This study examined the construct validity of the willingness-to-pay (WTP) method for evaluating nondecisional diagnostic information. Six hypotheses were formulated regarding the relationship between WTP and the subjective importance of testing, burden of testing, perceived reliability of the test, subjective belief of being infected, perceived severity of the disease, and perceived possibility of treatment. The hypotheses were tested using a questionnaire among individuals at increased risk of histoplasmosis. Univariate and multivariate relationships were examined by χ² test and logistic regression, respectively. Eighty-four Dutch speleologists participated in the study, 76 of whom gave WTP information. A significant relationship was found between WTP and subjective importance of testing. No relationship was found between WTP and the other hypotheses, and multivariate analysis showed no further significant relationships. Our findings do not confirm that WTP measurement is a valid method for assessing the value that respondents place on nondecisional diagnostic information. Our results do not accord with the results from other studies, which might be explained by the fact that the Dutch population is not familiar with paying for health care facilities out of their own pocket.

Keywords
Cost-benefit analysis · Economic evaluation · Willingness-to-pay · Validation

Validity of willingness-to-pay for nondecisional diagnostic information

There are a number of ways in which health care facilities can be evaluated economically. In cost-benefit analysis the consequences or outcome of a facility is typically expressed in monetary units. This makes it possible to compare costs and benefits in a direct way and to calculate the net social benefits. The goal of cost-benefit analysis is to determine whether a program's benefits exceed its costs, and thus whether a program is worthwhile [9]. Of the several methods that exist for estimating monetary values for health care programs, one that is popular is the willingness-to-pay (WTP) survey technique, known as contingent valuation [24]. A literature review of contingent valuation studies has shown that the number of such studies is growing rapidly, and that the majority are carried out as part of cost-benefit analyses [6]. Considering the economic evaluation of diagnostic facilities, however, a recent literature review has reported that, compared to other types of economic evaluation, only relatively few studies are based on the principles of cost-benefit analysis [29].

Diagnostic technologies and procedures in general are typically judged effective if they provide information which is relevant to a treatment/no-treatment decision and to eventual patient outcome [11, 30]. Nevertheless, information which is not directed towards therapeutic decision making may have a value to either physician or patient. This value can be defined as the nondecisional value of diagnostic information [34]. In the literature several methods can be found, varying from open-ended questions asking how respondents feel about knowing their diagnostic results, to health status measurement using questionnaires such as those on anxiety and the SF36, to WTP [22, 26, 34]. How to measure this nondecisional value of diagnostic information remains uncertain. In this study we addressed the question of whether WTP analysis is a method which leads to credible valuing of nondecisional diagnostic information.

One approach to investigating the validity of using a questionnaire when there is no criterion is to examine construct validity. A construct is a theoretically derived notion of the domain which the instrument should measure, leading to expectations about how an instrument should behave if it is valid [31]. To examine the construct validity of the WTP procedure as a method for assessing the value that respondents place on a nondecisional diagnostic information, we tested the following hypotheses:

- Subjective importance of testing, reflecting the risk aversion of a person, is positively related to the WTP for diagnostic information [34].

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The burden of testing experienced is negatively related to the WTP for diagnostic information [1]. Subjective belief in the accuracy of a diagnostic test is positively related to the WTP for diagnostic information. Prior knowledge of the presence or absence of the disease is negatively related to the WTP for diagnostic information [2]. The severity of the disease tested (perceived risk) is positively related to the WTP for diagnostic information [17, 19, 21]. The possibility of treatment after testing is positively related to the WTP for diagnostic information [8].

**Histoplasmosis**

The hypotheses were tested among individuals considered to be at increased risk of histoplasmosis. Histoplasmosis is caused by the dimorphic fungus *Histoplasma capsulatum*. The organism grows during its mycelial phase in soil, especially in soil that has been nitrogen-enriched by bat or bird guano. Infection is acquired when microconidia are inhaled into the lungs, where they transform into the pathogenic yeast-phase organisms [13, 14]. The organism is widely distributed throughout the world in both tropical and temperate climates. However, histoplasmosis is rare in Europe [14], and the vast majority of European cases are attributable to endogenous reactivation of a latent infection acquired in overseas endemic areas [5, 20]. Several outbreaks of histoplasmosis have been reported to be cave-associated, and therefore speleologists may be at increased risk of acquiring cave-associated histoplasmosis [16, 23, 28, 32].

**Methods**

**Respondents**

A group of Dutch speleologists was invited to participate in the study during their annual membership meeting. An information folder was handed out describing the disease, treatment consequences, and information on the diagnostic test. Each participant was asked to complete a self-administered questionnaire, and blood samples were obtained. The questionnaire focused on the history of spelunking activities to identify the possible risk factors of acquiring cave-associated histoplasmosis. Furthermore, the participants were asked about clinical symptoms suggestive of histoplasmosis (e.g., a nonproductive cough, substernal pain, and shortness of breath) after spelunking in a particular area and about having had a previous test for histoplasmosis. The blood samples were tested for the presence of antibodies to *H. capsulatum*. A detailed description of the study is presented elsewhere [27].

**Questionnaire**

Because treatment for histoplasmosis is not indicated in asymptomatic persons, for the speleologists the blood sample would directly provide nondecisional diagnostic information and indirectly, in the long run, information in case the person should become symptomatic. Testing for the seroprevalence of antibodies to *H. capsulatum* is not currently part of regular health care in the Netherlands. Testing among a risk population and measuring their WTP can be described as an ex post user-based perspective [24]. This approach involves asking individuals who would potentially gain from using the specific medical technology what maximum amount in monetary units they would pay to gain access to the facility. Various methods for asking someone’s WTP can be found in the literature. We chose to present the WTP question using five answering categories. We did so because simply asking the maximum amount that a respondent would be willing to pay poses a large cognitive task for a respondent [24]. In addition to this, when open-ended questions are used, an important concern for WTP analysis is the treatment of outliers [3, 21], and open-ended questions are likely to be biased and erratic [8]. Furthermore, because income is an important predictor variable in WTP analysis [15, 21], we tried to eliminate the possible influence of this variable by defining the WTP question using a percentage of the respondents’ monthly income. We could not find any suggestions in the literature that gearing the WTP question to respondents’ income would lead to bias. Regarding these considerations, we measured WTP using five answer categories ranging from not willing to pay anything to willing to pay an increasing maximum percentage of one’s monthly income (1%, 5%, 10%, and more than 10%).

To test the hypotheses, respondents were asked to indicate: (a) the subjective importance of testing, (b) the burden of testing (taking a blood sample), (c) the perceived reliability of the test, (d) the subjective belief of being infected (because the fact of being infected was unknown), (e) the perceived severity of the disease, and (f) the perceived possibility of treating the disease (below these are referred to as the hypothesis-related variables). For each question a five-category scale was used. To perform further statistical analyses (avoiding the problem of nearly empty cells and thus also introducing too many dummy variables in logistic regression analysis) both the WTP variable and the hypothesis-related variables were recoded into dichotomous variables in such a way to produce the greatest contrast in answering categories (Table 1).

Analysis of the data concerned several aspects. All participants were generally described for age, gender, and years active in spelunking. Frequencies of the answering categories to the WTP and hypothesis-related questions were calculated. Spearman’s correlation coefficient was calculated for the relationships between the WTP variable and the six hypothesis-related variables. To examine univariate relationships we used the $\chi^2$-test on the recoded variables. The multivariate association of WTP with the recoded variables was investigated using stepwise logistic regression. The level of statistical significance used was 5%.

**Results**

Of the 90 persons attending the membership meeting, 84 agreed to participate: 67 men (80%; mean age 38.6 years, range 20–62) and 17 women (20%; mean age 33.5 years, range 23–45). The mean number of years active in spelunking was 13 (range 2–32). Of the 84 respondents eight did not answer the question on WTP for the *H. capsulatum* test and therefore the number of respondents for our analysis was 76. Table 2 gives an overview of the number of respondents for each of the answering categories to measure the WTP for the diagnostic test. Twenty-two respondents (29%; 95% confidence interval: 18.7–39.2%) indicated not to be willing to pay anything for