ORIGINAL ARTICLE

Utility Weights for Allergic Rhinitis Based on a Community Survey with a Time Trade-off Technique in Japan

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ABSTRACT

Background: Allergic rhinitis is not a fatal disease, but its symptoms deteriorate the quality of life. High morbidity raises a concern about its impact on health care resources. Utility weights, which are required for cost-utility analysis by the level of severity, have not been established to date. This study aims to derive the weights based on a community survey with a time trade-off technique.
Methods: Self-administered monthly time trade-off questionnaires were administered to representative samples in the community. Four levels of severity were defined by clinical stratification proposed in the "Practical Guideline for the Management of Allergic Rhinitis in Japan".
Results: 146 responses (response rate: 51.0%) were collected. Utility weights by the four levels of severity were found to be 0.96, 0.94, 0.89 and 0.83, from mild to severest symptoms, respectively. These values were found to be statistically independent from the respondent's characteristics such as sex, age, existence of current nasal symptoms or history of allergic rhinitis.
Conclusions: The authors consider that the elicited utility weights are reliable. The results of this study could facilitate economic evaluations regarding allergic rhinitis in various contexts, contributing to better management of the disease.

INTRODUCTION

Allergic rhinitis has been recognised as a burden to both health care systems and society in Europe[1] and the U.S.[2] 18.7% of Europeans[3] and 9.9−16% of Americans[4] are estimated to be suffering from the disease. This is similar in Japan as well. Allergic rhinitis in a form of cedar pollinosis is one of the most common illnesses, of which prevalence is estimated to be as high as 19.7% of the nation.[5] This means one in five Japanese suffers allergic symptoms from winter to spring every year, during which cedar pollens scatter in the air. Other seasonal rhinitis caused by various allergens and perennial allergic rhinitis also affect the nation.[6] Allergic rhinitis is not a fatal disease, but its symptoms such as sneezing, itchy eyes or stuffy nose deteriorate the quality of life (QOL).

The Practical Guideline for the Management of Allergic Rhinitis in Japan[6] was published by an expert committee, in which clinical stratification of allergic rhinitis symptoms and severity (Fig. 1) is clearly defined for the purpose of standardization of practice and research. Although the guideline proposes a Japanese Rhinoconjunctivitis Quality of Life Questionnaire (JRQLQ) in order to evaluate outcomes in terms of QOL,[7] utility weights, which enable outcomes evaluation in terms of Quality-Adjusted Life Years (QALYs) by the level of severity of symptoms have not been established. A utility weight is a value from 0 to 1, which is attached to various health statuses. By combining it with survival time in changing health statuses, life expectancy is adjusted into QALYs taking QOL into account. For example, one year survival suffering from severe symptoms with

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Severity by the level of symptoms*		Sneezing fit or runny nose				
		++++	+++	++	+	−
Nasal congestion	++++	Severest	Severest	Severest	Severest	Severest
	+++	Severest	Severe	Severe	Severe	Severe
	++	Severest	Severe	Moderate	Moderate	Moderate
	+	Severest	Severe	Moderate	Mild	Mild
	−	Severest	Severe	Moderate	Mild	Asymptomatic

*Level of symptoms as below.

	++++	+++	++	+	−
Sneezing fit (Average number of fits per day)	21 +	20−11	10−6	5−1	Below +
Runny nose (Average number of nose blow per day)	21 +	20−11	10−6	5−1	Below +
Nasal congestion	Complete congestion for a whole day	Severer congestion and mouth-breathing for most of the day	Severe congestion and mouth-breathing for several hours in a day	Congestion but no mouth-breathing	Below +

Fig. 1 Clinical stratification of allergic rhinitis symptoms and severity. Source: Reference 2.

utility weights of 0.5 is considered as an outcome gain of 0.5 QALY. Such a calculation of QALYs with utility weights allows a better comparison of outcomes of QOL deteriorating disease treatments, and it is recommended in conducting economic evaluation of health care intervention.[8] In Japan, 0.89 for seasonal allergic rhinitis and 0.97 for perennial allergic rhinitis as the average of patients with various levels of symptoms using EQ-5D[9] only was reported by Monden and Ogino (2005)[10] to date.

This paper aims to derive utility weights for allergic rhinitis by the level of the standard clinical stratification of severity. Since high morbidity of cedar pollinosis raises a concern about its impact on health care resources in Japan[11,12] and elsewhere,[13,14] the results could facilitate economic evaluations using a recommended outcomes measurement, QALYs,[8] which could contribute to more efficient management of the disease.

METHODS

In deriving utility weights, choosing whose preference is to be elicited is essential.[15] The objective of deriving utility weights, that is, its use for cost-utility analysis, imposes a gold standard that preference of the general public should be elicited.[16] However, utility weights are sometimes drawn from patients or experts in practice, because it is often difficult for healthy individuals to have an accurate grasp of their health status subjected to a specific disease without experience.[17] In the context of this study, "suffering from rhinitis" or its symptoms are both common and

easy to understand, and therefore, we choose to ask the preference of representative samples among the general public.

Technically, there are two approaches in eliciting preference for health status as utility weights.[18] One approach is the use of multi-attribute health status classification systems,[19] as Monden and Ogino (2005)[9] used EQ-5D, while the other is the use of techniques, which directly measure the preference of individuals. We choose direct measurement in this study, since the former approach is suitable for questioning patients. There are three most widely used techniques in measuring preferences directly: the rating scale and its variants (RS), the standard gamble (SG) and the time trade-off (TTO).[18] RS is the easiest and quickest to implement, but it is also known as an erratic measure.[15] Therefore, RS is often used as an introductory or complementary to SG or TTO. Although theoretical superiority of the SG against TTO is established in regards to the axioms of the von Neumann-Morgenstern utility theory,[20] TTO is consistently found much easier to respond to compared to SG by respondents.[15] Therefore, the choice between them usually depends on the context of the study.[18]

In order to apply these techniques to representative samples of the general public, the mode of questioning needs to be chosen. It is known that risk or probability communication, which is required for SG, is better achieved by an interview along a dialogue,[21] but recruiting representative interviewees from the general public is hard to implement. On the contrary,

Box 1 Question for TTO

Using your imagination, please answer the questions as if you are acting a role in the following story. (N.B. This is a fictional story. And no drug like this is available in real life.)

You are about to be affected by pollinosis and will have to lead life with a certain level of discomfort for one month (30 days). Your symptoms will be persistent for one month, but a brand new medicine that completely cures pollinosis is recently developed. The pill should be taken on the first day you are affected.

Yet, it has its side effects. Taking the pill relieves all symptoms of pollinosis for one month, but you may suddenly fall asleep on a certain day after taking the medication. Then you never wake up for the rest of the month while the medication is effective. (The sleep is not life threatening nor harmful to your health.) There is no data on when you are going to fall asleep.

During this sleep, you will not feel any physical change like hunger, but you are immobile and unconscious. After that one month of the medication, you wake-up and resume everyday activity as if nothing happened. (One month is assumed as 30 days.)

You have this pill now. ***How many healthy days do you want if you are going to take this pill?*** Please circle "Yes" or "No" in the following answer sheet to show the days you wish to have depending on the severity of symptoms. Please do not think too hard, but let us know what your intuition suggests.

the TTO instrument can be devised as a self-administered questionnaire,[22] which can be used for a community survey with random sampling. Therefore, we choose the TTO complemented by the RS in this study.

There are wide variations in designing a TTO instrument.[23] Conventional lifetime TTO where a respondent trades against unwanted premature death originated from Torrance *et al*. (1976).[24] The Buckingham *et al*. (1996) experiment used two other variations: annual TTO where a respondent trades against unwanted convalescence, and daily TTO where a respondent trades against unwanted sleep in a day. The use of daily TTO is most recommended among these three, because it produces more consistent results.[26]

We constructed our questions for the TTO (Box 1) featuring cedar pollinosis instead of allergic rhinitis as the disease under consideration, although the descriptions of health statuses are in accordance with the clinical stratification of allergic rhinitis symptoms and severity. This is because featured pollinosis is more common and therefore it could attract more attention than stating allergic rhinitis. We devised a monthly TTO taking advantage of seasonality that is quite well-known to the general public. One month of continuous suffering is considered easy to imagine by the respondents. In our monthly TTO, the respondent trades against unwanted sleep in a month. Unwanted sleep metaphor for dead status, which is similar to daily TTO employed after pilot testing was administered to several collaborators.

Every respondent was repeatedly questioned four times in order to fill the four separate answer sheets (Fig. 2), imagining the sufferings of each severity level of symptoms explained in the clinical stratification (Fig. 1). They were asked to check 'Yes' or 'No' regarding medication according to the length of unwanted sleep. The level, at which answer changes from 'Yes' to 'No', was judged as an indication of the point of indifference in the trade-off. Utility weights were calculated by the following formula:

$$\text{Utility weight} = \frac{30 - \text{Number of acceptable sleeping days}}{30}$$

The questionnaire starts with a face sheet on the characteristics of the respondent, followed by an explanation of clinical stratification of allergic rhinitis symptoms and severity. Then, for each level of severity of symptoms, the respondent is asked to rate his/her preference from 0 points (dead) to 100 points (perfect health) on the visual analogue scale. The RS is incorporated before the TTO questions for the purpose of warm-up and engaging respondents, as well as for the comparison with the results by TTO.

The questionnaire as above was used in our community survey, of which samples were selected by stratified systematic sampling from the basic resident register of Tsukuba city, Ibaraki prefecture in Japan. It is an academic and garden city located in the suburbs of Tokyo. 300 samples in total were selected by sex and age stratum of 20−39, 40−59 and 60+. Adults of age 20 and over were chosen, since we considered that this did not have a serious bias in the representativeness of social preference. These sex and age categories were set for the purpose of examining the reliability of results. On the face sheet, existence of cur-
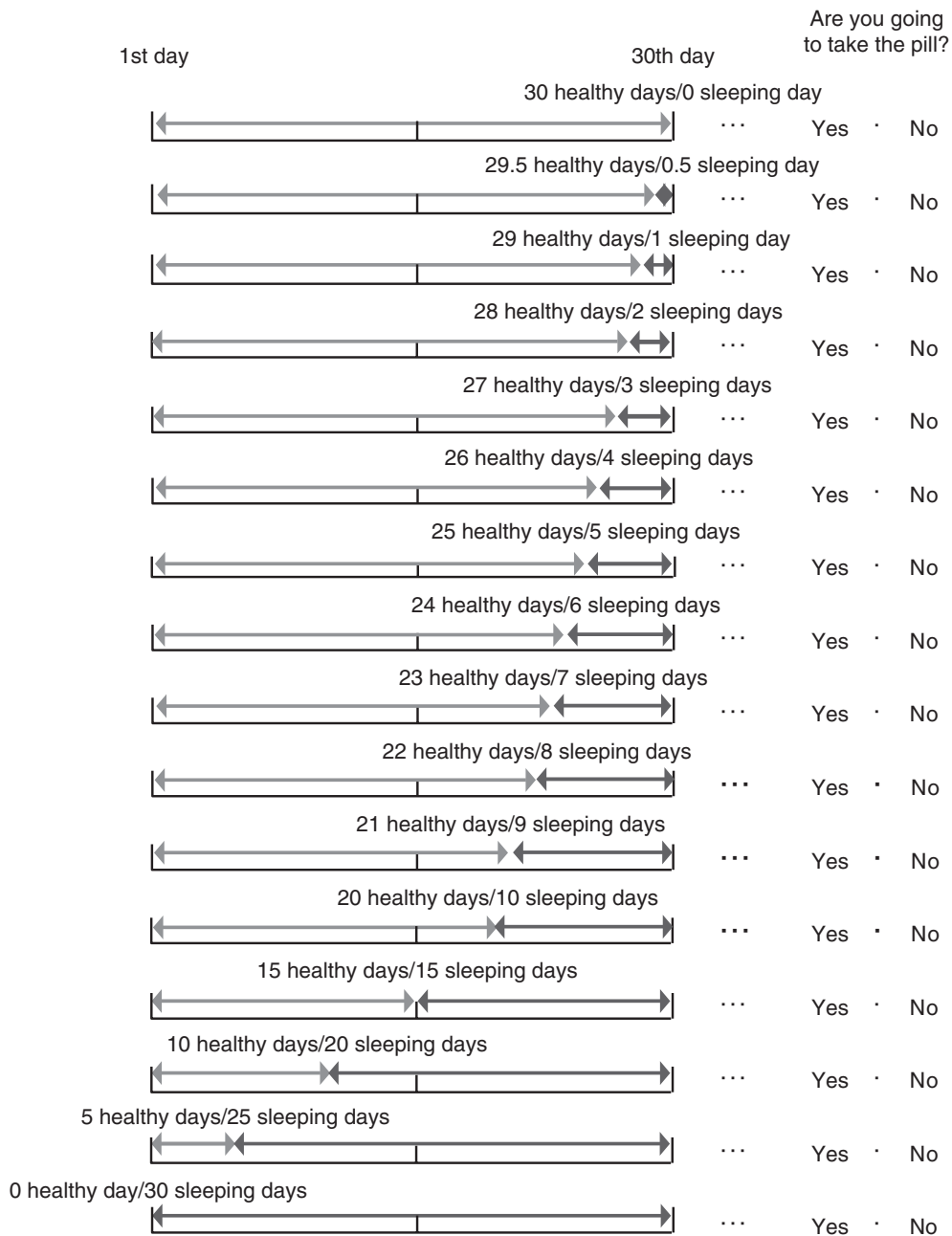
Fig. 2 Instrument used for time trade-off measurement.

rent nasal symptoms and history of cedar pollinosis were also asked, so that effects of these factors on the reliability of the results could be examined. We assumed that there was no difference between allergic rhinitis patients and non-patients regarding the understanding of suffering experiences classified in the clinical stratification of severity. Therefore, no significant difference was also expected between utility weights and the history.

The questionnaire was delivered by post, followed by the investigator visiting to collect responses at a later date. The survey was conducted in November of 2005 when cedar pollens were not scattered in the air.

The conduct of this study including the community survey was approved by the research ethics committee of the Graduate School of Comprehensive Human Sciences, University of Tsukuba.

RESULTS

Among 300 selected samples, 14 samples were unable to respond, because they either had been deceased or relocated, which made an effective sample size of 286. 146 responses were collected, which gave

Table 1 Characteristics of respondents

Sex	Male	68 (46.6%)	N.S.*
	Female	78 (53.4%)	
Age	20−39	39 (26.7%)	S.†
	40−59	49 (33.6%)	
	60+	58 (39.7%)	
Current nasal symptoms	Yes	46 (31.5%)	
	No	97 (66.4%)	
	No response	3 (2.1%)	S.
History of cedar pollinosis	Yes	49 (33.6%)	
	No	93 (63.7%)	
	No response	4 (2.7%)	
Average years of suffering from pollinosis		12.5 (SD = 11.3)	

*N.S. stands for 'not significant', which is found by the χ^2 test.
†S. stands for 'significant', which is found by the χ^2 test.

Table 2 Utility weights by severity with the rating scale and time trade-off

Technique	Characteristics of respondents		Mild	Moderate	Severe	Severest		Average
Rating scale			0.82 (0.79 0.85)*	0.71 (0.68 0.74)	0.56 (0.52 0.60)	0.43 (0.38 0.48)		0.63 (0.61 0.65)
Time trade-off			0.96 (0.95 0.97)	0.94 (0.93 0.96)	0.89 (0.85 0.92)	0.83 (0.78 0.87)		0.91 (0.89 0.92)
	Sex	Male	0.95 (0.94 0.97)	0.94 (0.91 0.96)	0.88 (0.83 0.92)	0.80 (0.72 0.87)	N.S.†	0.89 (0.87 0.92)
		Female	0.97 (0.95 0.98)	0.95 (0.93 0.97)	0.89 (0.85 0.94)	0.85 (0.80 0.91)		0.92 (0.90 0.94)
	Age	20−39	0.96 (0.93 0.99)	0.94 (0.91 0.98)	0.91 (0.88 0.95)	0.85 (0.79 0.92)		0.92 (0.89 0.94)
		40−59	0.97 (0.95 0.99)	0.95 (0.93 0.97)	0.87 (0.81 0.94)	0.77 (0.67 0.87)	N.S.	0.89 (0.86 0.92)
		60+	0.96 (0.94 0.98)	0.94 (0.92 0.97)	0.88 (0.82 0.93)	0.86 (0.80 0.92)		0.91 (0.89 0.93)
	Current nasal symptoms	Yes	0.97 (0.95 0.99)	0.96 (0.95 0.98)	0.90 (0.86 0.95)	0.83 (0.75 0.91)	N.S.	0.92 (0.89 0.94)
		No	0.96 (0.94 0.97)	0.93 (0.91 0.95)	0.87 (0.83 0.92)	0.82 (0.77 0.88)		0.90 (0.88 0.92)
	History of cedar pollinosis	Yes	0.97 (0.95 0.99)	0.95 (0.92 0.97)	0.90 (0.86 0.95)	0.83 (0.76 0.91)	N.S.	0.91 (0.89 0.94)
		No	0.96 (0.94 0.97)	0.94 (0.92 0.96)	0.88 (0.83 0.92)	0.82 (0.77 0.88)		0.90 (0.88 0.92)

*95% Confidence Interval.
†N.S. stands for 'not significant'. Effect of characteristics of respondents is found 'not significant', tested by a generalised linear model.

a response rate of 51.0%.

Table 1 shows the characteristics of the respondents. There were 68 males and 78 females. There was no statistically significant difference in the response rate between them by the χ^2 test. 39, 49 and 58 samples responded in the age strata 20−39, 40−59 and 60+, respectively. Here, a statistically significant difference in the response rate was found by the χ^2 test. The older the age strata, the higher the response rate. 31.5% of respondents reported currently experiencing nasal symptoms, while 33.6% reported having a past history of cedar pollinosis, of which average years of suffering was 12.5 years. A statistical association was found between current nasal symptoms and history of cedar pollinosis by the χ^2 test, despite the survey being conducted during out of cedar pollen season. This may be due to the comorbidity of perennial allergic rhinitis or pollen allergy other than cedar.[26]

Table 2 shows utility weights by severity with the RS and TTO. Utility weights with RS by the four levels of severity are 0.82, 0.71, 0.56 and 0.43 from mild to severest symptoms, respectively, while with TTO, 0.96, 0.94, 0.89 and 0.83, respectively. Lower weights found by RS may be due to the known tendency in the response to RS that respondents are more inclined to mark the point apart from extreme ends of the scale.[15] Figure 3 illustrates these by box plots.
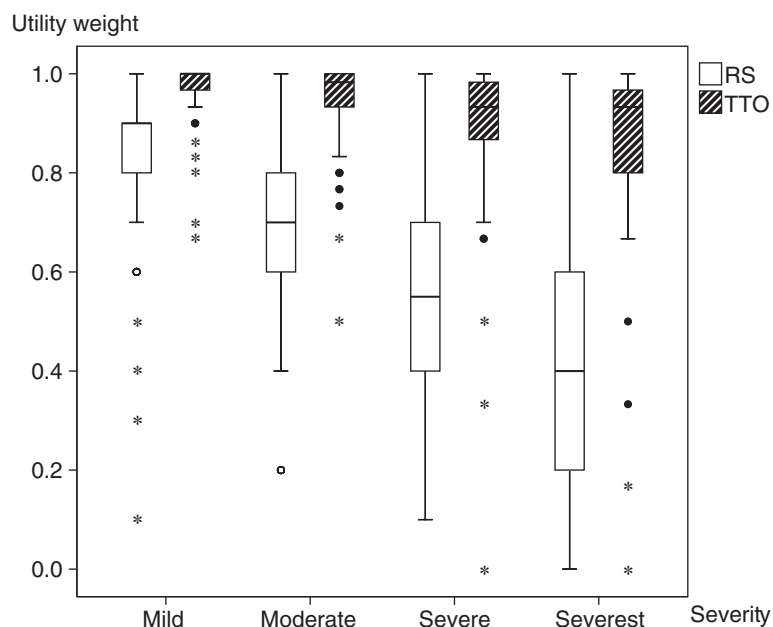
Utility weight

Fig. 3 Box plots of utility weights. RS, Rating scale; TTO, Time trade-off.

Table 2 also shows utility weights with TTO by the characteristics of respondents. Female respondents noted higher weights than males; respondents in age strata 40−59 noted the lowest weights; symptomatic respondents noted higher weights; and respondents with history of pollinosis noted higher weights. In regards to these differences, effects of characteristics of respondents to utility weights were tested with a generalised linear model, of which result were statistically insignificant in terms of characteristics.

DISCUSSION

We elicited utility weights for allergic rhinitis by the level of standard clinical stratification of severity defined by the Practical Guideline for the Management of Allergic Rhinitis in Japan.[6] We constructed a self-administered questionnaire applying monthly TTO for representative samples from the community. Utility weights by the four levels of severity were found to be 0.96, 0.94, 0.89 and 0.83, from mild to severest symptoms, respectively. The average weight of these, 0.91, can be judged as consistent with the formerly reported 0.89 for seasonal allergic rhinitis and 0.97 for perennial allergic rhinitis in Japan, taking into account that EQ-5D was applied to patients in this study and that seasonal rhinitis patients experience severer symptoms than perennial rhinitis patients.[9] Additionally, the weights found were stable regardless of respondents' characteristics such as sex, age, current nasal symptoms, or history of cedar pollinosis, which allows us to consider the findings of this study as being fairly reliable for social preference.

In particular, we choose to elicit the preference of the general public as a social preference assuming that individuals without any history of allergic rhinitis can imagine the various symptoms of rhinitis. If this is not the case, there may be a difference in results between subgroups of those with a history of allergic rhinitis and those without it. Such a difference may raise the problem of how to interpret these as social preference. However, no significant differences were found in this study.

There is a point to be noted in interpreting our results. Non-response by almost half of the samples raises a concern about the ease of answering to our devised self-administered TTO questionnaire. However, the response rate of 51.0% is more than the usual response rates of mail surveys, and comparable to those of several recent governmental interview surveys, 40−50%, of which decline is considered to be due to the citizen's amounting awareness on privacy backed up by the enforcement of Personal Information Protection Act in April of 2005.[27] The response rate of 51.0% may be judged as low, but it has become unrealistic to obtain more representative data in Japan.[27] Therefore, the level of response rate of our survey can be interpreted as independent from the ease of answering, and the questionnaire itself can be considered feasible for self-administration.

Although the clinical stratification of severity employed in this study is based on Japanese guidelines, the description of symptoms and severities are universal enough to be used in other countries. And found weights were not so different from 0.87, which is reported for hay fever/allergic rhinitis from the U.S., although the severity of symptoms is not stated in this study.[28] Our results may be applicable to economic evaluations regarding allergic rhinitis in vari-

ous contexts in many countries, such as transitioning of the second-generation antihistamines to over-the-counter status[29,30] or a tablet-based vaccination against hay fever.[31-33]

We devised a monthly TTO by taking advantage of seasonality that is quite well-known to the general public. The monthly TTO is a new variation that is in-between annual TTO and daily TTO, of which construct validity is ensured. However, empirical comparison with annual TTO and daily TTO may be necessary, which was not exercised in this study. This leaves room for further study. Arnesen and Trommald (2005) point out that variation in TTO questions could undermine the comparability of QALYs across diverse health statuses, and suggests that a detailed description of the implemented TTO is one way to relieve this problem.[34] This paper transparently presents information required for comparison and duplication of technique.

ACKNOWLEDGEMENTS

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