males had more positive attitude towards drug allergy.<sup>11</sup> Also, a Turkish study in 2020 found significant association between the participants' attitudes and their specialty. Compared to surgical departments, the residents in the medical departments exhibited a more positive attitude.<sup>8</sup> These results disagreed with our conclusion that there is no statistically significant relationship between the participants' attitudes and their gender and specialty.

As far as the researchers are aware, this study represents the first attempt to evaluate the relationship between drug allergy attitudes and age, years of experience, receiving education about drug allergies, knowledge level, history of participation or observation in drug provocation tests, and history of dealing with patients who had drug allergies. The results indicate that there is no statistically significant relationship between attitudes and age, years of experience, receiving education about drug allergy, knowledge level and history of participation/observation to any drug provocation test.

However, we found that history of not dealing with patients who had drug allergy significantly increases risk of a negative attitude by 4.84 folds.

This study had some limitations included the cross-sectional design, the relatively small sample size, and the single university hospital experience. Also, we aim to assess only knowledge and attitude as initial step that can be followed by evaluation of practices of physicians.

To improve patient treatment outcomes and comprehension of the allergy process, we recommend specialized educational programs on the mechanism, clinical manifestation, diagnosis, and

management of drug allergies. We believe that medical doctors' pre- and postgraduate training should include this kind of programs. Future research with a bigger sample size might encourage information exchange and teamwork among resident physicians when treating drug allergies. Moreover, we recommend further studies concerning the practice of physicians regarding drug allergy. Conducting an intervention trial would be a good next step in attempting to avoid future drug-allergy-related morbidity and mortality as well as to enhance residents' understanding and attitude regarding drug allergy.

In conclusion, the present study reveals that most of resident physicians had insufficient knowledge about drug allergy while about half of them had negative attitude. Years of experience, surgical specialties, not receive training in drug allergy and not contributing to or observing any drug provocation test significantly independently increased risk. These findings characterize residents who need specialized educational programs focusing on the mechanism, diagnosis, and management of drug allergies.

### **Ethical Considerations**

Approval was obtained from the Research Ethical Committee of the Faculty of Medicine, Zagazig University. (ZU-IRB # 10/28-1-2024). Informed consent was obtained from the participants after explaining the purpose of the study and ensuring that their participation is not obligatory and the anonymity of data.

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**Authors' contributions:** Maha S. Eltwansy: idea, background, method writing and preparing manuscript. Amany M. AbdAllah: data collection, analysis interpretation and writing and critical review. Nesma A. Mahmoud: data collection, discussion writing and critical review.

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