

# Community-level awareness of proper immediate steps regarding ocular chemical injury in Asir Region

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## Abstract

**Background:** Although the eyes represent 0.1% of the total human body, such organs are exposed to multiple injuries, some of which possibly lead to permanent loss of vision. Chemical injuries occurring on the eyes is deemed to be a major ophthalmic emergency, requiring immediate clinical assessment and initiation of treatment. Concerning the awareness of the Saudi population regarding the risks of chemical-based ophthalmic injuries and the permanent repercussions brought about by such incidents, together with the proper steps and actions that should be taken in such cases, this has unfortunately still a degree of paucity within the state. In addition, it is of great importance to recognize areas of shortcomings by health care workers, in order to provide accurate and non-complex medical facts regarding chemical-based ophthalmic injuries

**Aims:** This study focused on evaluating the general population's awareness of the immediate responses that are required, following ophthalmic chemical injury incidents within the Asir province of Saudi Arabia.

**Methodology:** This study contained a questionnaire that was randomly distributed across all segments of population in the Asir province of the Kingdom of Saudi Arabia (KSA), through various social media,

entitled 'The eyes are arguably the most important sensory organ of the human body'. This investigation lasted a total time span of six months (May – October 2021) and its design was classified as a descriptive cross-sectional survey of the local Asir community.

**Results:** In relation to overall population awareness regarding chemical eye injury within the Asir region, KSA, among this cohort, 288 (48%) had good awareness level regarding chemical eye injury and its management, while 312 (52%) had poor awareness. Through our research we found out that individuals in the Asir population require greater awareness regarding the immediate steps of management in cases of ocular chemical eye injuries. Furthermore, there is a need to establish that the only solution required to irrigate the eye is water, with a mechanism of eye washing from the middle part of the face to the tip of the eye.

**Conclusions:** These results should be evaluated by the Ministry of Health and the appropriate actions should be made, such as health awareness campaigns, regarding ocular chemical injuries and immediate corrective actions, in order to improve knowledge and to create a healthier society.

**Key words:** ocular chemical injury, community awareness, Abha

## Introduction

Although the eyes represent 0.1% of the total human body, such organs are exposed to multiple injuries, some of which possibly lead to permanent loss of vision [1].

Chemical injuries of the eyes is deemed to be a major ophthalmic emergency, requiring immediate clinical assessment and initiation of treatment [2]. A previous study conducted across Saudi Arabia alone, reviewed datasets regarding local chemical injuries presenting at two major state-run hospitals. Among a total of 59 patients (3:1, male:female ratio; mean age, 25 years), alkaline drain cleaners were the most common cause of chemical burns (75% of all cases). Concerning the remaining cases, causes for such ophthalmic injuries included concentrated sulfuric acid, car battery acid, and topical application of herbs [3–7].

In addition, on focusing on other nations regarding ophthalmic injuries of a chemical nature, approximately 7% of work-related ophthalmic injuries treated in hospital emergency departments in the United States of America are linked to chemical injuries [8].

Concerning the awareness of the Saudi population regarding the risks of chemical-based ophthalmic injuries and the permanent repercussions brought about by such incidents, together with the proper steps and actions that should be taken in such cases, this has unfortunately still a degree of paucity within the state. In addition, it is of great importance to recognize areas of shortcomings by health care workers, in order to provide accurate and non-complex medical facts regarding chemical-based ophthalmic injuries.

Knowledge regarding the proper action in case of a chemical agent injury to the eye is pivotal to promote a safer and healthier population. Consequently, it would be of great benefit to local Saudi Arabian communities such as Asir, to identify any lacunae in knowledge regarding the nature, medical risks and treatments regarding chemical-based ophthalmic injuries.

The aim of this study focused on evaluating the general population's awareness of the immediate responses that are required, following ophthalmic chemical injury incidents within the Asir province of Saudi Arabia. In addition, this study also assessed Asir's community level awareness regarding the danger of chemical exposure to the eyes, what types of chemical injuries can lead to loss of vision, and the role of physician and allied health professionals promoting population awareness regarding the appropriate steps to deal with such perilous injuries. Furthermore, this study also focused on highlighting the population demographic that stands at greater risk of incurring chemical-based ophthalmic injuries throughout their lifetime.

## Methodology

This study contained a questionnaire that was randomly published across all segments of population in the Asir province of the Kingdom of Saudi Arabia (KSA), through various social media, entitled as 'The eyes are arguably the most important sensory organ to the human body'.

This investigation lasted a total time span of six months (May – October 2021) and its design was classified as a descriptive cross-sectional survey of the local Asir community. The study cohort consisted of all accessible population members who fulfilled the eligibility criteria (minimum of 380 individuals), who were consequently invited to participate in the study.

Consecutive sampling techniques were applied, in order to match the online data collection methodology, through an online questionnaire, as described hereunder.

Following approval by the ethics committee of King Khalid University (KKU), data was collected using a pre-structured online questionnaire that was developed by researchers following intensive literature searches. The questionnaire design and content was confirmed and finalized by ophthalmology consultants of KKU Ophthalmological Department. The Questionnaire contained items of information-gathering details, medical history of ophthalmic injuries, employment details (medical-related or other), together with awareness items pertaining to the investigation theme. Following termination of individual questionnaires, all were separately uploaded onto social media platforms by the researchers and their relatives. Prior to release of the questionnaire across the entire Asir community, a preliminary pilot study consisting of 25 participants was performed in order to assess questionnaire validity, reliability, applicability and approximate filling in time.

### Data analysis

Datasets were extracted, revised, coded, and analyzed through IBM SPSS® version 22 (SPSS, Inc.). All statistical analyses were performed using two tailed tests. P value 0.05 was deemed to be statistically significant. Regarding awareness items, each correct answer scored one point and total summation of discrete scores for differing items was calculated. A patient with a score < 60% (0-11 points) of the total score was considered to have poor awareness, while good awareness was considered if they had a score of 60% (12 points or more) of the total or above. Descriptive analysis based on frequency and percent distribution was performed for all variables, including participant socio-demographic data, family and personal history of chemical injury, and job title. Furthermore, participant awareness regarding chemical-based eye injury, risk factors, causative substances, and management methods were demonstrated within frequency tables. Cross-tabulation was used to assess distribution of public awareness level regarding chemical eye injury, according to their personal data and job title. Correlations were probed using Pearson chi-square test and exact probability test for small frequency distributions.

## Results

A total of 600 participants fulfilling the inclusion criteria successfully completed the study questionnaire (Table 1). Participants' ages ranged from 18 to 64 years, with mean age of  $28.6 \pm 12.7$  years old. Among this cohort, 381 (63.5%) participants were males and 441 (73.5%) had a tertiary educational level, while 23 (3.8%) had pre-secondary educational level. Regarding monthly income, 56.5% had a monthly income < 5000 SR while 23.5% had an income > 9000 SR. Concerning participant employment details, 255 (42.5%) were students, 260 (43.3%) were non-health care workers, and 70 (11.7%) were health care workers. Among this cohort, 151 (25.2%) participants reported that they have a relative who was exposed to direct injury with a chemical substance.

Tables 2 & 3 depict awareness regarding chemical-based eye injury among participants within the Asir region, KSA. Among this cohort, 98.2% of the participants had prior knowledge that chemicals can cause eye damage and 91.7% correctly knew that substances that can cause eye damage include chlorine and detergents. In addition, 84.2% know that chemical eye injury can causes blindness due to eye perforation (53.3%) or scarring (51.3%). Regarding management of chemical-based ophthalmic injuries, 72.8% correctly reported that eye washing with large volumes of water, with 77.7% correctly knowing that only water should be used, regardless of the causative substance that provoked the chemical injury. Regarding eye washing time, only 6.3% knew it should be for 30 minutes or more. Regarding the mechanism of eye washing, 29% correctly reported that it should be performed by passing water from the middle part of the face to the tip of the eye. Additionally, 23% correctly knew that the level of pain does not correlate to the severity of the injury. Conversely, 85.7% agreed that rubbing the eye post-exposure to a chemical exacerbates ophthalmic damage, while 35.2% reported corneal opacity as the most dangerous sign. Wearing contact lenses as a protective measure was refused by 65.3% of the participants and only 11.8% reported that in eventualities where the eye is exposed to a chemical substance, one should keep wearing contact lenses. In addition, 92.7% agreed that after handling chemicals, they should wash their hands prior to touching the eyes.

Figure 1 depicts the overall population awareness regarding chemical eye injury within the Asir region, KSA. Among this cohort, 288 (48%) had good awareness level regarding chemical eye injury and its management, while 312 (52%) had poor awareness.

Table 4 highlights the distribution of overall awareness regarding chemical-based eye injury among participants, according to personal data, within the Asir region, KSA. Good awareness level was detected among 51.5% of younger participants (18-30 years), compared to 33% of middle-aged participants, with recorded statistical significance ( $P=.006$ ). In addition, 61.4% of health care workers had a good awareness level regarding chemical eye injury, in comparison to 37.3% of non-health care workers ( $P=.001$ ). Additional factors were not statistically proven to be associated with participants' levels of awareness.

**Table 1. Socio-demographic data of study participants, Asir region, Saudi Arabia**

<b>Socio-demographic data</b>	<b>No</b>	<b>%</b>
<b>Age in years</b>		
<i>18-30</i>	421	70.2%
<i>31-40</i>	88	14.7%
<i>&gt; 40</i>	91	15.2%
<b>Gender</b>		
<i>Male</i>	381	63.5%
<i>Female</i>	219	36.5%
<b>Education</b>		
<i>Below secondary</i>	23	3.8%
<i>Secondary</i>	136	22.7%
<i>Tertiary/ above</i>	441	73.5%
<b>Income</b>		
<i>&lt; 5000 SR</i>	339	56.5%
<i>5000-9000 SR</i>	120	20.0%
<i>&gt; 9000 SR</i>	141	23.5%
<b>Job</b>		
<i>Unemployed</i>	15	2.5%
<i>Student</i>	255	42.5%
<i>Non-health care worker</i>	260	43.3%
<i>Health care worker</i>	70	11.7%
<b>Have you or any of your relatives been exposed to direct injury with a chemical substance?</b>		
<i>Yes</i>	151	25.2%
<i>No</i>	449	74.8%

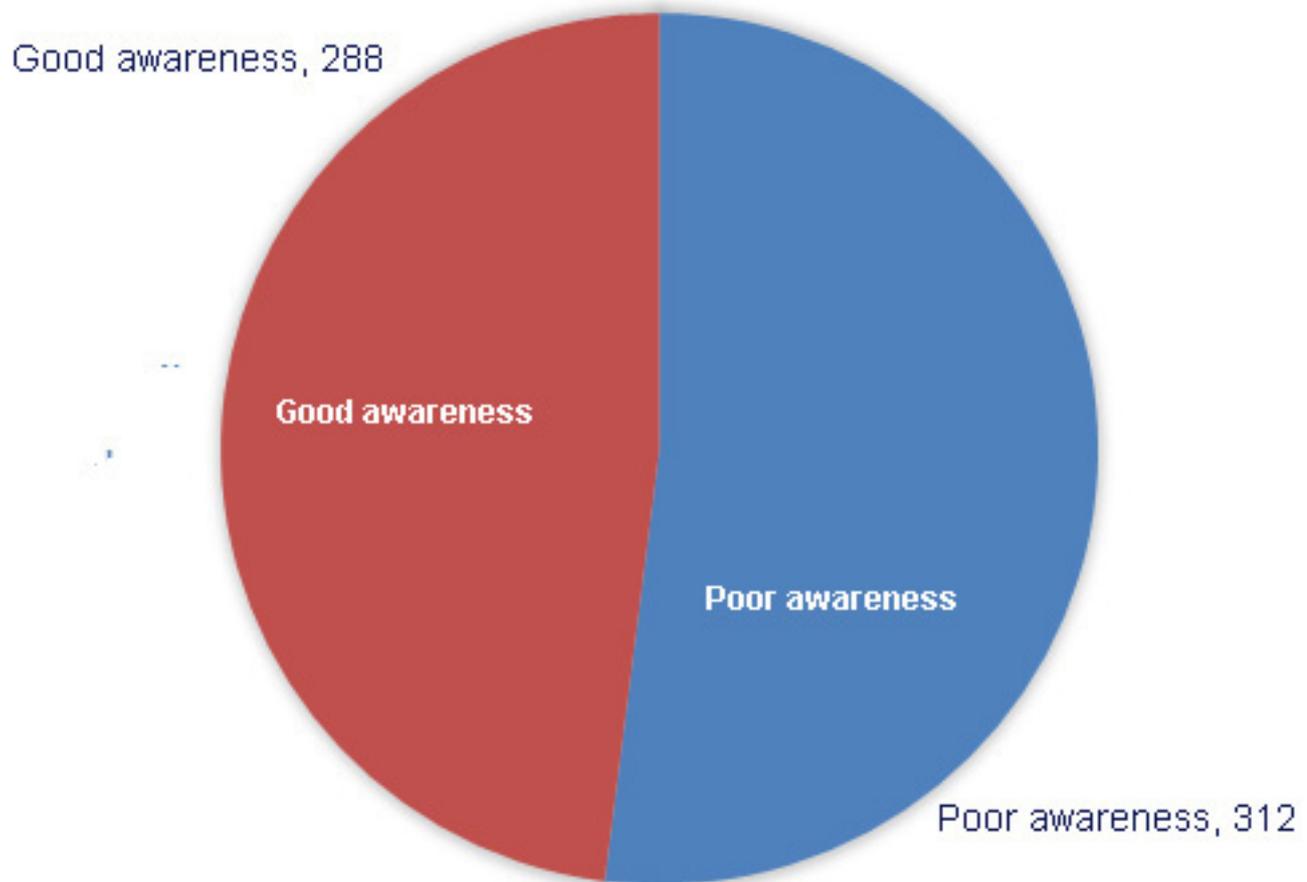
Table 2. Awareness regarding chemical-based eye injury among participants, Asir region, Saudi Arabia

Awareness items		No	%
<b>Chemicals can cause eye damage?</b>	Agree	589	98.2%
	Disagree	3	.5%
	Don't know	8	1.3%
<b>Damage that can result from the ocular chemical injury?</b>	Eye perforation	320	53.3%
	Eye scarring	308	51.3%
	Blindness	505	84.2%
	Keratoconus	158	26.3%
	Cataract	186	31.0%
	Eye cancer	181	30.2%
<b>Which of the following substances can cause eye damage?</b>	Chlorine and detergents	550	91.7%
	Car battery materials	520	86.7%
	Vinegar	290	48.3%
	Water	15	2.5%
<b>What is your first step in dealing with eye exposure to a chemical?</b>	Eye wash with a large amount of water.	437	72.8%
	Eye wash with a little amount of water.	14	2.3%
	Go to ER	130	21.7%
	Cover eye	8	1.3%
	Go to the pharmacy and take eye drops	11	1.8%
<b>What material will you use to deal with the injury?</b>	Water at any case	466	77.7%
	Alkaline substance if the injury is an acidic substance	14	2.3%
	An acidic substance if the injury is alkaline	24	4.0%
	Don't know	96	16.0%
<b>The method of dealing with injury differs according to the causing substance?</b>	Disagree	77	12.8%
	Agree	406	67.7%
	Don't know	117	19.5%
<b>How long is the appropriate period of eye wash?</b>	30 minutes or more	38	6.3%
	5-15 minutes	283	47.2%
	< 5 minutes	160	26.7%
	Don't know	119	19.8%

Table 3. Awareness regarding chemical-based eye injury among participants, Asir region, Saudi Arabia, continued

Awareness items, continued		No	%
What is the appropriate way to wash the eye?	Pass the water from the middle part of the face to the tip of the eye.	174	29.0%
	Pass the water from the side of the eye to the middle part of the face	100	16.7%
	Put water in a cup and cover the eye with it	149	24.8%
	Don't know	177	29.5%
The level of pain indicates the severity of the injury?	Disagree	138	23.0%
	Agree	351	58.5%
	Don't know	111	18.5%
Rubbing the eye after exposure to a chemical increases the damage?	Yes	514	85.7%
	No	12	2.0%
	Don't know	74	12.3%
Which of the following signs is more dangerous?	Corneal opacity	211	35.2%
	Severe eye pain	175	29.2%
	Eye redness	55	9.2%
	Eyelid adhesion	159	26.5%
Wearing contact lenses during chemical injury protects eye?	Disagree	392	65.3%
	Agree	97	16.2%
	Don't know	111	18.5%
In case the eye is exposed to a chemical substance you should?	Keep contact lenses	71	11.8%
	Remove contact lenses	376	62.7%
	Don't know	153	25.5%
Do you think that wearing protective glasses helps reduce the incidence of eye chemical injury?	Agree	517	86.2%
	Disagree	34	5.7%
	Don't know	49	8.2%
After handling chemicals, should you wash your hands before touching the eyes?	Agree	556	92.7%
	Disagree	10	1.7%
	Don't know	34	5.7%

Figure 1. Overall population awareness regarding chemical eye injuries in Asir region, KSA.



**Table 4. Distribution of overall awareness regarding chemical-based eye injury among participants by their personal data, Asir region, Saudi Arabia**

Personal data	Overall awareness level				p-value
	Poor (0-11)		Good (12-19)		
	No	%	No	%	
<b>Age in years</b>					
18-30	204	48.5%	217	51.5%	.006*
31-40	59	67.0%	29	33.0%	
> 40	49	53.8%	42	46.2%	
<b>Gender</b>					
Male	200	52.5%	181	47.5%	.750
Female	112	51.1%	107	48.9%	
<b>Education</b>					
Below secondary	13	56.5%	10	43.5%	.158
Secondary	80	58.8%	56	41.2%	
University / above	219	49.7%	222	50.3%	
<b>Income</b>					
< 5000 SR	166	49.0%	173	51.0%	.114
5000-9000 SR	72	60.0%	48	40.0%	
> 9000 SR	74	52.5%	67	47.5%	
<b>Job</b>					
Not working	7	46.7%	8	53.3%	.001*
Student	115	45.1%	140	54.9%	
Non-health care worker	163	62.7%	97	37.3%	
Health care worker	27	38.6%	43	61.4%	
<b>Have you or any of your relatives been exposed to direct injury with a chemical substance?</b>					
Yes	78	51.7%	73	48.3%	.922
No	234	52.1%	215	47.9%	

## Discussion

Vision is one of the most important human senses. Loss of vision from chemical injury can consequently greatly affect the quality of life. This study focused on assessing the knowledge of immediate corrective action in cases of chemical eye injury, among individuals residing within the Asir region of KSA, in order to reduce the incidence of ocular injuries and related complications through increased awareness.

Other studies and meta-analyses have also investigated ophthalmic injuries among varying population cohorts and working environments within other nations. The systematic review and meta-analysis carried out by Nowrouzi-Kia and colleagues identified and scrutinized 12 investigations having quantitative Critical Appraisal Skills Program (CASP) scorings on eye injuries occurring as an occupational hazard [9]. This investigation focused on four major factors leading to eye injuries at the place of work, namely the utilization (or otherwise) of protective equipment for the eyes, being of male gender, occupational-linked exposures to chemical / biological

hazards for the eyes and risk behavior (i.e. health and safety breaches) [9]. The outcomes of this investigation highlighted that variations in health and safety risk-taking procedures across nations and nature of occupation were the major factors in affecting such CASP scorings and suggested employers ascertain availability of all the necessary protective equipment for members of staff who are typically exposed to chemical hazards for ocular injuries in their line of work [9].

Interestingly, the systematic review performed by Chau and colleagues focused solely on awareness and clinical effectiveness of eye irrigation techniques for managing emergency ocular chemical burns within adult and pediatric cases across multiple quasi-/randomized controlled trials / observational investigations on this theme of research [10]. Overall, four studies carried out on 302 adults and pediatric cases with ocular chemical burns were scrutinized as part of this investigation, with one of the dataset outcomes demonstrating that techniques such as extended water irrigation of the eyes post-injury distinctly led to reduced hospitalizations and absence from the place of work [10].

Furthermore, the comprehensive study conducted by Jovanovic and colleagues focused on the demographic parameters typically linked to poor visual outcomes following eye injuries, due to mechanical / chemical or physical causes, across 298 clinical cases of hospitalizations within Bosnia and Herzegovina during 2006 – 2014 [11]. One of the major conclusions of this study suggested that patients of age > 36 years had increased risk of developing reduced visual faculties post-injury [11].

Within our specific investigation, participants were asked whether chemical substances can cause eye complications, whereby we found that 98.2% of participants agreed with this statement. This is consistent with the findings of another study conducted among the Saudi community, whereby 88.3% of study participants agreed that chemicals could induce ophthalmic injuries [3]. Other findings from our study highlighted a 48% overall good population awareness regarding chemical eye injury and its management within the Asir region of KSA. Specifically, 51.5% of this cohort who had good awareness levels for chemical ocular injuries were younger participants (18-30 years), in comparison to the middle-aged and elderly participant groups. This finding corroborates with previous outcomes from other studies that demonstrated elderly populations to have reduced perceptions of such risks and were therefore more prone to suffer such injuries [11]. In addition, 61.4% of health care workers had good awareness level regarding chemical eye injury, in comparison to 37.3% of non-health care workers. This is most possibly due to the fact that most employers ensure that such staff members who are at increased risk of chemical ocular injuries participate within induction / regular training sessions delivered by appropriate health and safety experts within their line of industry, thereby promoting prior knowledge and awareness due to the specific nature of the individual employment daily tasks and responsibilities. Lacunas in knowledge regarding the immediate removal of contact lenses in such emergency events, was also not a major cause for concern within the Asir population.

## Conclusions

The eye is one of the most important organs in the body and chemical eye injuries can rapidly lead to loss of vision - having a sudden life-changing detriment in quality of life. This investigation revealed that individuals in the Asir population need greater awareness regarding the immediate steps of management in cases of ocular chemical eye injuries. Furthermore, there is a need to establish that the only solution used to irrigate the eye is water, with emphasis on the eye washing/flushing technique commencing from the central facial area towards the tip of the eye. Rubbing of the eye after chemical exposure will increase the damage and keeping contact lens after chemical exposure should be done. These results should be evaluated by the ministry of health and the appropriate actions should be made such as health awareness campaigns regarding ocular chemical injuries and immediate corrective actions, in order to improve knowledge and to create a healthier society.

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