

## Management of Anaphylaxis to Hymenoptera Stings in Japanese Organizations with Forest Workers and Beekeepers

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### Abstract

**Objectives** Anaphylaxis to Hymenoptera sting is an important occupational allergy. To date, no studies have examined how organizations in Japan manage anaphylaxis to Hymenoptera stings. Therefore, in this study we surveyed organizations in Japan related to forestry and beekeeping to investigate how they promote health checks, intervene to promote prescription of adrenaline auto-injectors, and provide regular education and guidance on anaphylaxis.

**Methods** We contacted representatives of prefectural forestry agencies and branch offices of a Japanese beekeeping association by e-mail or telephone in all 47 prefectures for assistance distributing allergist-developed questionnaires. All questionnaires were completed between July 2019 and April 2020.

**Results** Valid responses were obtained from 30 prefectural forestry agencies and 19 beekeeping association branch offices. Approximately 37% (11/30) of prefectural forestry agencies and 0.0% (0/19) of beekeeping association branch offices screen for Hymenoptera venom-specific IgE antibodies in outdoor workers through health examinations or other means. Approximately 33% (10/30) of prefectural forestry agencies and 5.3% (1/19) of beekeeping association branch offices encourage forest workers and beekeeping association members, respectively, to consult their doctor about prescription of an adrenaline auto-injector.

**Conclusions** There are many obstacles to improving awareness of anaphylaxis among organizations in Japan and encouraging them to take appropriate measures. Thus, it is important to first raise awareness among managers of organizations so that they can communicate with and instruct their subordinates.

**Key words:** Organization; Forest workers; Beekeepers; Anaphylaxis; Adrenaline auto-injector

### Introduction

In Japan, the number of deaths from Hymenoptera stings is around 20 each year. Most of these deaths are due to anaphylactic reactions [1]. Anaphylaxis to Hymenoptera stings is regarded as an important occupational allergy [2]. In particular, forest workers and beekeepers are at high risk of developing anaphylaxis from Hymenoptera stings [2,3]. Only an emergency adrenaline injection can prevent anaphylactic shock and should be used as soon as possible after a sting [4].

In Japan, adrenaline auto-injectors can only be prescribed by a physician and have been covered by national health insurance since 2011 for prevention of anaphylaxis to not only food and drugs but also Hymenoptera stings. However, many employers do not provide employees with guidance on obtaining a prescription for an adrenaline auto-injector [5]. In addition, adrenaline auto-injectors are often not used even when anaphylactic symptoms occur, with non-use rates of 63.1% for hymenopterous stings and 25% for children with food allergies [6,7]. When adrenaline auto-injectors are used, they may not always be used properly. According to a report from the United Kingdom, 83% of people under the age of 18 years did not use adrenaline auto-injectors properly and more than 70% lacked an understanding of their proper use [8]. Employers should raise awareness of anaphylaxis to improve employee adherence to the proper usage of adrenaline auto-injectors, and to achieve this, it is important to provide education and guidance to the managers of organizations. However, to date, no studies have examined how organizations in Japan manage anaphylaxis to Hymenoptera stings.

In this study, we investigated health check-ups for forestry workers and beekeepers at high risk of Hymenoptera stings, the promotion of portable adrenaline auto-injector prescriptions, and the status of regular education and guidance provided as measures against anaphylaxis in forestry and beekeeping organizations in Japan.

### Methods

Japan comprises 47 prefectures, each with its own government. Forestry projects in Japan sometimes fall under the jurisdiction of national and prefectural governments or may be overseen by private-sector organizations. In 2013, the Forestry Agency reported that 1.55 million people were involved forest operations throughout Japan. In the present study, we targeted prefectural forestry agencies for a survey of forest workers. These agencies manage and put together dozens of forestry offices in each prefecture, each with tens or hundreds of workers. To survey beekeepers, we targeted the prefectural branch offices of a beekeeping association in Japan. In 2014, the Ministry of Agriculture, Forestry and Fisheries reported that there were 9567

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Questionnaire item		Prefectural forestry agencies (%)	Beekeeping association branch offices (%)
		(N = 30)	(N = 19)
Do you regularly conduct screening for Hymenoptera stings in outdoor workers (e.g., through health check-ups)?	Yes	3 (10.0)	0 (0.0)
	No	27 (90.0)	19 (100.0)
Do you screen for Hymenoptera venom-specific IgE antibodies in outdoor workers systematically through health examinations, etc.?	Yes	11 (36.7)	0 (0.0)
	No	19 (63.3)	19 (100.0)
Do you encourage outdoor workers to consult their doctor about prescription of an adrenaline auto-injector?	Yes	10 (33.3)	1 (5.3)
	No	20 (66.7)	18 (94.7)
Do you work with a specific medical institution to implement preventive measures against anaphylaxis to Hymenoptera stings?	Yes	4 (13.3)	0 (0.0)
	No	26 (86.7)	19 (100.0)
Do you regularly (e.g., every year) provide educational guidance (e.g., using media and lectures) on Hymenoptera stings?	Yes	8 (26.7)	1 (5.3)
	No	22 (73.3)	18 (94.7)

**Table 1:** Questionnaire survey on management of anaphylaxis to Hymenoptera stings in forest workers and beekeepers in Japan.

beekeeping organizations, each with a few to a few dozen beekeepers. Some of these organizations belong to the beekeeping association. The beekeeping association branch office in each prefecture is also usually the office of a general beekeeper who works on site. Requests to participate in the questionnaire survey were made by email or telephone to the prefectural forestry agency and the beekeeping association branch office in each prefecture. The questionnaires were completed between July 2019 and April 2020. The study was approved by the Research Ethics Committee of Dokkyo Saitama Medical Center (approval number 1946). Written informed consent was obtained from all participants prior to enrollment.

The questionnaire included the following 5 items: 1. Do you regularly conduct screening for Hymenoptera stings in outdoor workers (e.g., through health check-ups)? (yes or no); 2. Do you screen for Hymenoptera venom-specific IgE antibodies in outdoor workers through health examinations, etc.? (yes or no); 3. Do you encourage outdoor workers to consult their doctor about prescription of an adrenaline auto-injector? (yes or no); 4. Do you work with a specific medical institution to implement preventive measures against anaphylaxis to Hymenoptera stings? (yes or no); 5. Do you regularly (e.g., every year) provide education and guidance (e.g., using media and lectures) on Hymenoptera stings? (yes or no).

## Results

Valid responses were obtained from 30 prefectural forestry agencies and 19 beekeeping association branch offices. Table 1 shows the results of the questionnaire survey. Ten percent (3/30) of prefectural forestry agencies and 0.0% (0/19) of beekeeping association branch offices regularly screen for Hymenoptera stings in outdoor workers through health check-ups or other means. Approximately 37% (11/30) of prefectural forestry agencies and 0.0% (0/19) of beekeeping association branch offices screen for Hymenoptera venom-specific IgE antibodies in outdoor workers through health examinations or other means. Approximately 33% (10/30) of prefectural forestry agencies and 5.3% (1/19) of beekeeping association branch offices encourage outdoor workers to consult their doctor about prescription of an adrenaline auto-injector. Approximately 13% (4/30) of prefectural forestry agencies and 0.0% (0/19) of beekeeping association branch offices work with a specific medical institution to implement preventive measures against anaphylaxis to Hymenoptera stings. Approximately 27% (8/30) of prefectural forestry agencies and 5.3% (1/19) of beekeeping association branch offices regularly (e.g., every year) provide education and guidance (e.g., using media and lectures) on Hymenoptera stings. Prefectural forestry agencies were more likely to take measures, such as screening for Hymenoptera venom-specific IgE antibodies

and encouraging outdoor workers to consult their doctor about prescription of an adrenaline auto-injector, than were beekeeping association branch offices.

## Discussion

Forestry and beekeeping organizations should do the following as countermeasures against anaphylaxis to Hymenoptera stings: 1. Conduct periodic assessments for Hymenoptera stings; 2. Check for sensitization to Hymenoptera venom by screening for Hymenoptera venom-specific IgE antibodies; 3. Establish partnerships with medical organizations that can provide regular prescriptions of adrenaline auto-injectors as well as education and guidance (media, lectures, etc.) on their proper use. Furthermore, outdoor workers who have experienced a systemic reaction to a Hymenoptera sting and are positive for Hymenoptera venom-specific IgE antibodies should receive venom immunotherapy [9]. However, insurance does not cover allergen immunotherapy in Japan and the cost is more than most workers can afford, so forestry and beekeeping organizations should provide financial support. For these reasons, it is vital that outdoor workers receive regular prescriptions of adrenaline auto-injectors as well as education and guidance on their proper use. Forestry and beekeeping organizations need to make sure that outdoor workers who are positive for Hymenoptera venom-specific IgE antibodies carry adrenaline auto-injectors regardless of whether they have experienced systemic reactions to Hymenoptera stings. In addition, if an outdoor worker who is not sensitized to Hymenoptera venom is stung, they should be tested for Hymenoptera venom-specific IgE antibodies about 1 month later [10].

In this study, we clarified that prefectural forestry agencies take more measures against anaphylaxis to Hymenoptera stings in comparison with beekeeping association branch offices. This is likely because beekeeping organizations, including beekeeping association branch offices, are often run by families and friends. In addition, beekeepers are frequently stung, so it is possible that they are less concerned with measures against anaphylaxis. Perhaps there was a difference in awareness of survey requests between the prefectural government agencies and beekeeping association branch offices. However, even though prefectural forestry agencies take more measures against anaphylaxis to Hymenoptera stings in comparison with beekeeping association branch offices, the measures taken are insufficient. In some cases, these government agencies have taken countermeasures only a fatal accident or other incident. In addition, we analyzed the results of a questionnaire survey of prefectural governments and beekeeping organizations and found that some of the businesses belonging to the beekeeping association branches that participated

in this study as well as some of the forestry offices operating under the jurisdiction of public institutions have independently taken measures against anaphylaxis.

To improve awareness and management of anaphylaxis to Hymenoptera stings, it is important for health care professionals to provide education and guidance directly to government agencies, trade associations, and labor unions so that they can in turn provide education and guidance to their workers/members. The clinical features and management of insect stings have been detailed in guidelines from European countries [11]. However, no such guidelines have been established for the management of Hymenoptera stings as an occupational injury in Japan. Preparing guidelines for the management of anaphylaxis to Hymenoptera stings will require the involvement of public bodies, including academic societies and the national government. The risk of Hymenoptera sting varies according to occupation; beekeepers and forest workers in particular are at high risk of Hymenoptera stings whereas the risk is relatively low for construction workers, electricians, and office workers [12]. For this reason, it is necessary consider the unique characteristics of each industry and organization when establishing countermeasures against anaphylaxis to Hymenoptera stings. Adrenaline in tablet form is currently under development [13]. By removing the fear associated with intravenous injections, the availability of adrenaline tablets is expected to improve compliance with guidelines on the management of anaphylaxis to Hymenoptera stings.

## Conclusion

In conclusion, there are many obstacles to improving awareness of anaphylaxis among organizations in Japan and encouraging them to respond appropriately. Thus, it is considered important to first raise the awareness among the heads of the organization so that they can communicate with and instruct their subordinates to take the necessary steps to protect the health and safety of outdoor workers.

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## Ethical Approval

The study was approved by the Research Ethics Committee of Dokkyo Saitama Medical Center.

## Informed Consent

Written informed consent was obtained from all participants prior to enrollment.

## Registry and the Registration No. of the study/Trial

Approval number 1946 of the study.

## Animal Studies

N/A.

## Conflict of Interest

The authors declare no conflicts of interest.

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