Drugs Allergy and Risk Factors for Patients in Hospitals at Holy Karbala Province

Monir Ibrahim Ahmed[1], Raheem, Saad Saleem[2], Mustafa Jawad Kadhum[3]

[1]M.Sc., Student Department of community Health Techniques, Al-Najaf, College of health and medical techniques, Al-Furat Al-AlAwsat Technical University.

[2]Assist. Prof. Dr., Department of community Health Techniques, Al-Najaf, College of health and medical techniques, Al-Furat Al-AlAwsat Technical University.

[3]M.B.Ch.B-F.L.C.M.S. Imam hasan mujtaba hospital, karbala health directorate.

***Corresponding author:**

Yin Yixia.

[1]Email ID: munir.ahmed.chm@student.atu.edu.iq

[2]Email ID: Kuh.sad@atu.edu.iq

[3]Email ID: mustafa.jawad555@gmail.com

ABSTRACT

This research explores the topic of drug allergy and its associated risk factors. Drug allergies represent a significant clinical concern, as they can lead to a wide range of adverse reactions, some of which may be severe or life-threatening. Understanding the underlying causes and identifying individuals at higher risk is crucial for improving patient safety and guiding healthcare professionals in prescribing medications more effectively.

This study investigates drug allergies and their associated risk factors among patients in the Holy Province of Karbala. It aims to determine the prevalence of drug allergies, identify the most common causative drugs and clinical symptoms and explore links with various risk factors such as medical and family history, lifestyle, and polypharmacy. The research also evaluates how drug allergies affect hospitalization rates, treatment decisions, and patient outcomes.

1. INTRODUCTION

Allergies are a severe medical condition that can have fatal outcomes (1). Allergy is a vast issue comprising typical clinical allergic disorders, asthma, food allergy, medication allergies, and complicated immune-deficiencies (2). The term refers to any adverse or unexpected pharmacological reaction that happens at dosages used for therapy, diagnosis, or prevention. Between 15 and 25% of patients experience ADRs in routine clinical practice, while 7–13% of patients experience significant responses (3). The term "drug allergy" is used when referring to a "real" hypersensitivity reaction (HSR) (4). Predictable (type A) and unpredictable (type B) adverse medication reactions are the two categories. Eighty percent of all adverse medication reactions are predictable; they are frequent, dose-dependent, and brought on by the drug's pharmacologic effects. On the other hand, unanticipated reactions are rare, unconnected to the drug's pharmacologic effects, and independent of dosage (5). The two reactions do not rely on the dosage (6). Both inpatient and outpatient settings frequently experience adverse medication responses (7). The organ most commonly and conspicuously impacted by drug-induced allergy responses is the skin. The most prevalent cutaneous manifestation is a widespread maculopapular rash (i.e. erythematous lesions) (8) Both IgE-mediated and non-IgE-mediated processes can cause the common conditions urticaria (hives) and angioedema (swelling). Viral infections are more likely to induce delayed maculopapular rashes and acute urticaria/angioedema in children than in adults, and children who exhibit these symptoms are less likely to have medication allergies (9,10).

Objective

This study aims to investigate the prevalence of drug allergies among patients in hospitals across holy Karbala Province, identify the most commonly implicated drugs and their clinical manifestations, explore associated risk factors, and evaluate the impact of these allergies on hospitalization, treatment management, and patient outcomes.

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Methodology

Study design: The study was conducted by using a case control study design. Patients who visited and admitted to hospitals in the Holy Province of Karbala were the subjects of the study. Data was gathered from November 1, 2024, to January 31, 2025, through a questionnaire that was based on structured questions taken from the World Health Organization (WHO) and tailored to the views and additions of experts with department-related subspecialties. 384 patients of all ages, genders, and without any preferences or distinctions from one another made up the sample size. The study focuses on patients about whom no prior information is available. **Setting of the study:** Karbala Governorate, located in Alfurat Al-Awsat, Iraq, is where the study was carried out. With a population of over 3.6 million. In order to address the number of patients in the emergency and consultation departments who have drug allergies or do not, the study program has been adopted throughout the hospitals. Imam Hussein Medical City in the heart of Karbala and Imam Hasan Mujtaba hospital in the Al-Hur District on the outskirts of Karbala were the two facilities in the governorate of Karbala where the study was carried out. **Sampling Technique:** a non-probability sample technique called convenience sampling was employed to choose study participants. The choice of this strategy was based on its viability and patient accessibility during the data collection time. The attached equation was used to determine the sample size (11). The required sample size was calculated using the procedure for comparing two proportions in a case-control study design. Assuming a statistical power of 80% ($\beta = 0.20$), a 95% confidence level ($\alpha = 0.05$), and an expected proportion of exposure to the risk factor among cases (p_1) of 30% and among controls (p_2) of 15%, the minimum required sample size was calculated. A case-to-control ratio of 1:3 was employed to increase the study's power. Consequently, the final sample consisted of 384 individuals, 96 of whom were cases and 288 of whom were controls.

Sample

size equation

$$n = \frac{\left\{ z_{1-\frac{\alpha}{2}} \sqrt{2\bar{p}(1-\bar{p})} + z_{1-\beta}\sqrt{p_1(1-p_1)+p_2(1-p_2)} \right\}^2}{(p_1 - p_2)^2}$$

Inclusion criteria	Exclusion criteria
Patients (both gender and all age groups) who were found at emergency and Consultation department where questions was asked, answers was taken, and the purpose of the study was clarified.	1. Patients who reject responding. 2. Patients who refused to answer the questions

2. RESULTS

Relation between demographic characteristics and drug allergy

According to table (1), the age group of 20 to 29 years old had the highest percentage of drug allergy cases (33.3%), while the control group had the lowest percentage (37.2%). The distributions of other age groups were comparatively comparable, with the lowest percentages in the <20 year age group (8.3% and 9.0%, respectively), and there was no statistically significant difference in the age distribution between cases and controls (P-value = 0.138). **Gender**: the findings revealed a notable gender disparity, with women reporting 61.5% of medication allergy instances compared to men's 38.5%. On the other hand, there were more men in the control group (58.7%) than women (41.3%) (P-value = 0.00) (table 1). **Occupation**: The percentage of people doing free work was much lower in cases (15.6%) than in controls (15.6% vs. 6.0%). Employees accounted for 51.0% of cases, followed by housewives (21.9%) and students (11.5%). Drug allergy risk may be influenced by employment position and work environment, as indicated by the P-value = 0.001, which shows a substantial relationship between occupation and drug allergy (table 1).

Table (1) Relation between demographic characteristics and drug allergy

Variables		drug allergy		Total	P Value[b]
		Cases = 96 (%)[a]	Control = 288 (%)	N (%)	
Age Group	<20 Years	8 (8.3)	26 (9.0)	34 (8.9)	0.138
	20-29 Years	32 (33.3)	107 (37.2)	139 (36.2)	

	30-39 Years	18 (18.8)	56 (19.4)	74 (19.3)	
	40-49 Years	**8 (8.3)**	45 (15.6)	53 (13.8)	
	50-59 Years	18 (18.8)	34 (11.8)	52 (13.5)	
	≥60 Years	12 (12.5)	20 (6.9)	32 (8.3)	
Gender	Male	37 (38.5)	**169 (58.7)**	206 (53.6)	**0.001**
	Female	**59 (61.5)**	119 (41.3)	178 (46.4)	
Occupation	Free work	15 (15.6)	45 (15.6)	60 (15.6)	**0.001**
	Employee	**49 (51.0)**	**194 (67.4)**	243 (63.3)	
	Student	11 (11.5)	26 (9.0)	37 (9.6)	
	Housewife	21 (21.9)	23 (8.0)	44 (11.5)	

(a) Frequency (%).

(b) P values were obtained by the chi-square test.

Relation between medical history and drug allergy

Chronic Diseases: According to Table (2), a notably greater percentage of medication allergy sufferers—39.6% of cases compared to 22.6% of controls—reported having chronic illnesses. There is a high statistical correlation between having a chronic illness and the likelihood of developing a medication allergy, as indicated by the P-value of 0.001. **Family History of Drug Allergy:** Table (2) also shows that a greater percentage of drug allergy cases (44.8% cases vs. 12.3% controls) had a positive family history. The extremely significant relationship indicated by the P-value < 0.001 suggests that genetic predisposition is a crucial factor in the development of medication allergies. **Smoking:** The last result in Table (2) revealed that there was no significant association, while the percentage of smokers was somewhat higher in medication allergy cases (18.8% cases vs. 22.6% controls). Additionally, there was no discernible difference in the groups' exposure to passive smoking. (P-value = 0.637).

Table (2) Relation between medical history and drug allergy

Variables		drug allergy		Total	P-Value[b]
		Cases = 96 (%)[a]	Control = 288 (%)	N (%)	
suffering from chronic diseases	No	58 (60.4)	223 (77.4)	281 (73.2)	0.001
	Yes	38 (39.6)	65 (22.6)	103 (26.8)	
Family history	No	53 (55.2)	253 (87.8)	306 (79.7)	<0.001
	Yes	43 (44.8)	35 (12.2)	78 (20.3)	
Smoker	No	78 (81.3)	223 (77.4)	301 (78.4)	0.431
	Yes	18 (18.8)	65 (22.6)	83 (21.6)	
Type of smoking	Cigarette	9 (50.0)	31 (47.7)	40 (48.2)	0.499

	Hookah	3 (16.7)	12 (18.5)	15 (18.1)	
	vape	4 (22.2)	7 (10.8)	11 (13.3)	
	All	2 (11.1)	15 (23.1)	17 (20.5)	
Exposed to passive smoking	No	48 (50.0)	152 (52.8)	200 (52.1)	0.637
	Yes	48 (50.0)	136 (47.2)	184 (47.9)	

(a) Frequency (%).

(b) P values were obtained by the chi-square test.

How long variables effect on drug allergy

Using Binary Logistic Regression and Crude OR (Unadjusted Odds Ratio) and with 95% CI and P-values, table (3) shows the duration of association between medication allergy and other possible risk variables. **Age Group**: less than 20 years was the reference category in table (3). There were no statistically significant differences between age groups when compared to the reference group, since none of the other age groups displayed a statistically significant correlation with drug allergy (P-values > 0.05). **Gender**: reference: Male in the same table (table 3). Women were much more likely to have a medication allergy: P = 0.001, crude OR = 2.2 (1.41 - 3.63). This implies that women have a statistically significant greater than twofold risk of developing a medication allergy in comparison to men. **Suffering from Chronic Diseases**: reference: No chronic diseases. Individuals with chronic diseases had a significantly big risk of drug allergy: Crude OR = 2.24 (1.37 - 3.68), P = 0.001. This means that people who experiencing from chronic diseases are more than twice as likely to develop drug allergy compared to those free from chronic disease, which is statistically significant (table 3). **Family History**: reference: No family history of allergy. Having a family history significantly increased the risk of drug allergy: Crude OR = 5.86 (3.43 - 10.01), P < 0.001. This means that individuals with family history can have drug allergy by 5.86 times comparing with people free from family history (table 3).

Table (3) how long variables effect on drug allergy

Variables		Crude OR[a] (95% CI)	P Value
Age Group	<20 Years	Ref.*	
	20-29 Years	0.97 (0.401, 2.356)	0.950
	30-39 Years	1.04 (0.402, 2.712)	0.928
	40-49 Years	0.57 (0.194, 1.723)	0.325
	50-59 Years	1.72 (0.648, 4.570)	0.276
	≥60 Years	1.95 (0.670, 5.672)	0.220
Gender	Male	Ref.	
	Female	2.2 (1.41, 3.63)	0.001
suffering from chronic diseases	No	Ref.	
	Yes	2.24 (1.37, 3.68)	0.001

Family history	No	Ref.	
	Yes	5.86 (3.43, 10.01)	<0.001

* Reference: (a) Odds ratio with Binary logistic regression.

Adjusted Odds Ratios for Factors Associated with Drug Allergy

The adjusted odds ratio (OR) by backward binary logistic regression analysis, which looks at the association between several characteristics and the chance of having a medication allergy, is displayed in Table (4). When the impacts of other variables (confounders) are taken into account, it displays the correlation between a variable and the medication allergy. Compared to the crude odds ratio, adjusted OR offers a more accurate and trustworthy approximation of the real relationship. When talking about **Gender**, the same table (4). Reference group (Ref.): Male. Adjusted Odds Ratio (OR) for Female: 2.27. 95% Confidence Interval (CI): (1.36, 3.79). P-value: 0.002. So, Females are 2.27 times more likely to have a drug allergy compared to males. This result is statistically significant, since the p-value is less than 0.05. **Family History:** by the same table (4). Reference group: No family history of drug allergy. OR for Yes: 6.05. 95% CI: (3.46, 10.56). P-value: < 0.001. This indicates that the likelihood of having a medication allergy is 6.05 times higher for those who have a family history of the condition. The outcome is extremely statistically significant, and this is the strongest correlation between the variables.

**Table (4) Adjusted Odds Ratios for Factors Associated with Drug Allergy**

Variables		Adjusted OR[b]	Confidence interval (95% CI)	P Value
Gender	Male	Ref.		
	Female	2.27	(1.36 - 3.79)	0.002
Family history	No	Ref.		
	Yes	6.05	(3.46 - 10.56)	<0.001

* Reference

 (b) Adjusted OR by backward Binary logistic regression.

Common symptoms of drug allergy

The most typical signs of medication allergies in patients are displayed in Figure (1): The most common symptom, involving 81% of patients, is rash. Breathlessness comes in second at 40%. 27 percent of patients have swelling. 16% report feeling lightheaded or fainting. Eleven percent are other symptoms, which include a range of unidentified reactions.
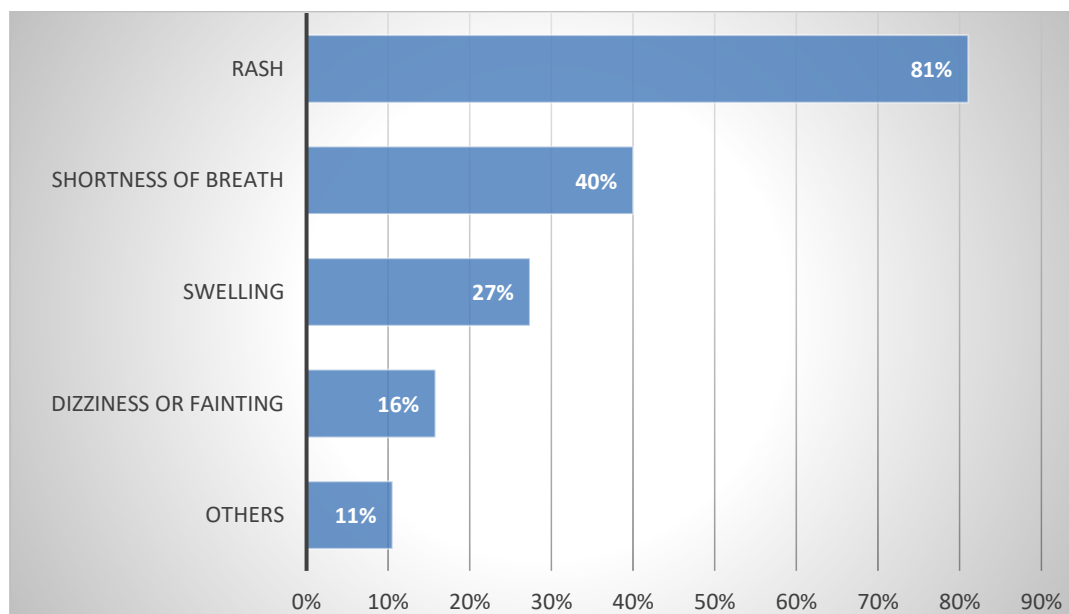
Figure (1)   Common symptoms of drug allergy

Appearance of allergic reaction

The amount of time it takes for an allergic reaction to manifest following exposure is shown in Figure (2). The majority of allergy reactions (57%) happen right after exposure. (35%) show up in a couple of hours. Five percent appear in a day. (3%) takes longer than a day to show up.
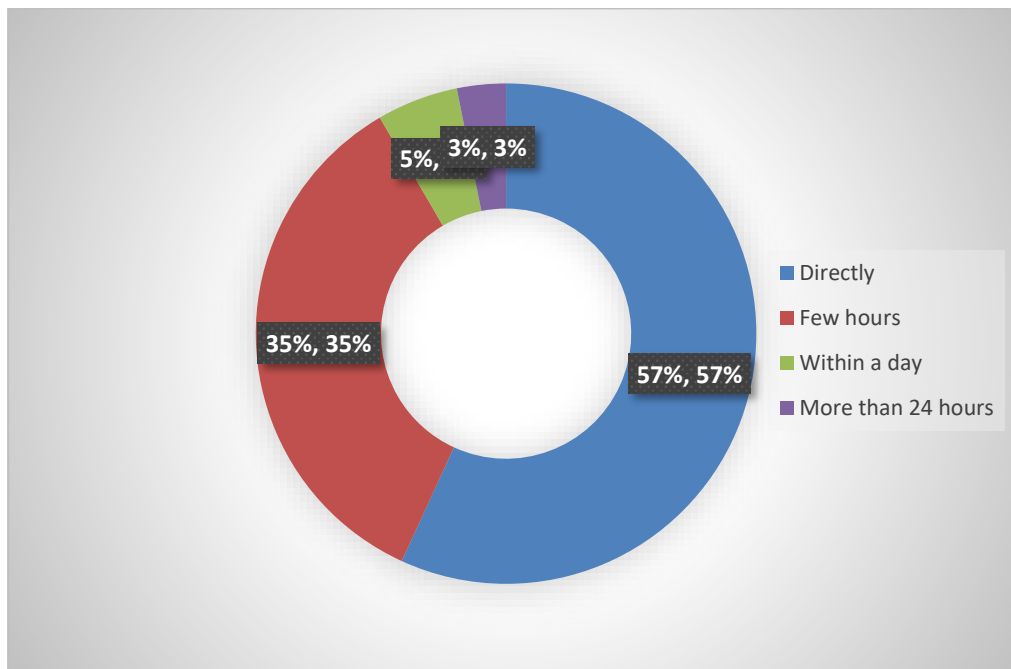

Figure (2) Appearance of allergic reaction

3. DISCUSSION

Age group: the study's findings revealed no statistically significant link (table 4.3) between medication allergy and age groups, with a weak association between the two. This result is consistent with the earlier research of (12), which clarified that age is neither a significant predictor nor a direct cause of medication allergic responses. Genetic predisposition, past sensitization, and the chemical composition of the drug are important factors in immunological systems including T-cell and B-cell mediated pathways that significantly impact drug allergy (13,14). **Gender:** regarding the association between gender and drug allergy (table 4.4), the study's results showed that drug allergy was substantially more common in women than in men, with a prevalence rate of 61.5% in women and 38.5% in men (P= 0.002). This finding is in line with a prior study of (15) that showed sex hormones, specifically estrogens and androgens enhance a woman's risk of developing a medication allergy. These hormones, which are produced from peptide or cholesterol molecules, have an impact on immune response modulation. The higher incidence of hypersensitivity reactions may be explained by the fact that females generally have larger humoral and cellular immune responses than males. Changes in hormone levels, particularly those of estrogens, might intensify the Th2 cytokine profile during periods like the menstrual cycle, pregnancy, and menopause, which in turn can promote allergic inflammation (16). **Suffering from Chronic Diseases:** drug allergies were shown to be substantially more likely to develop in those with chronic illnesses, suggesting a highly statistically significant link. This result is consistent with the earlier research by (17) when found that People with chronic illnesses like diabetes, autoimmune diseases, and cardiovascular diseases are more prone to hypersensitivity reactions because they can dysregulate inflammatory and immunological surveillance systems and, because of persistent immunological activation, polypharmacy, and immune dysregulation, medication allergies are more common in patients with long-term viral infections like HIV. Increased oxidative stress, immune system dysregulation, and the usage of various medication regimens are all associated with this increased risk. **Family history:** Drug allergy risk and family history (table 4.4) were found to be highly and statistically significantly correlated (P < 0.001). Children who had at least one parent with a documented drug allergy were up to 15 times more likely to have drug hypersensitivity reactions than children without a family history, citing a previous study by (18), that study is consistent with this conclusion, the primary biological explanation for this relationship is genetic predisposition. Numerous investigations have demonstrated a strong correlation between drug hypersensitivity diseases and variations in the human leukocyte antigen (HLA) system.

4. CONCLUSION

Age is not a significant risk factor for drug allergies. One important risk factor is gender; women are more prone to medication allergies than men. The biggest risk factor was a family history of allergies. History of chronic illness emphasizes the significance of medication regulation and medical supervision, while the substantial correlation with family history points to a genetic predisposition.

5. RECOMMENDATIONS

Create a nationwide database to record drug allergy cases and encourage doctors to make sure that drug allergies are properly noted in patients' medical records, especially for female patients, raise patient awareness by distributing educational pamphlets at facilities is important. Taken of pre-administration allergy testing is necessary especially for those with chronic illnesses or a family history of drug allergies.

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