A Cross-Sectional Study on Prevalance of Food Allergy and Its Knowledge Among Malaysian Population

Bama V.V. Menon[1]*, Hanish Singh Jayasingh Chellamal[2], Atiqah Syuhada Binti Md Zaini[1], and Anandarajagopal Kalusalingam[1]

[1]School of Pharmacy, KPJ Healthcare University, Nilai 71800, Negeri Sembilan, Malaysia
[2]Department of Pharmacology and Pharmaceutical Chemistry, Faculty of Pharmacy, University Teknologi MARA, Puncak Alam, Selangor, Malaysia
*Corresponding email: bamamenon@kpjuc.edu.my; H/P No.: +60-123864980

Abstract

Food allergy can cause severe acute allergic reactions such as hives, rashes and generalized swelling, eczema, diarrhoea, vomiting, stomach aches, asthma and sinusitis. Allergy to food substances may seem common in Malaysia but available data is limited. Since it is detrimental in certain circumstances, hence the awareness regarding allergies is crucial. The objective of this study is to determine the prevalence rate of food allergy, to evaluate the knowledge and awareness of food allergy and to determine the relationship between the status of food allergy and knowledge of food allergy among Malaysia population. The study employed a cross-sectional descriptive study using a validated questionnaire shared with 321 respondents aged 18 years and above from all over Malaysia. Descriptive analysis was conducted to gauge the prevalence while Pearson correlation was used to determine the relationship between status of allergy and knowledge. There were 105 respondents with food allergy and the prevalence rate was 0.42 per 100,000 people which was considerably lower compared to other countries like Korea and US. 19% of respondents answered that food intolerance and food allergy were the same as opposed to a study in US reporting a value of 64.9%. The Pearson correlation analysis showed there were significant relationship between the status of allergy and knowledge level of food allergy ($p < 0.05$). The study showed that Malaysian population had a moderate knowledge towards food allergy. This is a cause for concern because lack of knowledge may cause severe consequences when related to food allergy.

Introduction

Food is an essential source of nutrition, comprising of carbohydrates, fats, and proteins. It plays a crucial role in promoting development and growth throughout life. According to the World Health Organization (WHO), a food allergy is defined as an adverse health effect resulting from a specific immune response that consistently occurs upon exposure to a particular food (1). The prevalence of food allergies has increased, particularly among children compared to adults. A food allergy involves an adverse reaction to food through an immunological mechanism (2).

Clinical symptoms of food allergies can range from mild discomfort to severe or life-threatening reactions, necessitating immediate medical intervention. Symptoms may manifest on the body, including redness, itchiness, eczema, hives, rashes, and even asthma. The severity of reactions varies, with some leading to anaphylaxis, a potentially life-threatening response (3).

In Asia, clinicians often perceive the prevalence of food allergies to be low. The types of food allergies differ from those in Western populations, where peanuts and tree nuts related allergies are most common. In Asia, the specific allergens vary by region. For example, bird's nest is a common allergen inducing anaphylaxis in Singapore, while in Southeast Asia, galacto-oligosaccharide-containing formula has been known to trigger allergies in Thailand,

Vietnam, and Singapore. In India, particularly in regions with a high vegetarian population, legumes such as chickpeas are a common cause of food allergies, and eggplant allergy has a high prevalence (4).

Currently, the treatment for allergies involves medication, lacking preventive measures or a cure. Raising public awareness of food-induced allergies can contribute to a simultaneous decrease in the prevalence of food allergies, ultimately improving the quality of life for affected individuals. Public awareness plays a crucial role in early prevention before allergies arise, especially given the increasing prevalence rates. The relationship between knowledge and the prevalence of food allergies is significant, with better-informed individuals experiencing lower rates. Limited studies exist on knowledge and awareness of food allergies in Asian countries compared to the United States. In Malaysia, awareness, knowledge, and attitudes toward food allergies among food handlers are found to be only moderate (6).

This study aimed to determine the prevalence and knowledge of food allergies among the Malaysian population. Since the prevalence of food allergies in Malaysia is not well-established, this research can provide prevalence rates for adolescents, adults, and the geriatric population. The strong correlation between knowledge and prevalence suggests that increasing public awareness can help reduce the prevalence of food allergies. The study aimed to raise awareness about the importance of understanding food-induced allergies to prevent potential life-threatening syndromes.

Methods

Study Design

This study adopted a cross-sectional descriptive design to evaluate both the knowledge and prevalence of food allergies within the population of Malaysia. The study targeted individuals aged 18 years and older residing in Malaysia. Data collection occurred between April 2020 and May 2020. A pre-validated questionnaire, previously assessed in a pilot study involving 15 respondents conducted in January 2020, was employed for the study.

Ethical Consideration

The study was approved by the Institutional Research Ethical Committee of KPJ Healthcare University, Nilai, Malaysia with the reference no: KPJUC/RMC/SOP/EC/2020/248.

Bias

To mitigate bias, a simple random probability sampling method was employed. The study design aimed to exclusively encompass the target population. The questionnaire, previously validated and checked for reliability in a preliminary study, underwent a thorough review to eliminate any questions that might elicit biased or favourable responses. Additionally, the study achieved a reasonable response rate.

Target Population

The study focused on the public residing in Malaysia as its target respondents. Eligible participants were individuals aged 18 years and above, currently residing in Malaysia, encompassing both citizens and non-citizens. Selection of respondents adhered to specific inclusion and exclusion criteria.

Inclusion Criteria
• Age of 18years old and above
• Competency to understand English and Bahasa Melayu.
• Local resident in Malaysia

Exclusion Criteria
• Age of 17 years old and below.
• Not local resident in Malaysia
• Incomplete questionnaire.

Sampling Procedure
In this study, a convenience sampling method was employed, utilizing a questionnaire format for data collection. The

questionnaire aimed to assess both the knowledge and prevalence of food allergies within the Malaysian population and was distributed widely across the country. The distribution of questionnaires took place through online platforms, including social media channels such as Facebook and Twitter, as well as through WhatsApp. Prior to participating, respondents were provided with an explanation of the study's objectives, and their voluntary participation involved expressing their personal opinions through marked responses to ensure an understanding of food allergy awareness.

Informed Consent

The online survey form was explained, and informed consent was clearly delivered prior to answering the questionnaire and they are advised to proceed for next section upon consent.

Sample/ Study size

The determination of the sample size for this study was guided by its research objectives, considering the population size. Utilizing the Daniel equation, the calculation yielded an approximate sample size of 280 respondents, which was then chosen for the study. The study aimed to explore the impact of sample size and species characteristics on the performance of various species distribution modelling methods, as highlighted by Hernandez et al. Their findings suggested that larger sample sizes enhance model accuracy.Given the self-administered questionnaire approach for data collection, there was a potential for a high risk of low response rates and errors. To address this concern, and considering the exclusive criteria of incomplete data collection, a 10% additional margin was incorporated into the sample size. Thus, 308 respondents were calculated to compensate for possible withdrawals and incomplete data. In anticipation of a 10% non-response rate, the final adjusted sample size used for the study was 310 respondents.

Study Tools

The quantitative research design employed in this study focuses on objective measurement through the analysis of data collected via a validated questionnaire. The questionnaire was prepared in two languages, English and Bahasa Melayu, adapted from two articles - "A population-based questionnaire survey on the prevalence of peanut, tree nut, and shellfish allergy in 2 Asian populations" (5) and "Australian Parents Food Allergy Knowledge" (6). It underwent preliminary pilot testing on a small sample to validate the questionnaire and gather suggestions for item improvement, a crucial step in determining inclusion or rejection of items for the main study. The pre-validated questionnaire, used as a survey tool for the public, was distributed to 310 respondents, in line with the sample size calculated through Daniel's equation. The self-administered questionnaire was filled out by the respondents themselves. Distribution to the 310 respondents occurred randomly through online platforms, ensuring a self-filled questionnaire where respondents expressed their opinions and provided responses.

Data sources/measurements

The data sources for each variable of interest in this study are the members of the public residing in Malaysia, assessed through a set of questionnaires. The questionnaire comprised of 37 questions, organized into three sections. Section A focused on sociodemographic information and is divided into two parts. Part I included 5 questions related to personal information, while Part II consisted of 4 questions regarding the history of food allergies. In Section B, the questionnaire addressed the prevalence of food allergies among the public, containing 11 questions. Most questions used a Dichotomous scale with the options "Yes" or "No," except for re-challenge questions (5). Section C assessed the knowledge of the public regarding food allergies and included 17 questions with response options such as "Agree," "Disagree," and "Do not know." This section employed a 3-point Likert Scale (6).

Study on Prevalance of Food Allergy

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Statistical Analysis

All data analysis for this study was performed using Statistical Package for the Social Sciences (SPSS) software, version 26. Demographic information was analysed using frequency, while the knowledge scores were calculated. Each correct answer in the knowledge section was coded as (3), incorrect answers as (2), and "Do not know" responses as (1). The item scores were then summed to obtain the total knowledge score on food allergies, ranging from a minimum of 17 to a maximum of 48. The total scores were converted into percentages, categorized based on the method used in "Knowledge Attitude and Preventive Behaviors Towards Hand Foot and Mouth Disease Among Caregivers of Children Under Five Years Old in Bangkok, Thailand" (8). Descriptive statistics, including mean, standard deviation, frequency, and percentage, were applied to analyse the demographic information related to food allergies and knowledge. The results were summarized using the Chi-square test. The level of statistical significance was set at a p-value < 0.05, and a confidence interval (CI) of 95% was considered.

Results

The recommended sample size was three hundred and ten participants aged 18 and above. The amount of participants that responded during data collection period was 325. Among the participants, 321 respondents completed the questionnaire.

Sociodemographic data

Personal information

The collected data revealed the age distribution of respondents as follows: 18-28 years old, constituting 233 respondents (72.6%); 29-38 years old, comprising 33 respondents (10.3%); 39-48 years old, with 26 respondents (8.1%); 49-58 years old, accounting for 23 respondents (7.2%); 59-68 years old, with 5 respondents (1.6%); and those above 69 years old, representing the smallest group with 1 respondent (0.3%). The calculated categorical age mean is 2.55. The questionnaire identified two genders, with 79 respondents (24.6%) being male and 242 respondents (75.4%) being female. Regarding race groups from the questionnaire, respondents were categorized into Malay, Chinese, Indian, and Others. The majority were from the Malay population, totalling 227 (70.7%), followed by Indians with 61 (19%), Chinese with 23 (7.2%) respondents, and Others with 10 (3.1%) respondents.

This study encompassed 14 states, focusing on the Malaysian population. Johor had the highest number of respondents at 109 (34%), followed by Perak with 49 (15.3%), Selangor with 37 (11.5%), Kedah with 29 (9%), Pulau Pinang with 24 (7.5%), and Negeri Sembilan with 17 (5.3%) respondents. Four states recorded an equal number of respondents: Perlis and Sabah with 11 (3.4%) each, and Melaka and Sarawak with 6 (1.9%) each. Kelantan, Pahang, Terengganu, and Wilayah Persekutuan Kuala Lumpur collected 7 (2.2%), 8 (2.5%), 4 (1.2%), and 3 (0.9%) respondents respectively.

This study encompassed five education levels: Master's, Degree, Diploma or Foundation, Secondary School, and Primary School. Among the 321 respondents, the highest number held a Degree, accounting for 160 (49.8%) respondents, followed by those with a Diploma or Foundation background, totaling 128 (39.9%). Respondents with a Master's, Secondary School, and Primary School background constituted 5 (1.6%), 27 (8.4%), and 1 (0.3%), respectively. Regarding geographical areas, respondents were classified as urban or rural. The majority, 231 (72%), were from urban areas, while 90 (28%) were from rural areas.

History of food allergy

Regarding food allergy findings, two questions were posed in this study: 1) Whether respondents are aware of food allergies, and 2) If respondents themselves have a food allergy. The majority, 307

(95.6%) respondents, knew about food allergies, while 14 (4.4%) did not. In terms of having a food allergy, most respondents, 216 (67.3%), reported not having a food allergy, whereas 105 (32.7%) respondents confirmed having one.Concerning family history, 175 (54.4%) respondents had a family history of food allergies, while 146 (45.5%) did not.Among the respondents without food allergies (216 or 67.3%), 60 (18.7%) self-reported having a food allergy, and only 45 (14%) respondents had a doctor-diagnosed food allergy.

Prevalence of food allergies

The respondents were categorized into six groups based on when they first experienced food allergies: between 0 to 10 years old, 11 to 20 years old, 21 to 30 years old, 31 to 40 years old, 41 to 50 years old, and 51 to 60 years old. The highest frequency occurred among respondents who experienced food allergies for the first time between the ages of 11 to 20, totalling 52 (16.9%). Following this, 35 (10.9%) respondents reported their first experience between 0 to 10 years old. Additionally, the first reaction occurred for 8 (2.5%) respondents between 21 to 30 years old, 6 (1.9%) between 31 to 40 years old, 3 (0.9%) between 41 to 50 years old, and 1 (0.3%) between 51 to 60 years old.

Types of Food Allergic

Food allergies can be triggered by various types of food, and respondents in this study were asked to select from a list of potential allergens. The results indicated that the majority of respondents, totalling 67 (20.9%), reported being allergic to shrimp, followed closely by seafood with 65 (20.2%) respondents. Peanut and fish allergies were reported by 15 (4.7%) and 11 (3.4%) respondents respectively. Interestingly, egg allergies and allergies to other types of food (e.g., chocolate, chili) were reported by an equal number of respondents, each with 10 (3.1%). Additionally, meat, fruit, milk, and soy allergies were reported by 9 (2.8%), 5 (1.6%), 4 (1.2%), and 3 (0.9%) respondents

respectively. Wheat and yogurt allergies were reported by the fewest respondents, each with 2 (0.6%).

Symptoms of Food Allergic

The analysis of symptoms revealed that the highest number of respondents, 58 (18.1%), experienced redness of the skin. Following this, hives, itchy throat or mouth, running nose or congestion, swollen lip, swollen eye, and abdominal pain were reported by 53 (16.5%), 36 (11.2%), 32 (10.0%), 30 (9.3%), 26 (8.1%), and 14 (4.4%) respondents respectively. Vomiting and other symptoms (e.g., acne, feverish, swollen ear) were reported by an equal number of respondents, each with 11 (3.4%). Wheezing or trouble breathing and diarrhoea were reported by 10 (3.1%) respondents each.

Type of Medication

In the analysis of the type of medication, the majority of respondents, comprising 28 (8.7%), reported taking antihistamines for their food allergies. Some respondents, totalling 12 (3.7%), could not recall the name of the medication. Additionally, anti-inflammatories and other medications (e.g., methotrexate) were reported by 9 (2.8%) and 7 (2.2%) respondents respectively.

Action taken after allergic reaction

During allergic reactions, respondents were presented with three options: 1) seek the doctor, 2) take medication without consulting a doctor, and 3) wait for symptoms to resolve without taking medicine. The majority of respondents, totalling 59 (18.4%), chose to wait for symptoms to resolve without taking medicine. Following this, 49 (15.3%) respondents opted to seek the doctor, and 41 (12.8%) chose to take medication without consulting a doctor.

Ability after allergic reaction

According to the results, the analysis indicated that the majority of respondents, totalling 61 (19.0%), continued to eat the

food causing their allergic reactions and still experienced symptoms. The remaining respondents either did not eat the allergenic food or consumed it without experiencing symptoms, with total numbers of 25 (8.7%) and 16 (5.0%) respectively.

Knowledge towards food allergy

According to the findings, the level of knowledge was categorized into three levels: poor knowledge (<60%), moderate level (60 to 80%), and good knowledge (>80%). The majority of respondents, totalling 158 (49.2%), scored at a moderate level. This was followed by those with good knowledge,

comprising 139 (43.3%) respondents, and those with poor knowledge, accounting for 24 (7.5%) respondents.The frequency and percentage of answers given by the respondent based on the provided statements are available in Table 1.

The association between the status of allergy and the knowledge level

The results indicated an association between respondents having a food allergy and their level of knowledge on food allergies. Among the respondents without food allergies, the majority, totalling 105 (32.7%), demonstrated higher knowledge of

Table 1: The frequency and percentage of answer given by the respondent	
Statement	Respondents, n (%)
Food allergy involves the immune system (T)	216 (67.3)
Food allergy is a serious health problem in Malaysia (T)	115 (35.8)
Are the peanut allergy being the most common allergies in Malaysia? (T)	169 (52.6)
The only way to know that you are allergic to a food is with a medical test. (F)	114 (35.5)
Are the rashes being the most common symptoms of food allergy? (T)	232 (72.3)
People with food allergies are treated differently because of their food allergy. (T)	202 (62.9)
Eczema may be the first sign of having a food allergy. (T)	143 (44.5)
Asthma is an important risk factor for severe anaphylaxis (T)	195 (60.7)
Food additives are common food allergens? (eg: colouring agent, preservative) (F)	60 (18.7)
Milk allergies is similar to milk intolerance. (F)	61 (19.0)
Teenagers are at higher risk for fatal food allergy compared to younger children. (T)	57 (17.8)
Taking a daily allergy medicine can prevent food allergy reactions. (F)	114 (35.5)
Are medicine could cause an allergic reaction? (T)	249 (77.6)
Do we need to check all the ingredients contained in the food before buying it? (T)	287 (89.4)
For someone who has a food allergy, staying away from the food that allergic to him/her is difficult. (T)	203 (63.2)
People with food allergies worry a lot about their allergy. (T)	240 (74.8)
It is difficult for people with food allergies to safely eat at restaurant. (T)	227 (70.7)
N = frequency	

food allergies, in contrast to 11 (3.4%) respondents with food allergies having a poor knowledge level. The Chi-Square value was 8.165 with a p-value of 0.017 ($p<0.05$), suggesting animportant relationship between respondents having a food allergy and their level of knowledge on food allergies. Consequently, it can be concluded that knowledge is influenced by the presence or absence of food allergies among respondents.

Discussion

The study focused on the prevalence of food allergies among Malaysians aged 18 and above, as well as their knowledge and awareness regarding this issue. The research aimed to determine the correlation between the prevalence of food allergies and the level of knowledge among the population.

Prevalence of Food Allergy

Based on the findings, the prevalence of food allergies among the Malaysian population was determined to be 0.42 per 100,000 people. In comparison with other Asian countries, previous studies mainly focused on the pediatric population, where the prevalence among children aged 5 to 12 years ranged from 4 to 5%, and in Korea, it was found to be 10% among those aged 6 to 12 years (9). A study reported an incidence of food allergies in Spain at 4.6% and in Australia at 19.1% (10). Similarly, In the United States, the prevalence of food allergies is approximately 3.7% among adults and 6% for infants and young children (11). Therefore, when compared to these studies, the prevalence of food allergies in Malaysia appears to be considerably lower.

This study identified twelve types of food allergens, with shrimp being the most common cause of allergies at 20.9%, followed by seafood at 20.2%. This was followed by peanut (4.7%), fish (3.4%), egg (3.1%), meat (2.8%), fruit (1.6%), milk (1.2%), soy (0.9%), wheat (0.6%), and yogurt (0.6%). In comparison, a study in the United States in 2017 reported shellfish allergies at 3.9%, with peanut (2.4%), tree nut (1.9%), and fin fish (1.1%) following as the highest reported allergens (12). Additionally, a 2019 report indicated that shellfish allergies were highest among adults at 2.9%, affecting an estimated 7.2 million adults in the US, followed by milk, peanut, tree nut, fin fish, egg, wheat, soy, and sesame (13). These results align with previous studies that have identified fish and seafood as common causes of allergies, particularly shellfish like lobster, shrimp, crab, and crayfish. However, some discrepancies exist, as Vierk et al. identified milk or dairy as the most common allergen, attributing it to misconceptions between milk intolerance and milk allergy (14). This study suggests that milk was a moderate cause of food allergies, differing from previous findings that included individuals with lactose intolerance.

This study explored various patterns of food allergens across different countries, particularly in Asia. It revealed that shellfish, including prawn or shrimp, exhibited high prevalence rates in Asian countries such as the Philippines (5.12%) and Singapore (5.23%), contrasting with the lower prevalence in the United States (0.7%) (4). Despite peanut being a significant allergen, its prevalence was comparatively lower in Asian countries compared to Western countries. The study conducted in Malaysia, an Asian country, highlighted fish and seafood as major causes of allergies, potentially influenced by geographic and genetic factors given the diverse ethnicities in the Asian population (15).

The study's results indicated that a majority of respondents experienced redness of the skin and hives during allergic reactions, with the severity of symptoms influenced by factors like the amount of food ingested, age, and absorption speed. In Vietnam, hives were the most frequent symptom, followed by diarrhea (16). Contrarily, studies in other regions identified allergic rhinitis as the most common symptom, followed by urticaria and asthma (17, 18). Skin manifestations were common

among adults, varying in severity based on the allergen and ingested amount.

Regarding medication during allergic reactions, the most commonly used were antihistamines and anti-inflammatories, including loratadine, cetirizine, chlorpheniramine, hydrocortisone, prednisolone, and betamethasone. These medications align with standard practices for managing and relieving food allergy symptoms, emphasizing the importance of complete allergen avoidance and pharmacotherapy, including rapid-acting oral antihistamines (levocetirizine, cetirizine, loratadine, fexofenadine, and mizolastine) and, when necessary, Epipens containing adrenaline for IgE-mediated reactions (19; 20). Oral corticosteroids are employed in managing eosinophilic esophagitis and gastroenteritis symptoms, while topical corticosteroids, though less effective, are used in specific cases (21). The treatment received by respondents aligned with established protocols for addressing allergic reactions and alleviating symptoms.

Knowledge of food allergy

Another objective of this study was to assess the knowledge of food allergies among the Malaysian population. The findings indicated that the majority of respondents had a moderate level of knowledge regarding food allergies. This contrasts with a study in the United States, where adult respondents showed poor knowledge regarding the distinction between food allergy and food intolerance, with only 64.9% answering correctly (21). Gupta et al. (22) also found wide variations in knowledge among the general public, with many misconceptions related to the prevalence, definition, and triggers of food allergies.In this study, only 61 out of 321 respondents incorrectly identified food intolerance and food allergy as the same, similar to the misconception found in Gupta et al.'s study (21). Therefore, the level of knowledge about food allergies among the Malaysian population appears to be somewhat similar, especially when examining each knowledge item individually.

When comparing parents with food allergies, Gupta et al. found that knowledge was 75% correct, but parents were unaware that teenagers are at a greater risk of fatal anaphylaxis than younger children (23). In contrast, this study revealed that only 17.8% of respondents agreed with this statement, indicating a lack of awareness about the increased risk of anaphylaxis in teenagers. However, when focusing on each knowledge item, the majority of respondents correctly acknowledged that food allergic reactions involve the immune system (67.3%). This aligns with the pathology of food allergies, where immune reactions are triggered by food protein antigens (24). Moreover, in line with Zukiewicz-Sobczak et al.'s findings that allergic reactions can be caused by medications, ranging from mild to severe skin or systemic reactions, 77.6% of respondents in this study correctly agreed that medicines can cause allergies (25).

Relationship between the status of allergy and level of knowledge of food allergy

The analysis of the association between allergy status and the level of knowledge of food allergies in this study revealed a noteworthy difference between non-allergic and allergic respondents. The majority of non-allergic respondents demonstrated good knowledge. This finding contrasts with a previous study by Allan (7), which found no major difference in parents' knowledge of food allergies based on their child's allergy status. Similarly, a study by Choi, Ju, and Chang found no major difference in knowledge levels based on students' allergy status in the age range of 6 to 12 years (26).In contrast, the present study focused on the allergy status of the general public, revealing a difference between those with allergies and those without in terms of knowledge of food allergies. The higher number of non-allergic respondents in this study may have influenced the association between allergy status and knowledge level. This discrepancy suggests that the context and scope of the study

population can impact the relationship between allergy status and knowledge of food allergies.

Conclusion

The present findings assessed the knowledge and awareness of food allergies in the Malaysian population, revealing a moderate level of knowledge. Recognizing the difference between allergies and intolerance, understanding the treatment of food allergies, and identifying allergy symptoms are crucial aspects of public awareness. Notably, this study found that the status of food allergy considerably impacted knowledge scores. Non-allergic respondents demonstrated higher knowledge levels compared to those with allergies, emphasizing the importance of understanding these distinctions within the population.

Limitations

Establishing causality is challenging in this study due to its cross-sectional design. The approach involved distributing questionnaires online to the public, but faced challenges in reaching a representative sample across all 14 states in Malaysia. Understanding the queries posed a difficulty for some respondents, leading to potential loss in the number of participants. Additionally, a few respondents did not take the questionnaire seriously, posing a threat to the reliability and validity of the data analysis. Efforts were made to overcome these challenges by personally explainingthe study's purpose to respondents. Despite these challenges, the study was conducted in accordance with the necessary requirements.

Acknowledgement

Conflict of Interest

We declare that we have no conflict of interest.

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