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Prevalence of allergy to hymenoptera stings in different samples of the general population

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To get figures of prevalence of systemic reactions (SRs) to hymenoptera sting in adults between the ages of 18 to 65 years, we performed three different surveys using the same questionnaire from 1984 to 1988. The first one was a door-to-door survey in Southeast France, which included 8271 adults and used a questionnaire. The second one, which included 2067 adults, was performed in a health care center and comprised the same questionnaire and venom skin tests in subjects reporting a history of SRs. The third survey was a national poll performed through a home-based national computer network. The percentage of SRs ranged from 0.66% in the second survey including skin tests to 3.3% in the poll survey. The higher prevalence figure in this latter survey may be related to a false-positive history. There was no urban-rural difference in prevalence of SR. (J ALLERGY CLIN IMMUNOL 1992;90:331-4.)

Key words: Hymenoptera, allergy, anaphylaxis, systemic reaction, occurrence, epidemiology

Data on the prevalence of systemic reactions (SRs) to hymenoptera stings (HS) are scanty. Moreover, the subjects considered in many investigations have not been representative of the general population. Prevalence figures ranging from 0.15% to 3.9% have been reported.^{1,2} This wide variation may be related to a number of factors, that is, age, geographic location, definition of allergic reaction, and data gathering techniques (self-administered, standard questionnaire, or medical questionnaire). To obtain more accurate figures of prevalence of SR to HS in adults between the ages of 18 to 65 years, we performed three different surveys using the same questionnaire from 1984 to 1988.

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Abbreviations used

SR: Systemic reaction

HS: Hymenoptera sting

SUBJECTS IN THE STUDY AND METHODS

The first survey included 8271 adults, 18 to 65 years old, living in Southeast France: Marseille and three small towns nearby. These subjects were randomly selected from the general population by a three-stage cluster sampling in Marseille and simple random sampling in the surrounding towns. The questionnaire was administered door-to-door by medical students. It included four questions related to HS (Table I). In computing prevalence rates of SR, responses about local reactions were not considered. Only SRs listed on Table I were considered as such. Taking into account the mean refusal rate, which was 5%, and the mean absence rate of 10%, the overall response rate was approximately 85%.

The second survey was described by Charpin et al.³ In brief, it was performed in a public health care center in Marseille and included 2067 adults, 18 to 65 years old. The health care center provides free checkups on a 5-year basis

TABLE I. Questionnaire used to ascertain reactions to HS

Have you ever been stung by a bee or a wasp?
*If Yes
Did you experience a serious reaction immediately after the sting?
*If Yes
What kind of reaction: local, urticaria, angioedema, breathlessness, dizziness, loss of consciousness?
Did you see a doctor for this reaction?

TABLE II. Age and sex distribution in the three surveys

Survey	Men			Women			Sex ratio
	18-29	30-44	45-65	18-29	30-44	45-60	
Door-to-door	1055	1338	1399	1233	1512	933	0.85
Health care center	181	571	412	182	452	269	1.29
Computer	226	210	297	225	209	298	1.0

TABLE III. Percentage of subjects with a history of HS, a history of SR, and percentage of subjects with a history of SR who sought medical assistance for SR

Survey	Percent with history of sting	Percent with history of SR	Percent SR visiting a doctor
Door-to-door (<i>n</i> = 8271)	61	1.9	72
Health care center (<i>n</i> = 2067)	75	0.9	100
Computer (<i>n</i> = 1415)	69	3.3	20

to every person affiliated with the French National Health Insurance Program (i.e., 95% of the general population). Subjects were interviewed by medical doctors training to be allergists. The questions were the same as in the first survey (Table I). The only difference was that subjects reporting SR to HS were asked to undergo skin tests with hymenoptera venoms. The venoms used were honeybee, yellow jacket, wasp (Laboratoire Dome, Paris, France), and vespa crabro (Laboratoire Stallergène, Paris, France).

The third survey consisted of a National poll performed through an inhome national computer network (Minitel, France Telecom, Paris, France) by a specialized agency (Sofres). A representative sample of 1415 Minitel users, 18 to 65 years old, were selected according to the quota method and paid to participate in the study. The same questionnaire as in the previous two studies (Table I) was administered via a computer.

Table II displays the age and sex distribution of subjects included in each survey.

RESULTS

Two thirds to three fourths of interviewees acknowledged having been stung (Table III).

The prevalence of history of SR to HS ranged from 3.3% in the third survey (Minitel survey) to 0.9% in the second survey (health care center) (Table III). As shown in Table IV, the percentage of visible reactions such as angioedema and urticaria was quite similar in all three studies. The higher percentage of SRs in the computer study is consistent with the higher number of subjects reporting such symptoms as breathlessness and dizziness after stings. In the health care center survey, three fourths of subjects reporting previous SR to HS had positive skin tests to hymenoptera venoms. The percentage of subjects with both a history of SR and positive skin tests to hymenoptera venoms was 0.66% in this survey. The percentage of subjects who sought medical assistance for SR ranged from 20% in the third survey to 100% in the second one.

Sixty-two percent of the 6075 urban dwellers studied had a history of previous sting. The prevalence of SR to HS in urban dwellers was 1.8% overall and 2.9% in the stung subgroup. Sixty-eight percent of the 4263 rural dwellers had a history of previous sting.

TABLE IV. Percentage of the study population who reported different symptoms and signs in the three surveys

Survey	Angioedema	Urticaria	Breathlessness	Dizziness	Loss of consciousness
Door-to-door	0.9%	0.9%	0.72%	1.4%	0.2%
Health care center	0.4%	0.2%	0.4%	0.7%	0.2%
Computer	0.5%	0.8%	1.2%	2.1%	0.4%

TABLE V. Percentage of SR to HS in the literature

Ref no.	Target population	% of SR according to		
		Questionnaire	Physician	Questionnaire + skin tests/RAST
1	2010 girl-scouts	0.9	0.15	NA
2	2964 boy-scouts	3.9	0.8	NA
5	4992 boy-scouts	0.8	0.3	NA
6	3705 asthma or rhinitis patients	NA	0.38	NA
7	3679 subjects from the general popul.	2.7	NA	1.35*
8	210 employees	3.3	NA	1.8†

NA, Not applicable.

*Questionnaire + RAST.

†Questionnaire + skin-tests.

The prevalence of SR in rural dwellers was 1.7% in the overall and 2.5% in the stung subgroup. The difference in the prevalence of SR in the urban and rural environment was not statistically significant.

DISCUSSION

In these three surveys performed in different samples of the general population, the prevalence of SR to HS ranged from 0.66% to 3.3%. This wide range cannot be attributed to differences in the questionnaire, which was the same in all three investigations. Furthermore, age and sex distribution were similar in the three populations (Table II). Two factors were probably responsible for this variation. The first involves criteria used to define SR. If SR was ascertained on the basis of questionnaire and positive skin tests to hymenoptera venom, prevalence was much lower because subjects with a history of SR may have negative skin tests. This could be due to either a false history of SR possibly caused by misinterpretation of anxiety or pain after the sting or to a regression of cutaneous sensitivity to hymenoptera venom after many years. Regression of cutaneous sensitivity is supported by the findings of Savliwala and Reisman⁴ who reported that skin tests became negative in 6 out of 26 patients with a history of SR to HR after an average of 9.5 years after SR. In our second survey we compared the interval since SR to HS in subjects with or without positive skin tests and found that it

was 3.6 ± 3.7 years for subjects with positive skin tests and 9.2 ± 4.3 years for subjects with negative skin tests ($p < 0.01$). Table V, which summarizes data from previous studies that evaluated the percentage of SRs, illustrates the influence of diagnostic criteria on the prevalence figures obtained.

Since our three studies were not matched, it is difficult to evaluate the impact of different examiners on the prevalence rates. However, it is likely that the setting in which the study is performed influenced results. The highest rates were obtained in the third survey, in which the questionnaire was administered on a home computer screen, and the lowest rates were found in the second survey, which was administered in a health care facility by doctors. However, these doctors were instructed to read the questions and not to interpret answers provided by the interviewees. In the latter setting interviewees could be much more prone to report only severe reactions and to dismiss questionable reactions. This interpretation is further supported by the fact that 100% of the subjects at the health care facility claimed to have seen a doctor after the sting as compared with only 20% in the computer study. This discrepancy was also pointed out by Abrishami et al.¹ and Settupane et al.² Similarly, Abrishami et al.,¹ who sent a self-completed questionnaire to the parents of 2010 girl scouts before summer camp, were able to verify SR to HS in only 0.15% of the children, whereas their parents had reported such a history in

0.8% of them. Likewise, in their study of 2964 boy scouts, Settiple et al.² were able to obtain physician confirmation of allergy to hymenoptera sting in only 0.8% of the children, whereas parents replied affirmatively to the questionnaire for 3.9% of them. In another survey performed in 4992 boy scouts before summer camp,⁵ the prevalence of sting allergy was 0.8% according to the questionnaire and 0.3% according to the physician's examination. However, it should be emphasized that the questionnaire used in the latter study was different from the one used in the study by Settiple et al.,² which provided much higher prevalence rates.

Chafee⁶ reviewed 3705 patients with asthma and/or allergic rhinitis and found that 14 or 0.38% also had hymenoptera allergy. However, these results are not directly comparable with those of the previously mentioned studies, since the characteristics of the populations and the methodology used to obtain information were markedly different. In Australia Stuckey et al.⁷ surveyed 3679 subjects and found that 92 subjects, that is, 2.7%, had a history of SR to HS. In a random group of 210 adults employed by the Westinghouse Electric Corporation in northern Baltimore, Golden et al.⁸ reported a 3.3% cumulative prevalence rate of SR to HS, and only 56% of subjects with a history of SR had positive skin tests to hymenoptera venoms. Thus the percentage of subjects with both a history of SR to HS and positive skin tests was 1.8%. It is noteworthy that prevalence of SR rates based on cumulative experience were higher in these two studies involving adult subjects than in studies involving children.^{1, 5, 7, 8}

Besides history, other tools have been evaluated for diagnosis of hymenoptera allergy. Venom skin tests are neither sensitive nor specific. Skin tests can, as previously mentioned, be negative in subjects with a history of SR but can also be positive in subjects with no history of SR to HS. In their study Golden et al.⁸ encountered 15% of positive subjects with no history of SR to HS. Similarly, evaluation of venom-specific IgE is no more reliable than skin tests. In our health care center study, 21 of the 24 subjects with a history of SR underwent RAST to honeybee, wasp, and yellow jacket venom.³ Results were negative in seven subjects. We performed RAST determination in 82 randomly chosen subjects who did not present local reactions or SRs after HS and obtained positive results

in 12 (14.6%). Likewise, in the Busselton Health Survey,⁷ 13.9% of 3240 subjects without any history of reaction to HS were RAST class 2 or more. Thus although venom skin tests and venom-specific IgE determinations may be helpful diagnostic indicators, they cannot be used as conclusive evidence in epidemiologic surveys. Live insect challenge tests have been used to ascertain clinical diagnosis of hymenoptera allergy. The problem with this approach is the reproducibility of SR. Settiple and Chafee⁹ followed up a group of 119 patients who had an SR to bee sting and who were re-stung before desensitization and found that 44% had lesser reactions, 43% the same reactions, and 13% had worse reactions.

On the basis of these findings we conclude that the prevalence of SRs to HS ascertained by questionnaire is highly dependent on the study setting. Prevalence is probably underestimated because many subjects from the general population are not aware that HS can induce SRs.³ In the previous studies (Table V), as well as in our own, prevalence ranges from 0.8% to 3.9% when diagnosis was based on a questionnaire and from 0.15% to 1.8% when diagnosis was based on medical examination, venom skin tests, or RAST. These latter estimates are likely to be closer to the truth than the former ones.

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