Health disparities in hymenoptera venom allergy management

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ABSTRACT

Background: *Hymenoptera venom anaphylaxis (HVA) is reported in up to 3% of stings and accounts for approximately 40 US deaths annually. HVA patients require immediate availability of epinephrine and Allergist referrals for consideration of venom immunotherapy. Data regarding epinephrine autoinjector prescriptions, Allergist referral rates, and potential racial disparities are limited.*

Objective: *The primary objective was to determine if there were statistically significant differences in epinephrine autoinjector prescriptions and Allergist referrals between Caucasian and African American patients. The secondary objectives were to determine if there were statistically significant differences between adult and pediatric patients and to determine if there were significant differences between epinephrine prescriptions between patients with and without Allergist referrals.*

Method: *This study is a retrospective, descriptive chart review analyzing patients seen between January 01, 2019 and December 31, 2021. Data were obtained utilizing the Epic Systems (Verona, WI) application Slicer Dicer. Individual chart review was performed for age, race, epinephrine autoinjector prescription, and Allergist referral.*

Results: *342 patients were identified as having HVA. Caucasian patients (60 out of 219; 27.4%) were more likely to get epinephrine autoinjector prescriptions than African American patients (17 out of 109; 15.6%) ($p = 0.018$). Adult patients (25 out of 314; 8.0%) were less likely than pediatric patients (8 out of 28; 28.6%) to have Allergist referrals ($p = 0.004$). Patients with Allergist referrals (25 out of 32; 78.1%) were more likely to be prescribed an epinephrine autoinjector than patient without Allergist referrals (54 out of 310; 17.4%) ($p < 0.00001$).*

Conclusion: *Epinephrine autoinjector prescriptions and Allergist referrals are low overall in HVA. Racial disparities were identified with African American patients being significantly less likely to receive epinephrine autoinjector prescriptions. Additionally, adult patients, who may be at increased risk, were less likely to receive Allergist referrals.*

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The insects responsible for serious, sting-related allergic reactions belong to the order Hymenoptera. Hymenoptera species that sting humans include bees, wasps, yellow jackets, hornets, and imported fire ants. Most reactions are localized but severe systemic reactions, including anaphylaxis, can occur. Anaphylactic reactions are reported in up to 3% of Hymenoptera stings.[1–4] Hymenoptera venom allergy (HVA) results in an estimated 40 deaths per year in the United States.[1,5] The true incidence of fatal reactions may be higher because sudden deaths that occurred outdoors may be mistakenly attributed to other causes. HVA can develop at any age, but adults experience more severe reactions. Most deaths from HVA occur in adults.[1]

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The risk of a systemic reaction in a subsequent sting in an individual with a history of HVA is as high as 60%.[1,2,6,7] Epinephrine autoinjector prescriptions are essential but not sufficient intervention for HVA management. Patients may not fill prescriptions, may forget to carry autoinjectors when outdoors, or may have severe reactions refractory reactions that require additional epinephrine. Patients suspected of HVA should be referred to an allergist to determine candidacy for venom immunotherapy.[1,8] Venom immunotherapy reduces the risk of recurrent life-threatening reactions on subsequent sting to < 5%.[1,8,9]

OBJECTIVE

The objective of this study was to assess health-care disparities in the management of HVA. The primary objective was to determine if there were statistically significant differences in epinephrine autoinjector prescriptions and allergist referrals between white and African American patients. The secondary objectives were to determine if there were statistically significant differences between adult and pediatric patients, and to determine if there were significant differences of

Table 1 **Terms utilized to identify *Hymenoptera* in allergy tabs with Slicer Dicer**

Terms
WASP VENOM, WASP VENOM PROTEIN STARTER KIT, VENOM-WASP, VENOM-WASP PROTEIN, ALLERGEN EXTRACT-VENOM-WASP PROTEIN, BEE STING KIT, BEE VENOM PROTEIN (HONEY BEE), VENOM-HONEY BEE, SUPER BEES, ALLERGEN EXT-VENOM-HONEY BEE, HORNET VENOM, VENOM-YELLOW HORNET, VENOM-YELLOW HORNET PROTEIN, VENOM-WHITE-FACED HORNET, ALLERGY EXTRACT-VENOM-YELLOW HORNET PROTEIN, YELLOW JACKET VENOM, VENOM-YELLOW JACKET, VENOM-YELLOW JACKET PROTEIN, MIXED VESPID VENOM, HYMENOPTERA ALLERGENIC EXTRACT, FIRE ANT ALLERGENIC EXTRACT, FIRE ANT

epinephrine autoinjector prescriptions between patients with and those without allergist referrals. An additional study objective was to determine if there were significant differences in epinephrine autoinjector prescriptions between male and female patients.

METHODS

This study was a retrospective, descriptive chart review that analyzed patients seen between January 1, 2019, and December 31, 2021. Data were obtained by using the Epic Systems (Verona, WI) application Slicer Dicer to obtain race, age, epinephrine autoinjector prescriptions, and allergist referrals of patients with Hymenoptera listed as an allergy. Terms searched to identify patients are included in Table 1. Three hundred and forty-two patients were identified in the Shreveport-Bossier City metropolitan statistical area in Louisiana. Individual chart reviews were performed to confirm race, age, epinephrine autoinjector prescriptions, and allergist referrals. Patients were defined as pediatric if < 18 years of age at the time of the first encounter during the predetermined period between January 1, 2019, and December 31, 2021. Race categories were defined as white, African American, and other. The racial category defined as other included the following: Hispanics, Asian Americans, mixed-race patients, and those wishing to not disclose race. Statistical analysis involved T-score analysis and χ^2 testing to assess statistically significant differences among patient groups. Of note, institutional review board (IRB) exemption was proved after review by the IRB at LSU Health Shreveport (IRB 00002010).

Table 2 **Demographics of patients with Hymenoptera listed as an allergy (n = 342)**

Demographics	Patients, *n*
Race	
White	219
African American	109
Other	14
Age	
Adult	314
Pediatric	218

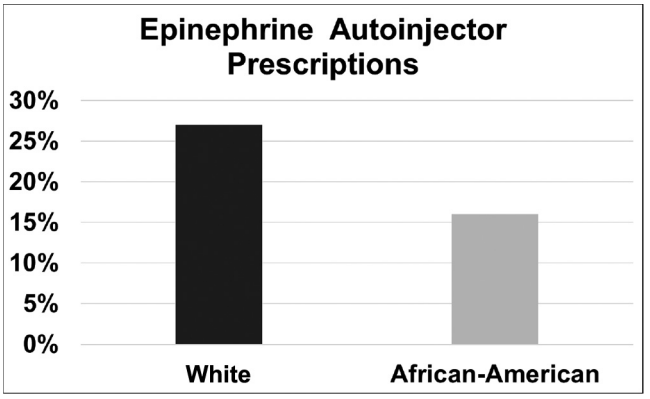

Figure 1. *Epinephrine autoinjector prescriptions rates for white and African American patients.*

RESULTS

Three hundred and forty-two patients were identified as having HVA when using the search criteria and verification as described in the methods section: 219 were white and 109 were African American (Table 2). White patients (60 of 219 [27.4%]) were more likely to get epinephrine autoinjector prescriptions than were African American patients (17 of 109 [15.6%]) ($p = 0.018$) (Fig. 1). There was no significant difference in allergist referrals between white patients (20 of 219 [9.1%]) and African American patients (12 of 109 [11%]) ($p = 0.59$). A total of 14 patients were categorized as other and were not

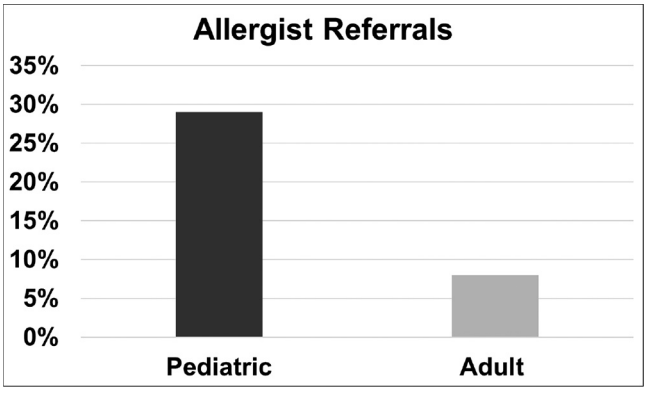

Figure 2. *Allergist referral rates for adult and pediatric patients.*

included in statistical analysis. Three hundred and fourteen patients were adults and 28 patients were pediatric (Table 2). There was no significant difference in epinephrine autoinjector prescriptions between adult patients (69 of 314 [22.0%]) and pediatric patients (10 of 28 [35.7%]) ($p = 0.983$). The adult patients (25 of 314 [8.0%]) were less likely than pediatric patients (8 of 28 [28.6%]) to have allergist referrals ($p = 0.004$) (Fig. 2). The patients with allergist referrals (25 of 32 [78.1%]) were more likely to be prescribed an epinephrine autoinjector than were the patients without allergist referrals (54 of 310 [17.4%]) ($p < 0.00001$). Three hundred and forty patients identified as either male or female. Two patients wished to not disclose sex or gender, and were not included in statistical analysis. There was no significant difference between epinephrine autoinjector prescriptions between the male patients (15 of 164 [9.15%]) and female patients (17 of 176 [9.66%]) ($p = 0.87$).

DISCUSSION

Our study indicates an overall low rate of epinephrine and allergist referrals to all the patients with Hymenoptera allergy listed in their charts. In addition, racial disparities were noted in epinephrine autoinjector prescriptions, with the white patients more likely to have prescriptions than the African American patients. Age-based health-care disparities were noted in allergist referrals, with a higher referral rate for the pediatric patients than adults, despite HVA being more fatal in adults.[1] Of note, the patients with allergist referrals were more likely to have epinephrine autoinjector prescriptions compared with those without referrals. This may indicate that providers believed that these patients had clinically significant reactions.

To our knowledge, this study was the first study that examined health-care disparities in HVA management within an academic medical center. Routine evaluation of HVA and current epinephrine autoinjector prescriptions are standard of care for all patients suspected of systemic anaphylactic reactions.[1,8] In addition, allergist referrals are strongly recommended per current evidence-based guidelines.[1,8] This study indicates a need for further education with regard to HVA management for health-care providers, with particular focus on African American and adult patients. To achieve these goals, institutional level education for providers and nursing staff likely to encounter these patients may be helpful. Furthermore, we have future goals of creating educational material for primary care providers at our institution to help increase epinephrine autoinjector prescriptions and allergy referrals in appropriate patients, especially those with identified disparities.

This study is not without limitations. A retrospective chart review was used without contacting the patients to confirm accurate documentation. Many allergies are self-reported and may not truly represent a clinically significant reaction. The chart review determined if the patients had a referral to an allergist within the system. We were unable to verify whether the patients without referrals had consulted an external allergist. Socioeconomic differences were not fully analyzed and could be a confounding factor to this study. In addition, racial disparity was not statistically analyzed on patients in the other racial category due to overall low numbers in our designated population. This study did not analyze referral rates between male and female patients. Sexual orientation and gender identification were additional factors not analyzed in this study.

CONCLUSION

Epinephrine autoinjector prescriptions and allergist referrals are low overall in HVA. Racial disparities were identified, with African American patients being significantly less likely to receive epinephrine autoinjector prescriptions. In addition, adult patients who may be at increased risk were less likely to receive allergist referrals.

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