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Determinants of willingness to pay for health services: a systematic review of contingent valuation studies

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Abstract

Introduction Stated preference studies are a valuable tool to elicit respondents' willingness to pay (WTP) for goods or services, especially in situations where no market valuation exists. Contingent valuation (CV) is a widely used approach among stated-preference techniques for eliciting WTP if prices do not exist or do not reflect actual costs, for example, when services are covered by insurance. This review aimed to provide an overview of relevant factors determining WTP for health services to support variable selection.

Methods A comprehensive systematic literature search and review of CV studies assessing determinants of WTP for health services was conducted, including 11 electronic databases. Two of the authors made independent decisions on the eligibility of studies. We extracted all determinants used and related p values for the effect sizes (e.g. reported in regression models with WTP for a health service as outcome variable). Determinants were summarised in systematic evidence tables and structured by thematic domains.

Results We identified 2082 publications, of which 202 full texts were checked for eligibility. We included 62 publications on 61 studies in the review. Across all studies, we identified 22 WTP determinants and other factors from 5 thematic domains: sociodemographic characteristics, perceived threat, perceived benefit, perceived barriers, and other information.

Conclusion Our review provides evidence on 22 relevant determinants of WTP for health services, which may be used for variable selection and as guidance for planning CV surveys. Endogeneity should be carefully considered before interpreting these determinants as causal factors and potential intervention targets.

Keywords Contingent valuation · Willingness to pay · Public health · Sociodemographic determinants · Economic valuation · Literature review

JEL Classification D61 Allocative Efficiency · Cost–Benefit Analysis; I11 Analysis of Health Care Markets

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Introduction

The concept of willingness to pay (WTP) is used to elicit the consumers' valuation of non-market goods [1]. The consumers' demand for non-market goods can be estimated by contingent valuation (CV) [2]. CV is a practical approach to describe individuals' and society's preferences in various areas such as environment, transportation, education, health care, and others [3]. In the context of resource allocation decisions under restricted budgets, CV studies can provide information on the value of goods and services where either no market exists or the markets' price information does not reflect the actual costs of goods or service provision.

Health services, defined as activities that provide medical treatment [4], have no market price in a publicly financed health system. Hence, in CV studies, the value of health care

is described indirectly. CV studies in health care are well established, and the number of publications applying CV is rising [2, 5]. In CV studies, individuals are asked about their hypothetical WTP for specific services or goods that are usually only requested when a need arises for the individual, for example, through illness [6]. Four value elicitation techniques have been used in health care CV studies: bidding games, open-ended questions, payment cards, and discrete choice questions [7].

Despite the increasing use of CV in health economic evaluation, this approach has weaknesses. Critics question the application of cost–benefit analyses based on stated WTP for interventions or services in a medical context. Some of the main points of criticism refer to challenges in ensuring the validity and reliability of the results. Other concerns address the fact that a hypothetical WTP for a non-market good is prone to errors and systematic biases [8].

The established operationalisation options for the medical benefit usually refer to user- or patient-relevant outcomes such as utilities, quality-adjusted life years (QALYs), prolongation of life, or reduction of morbidity and disability. Since resources in a health care system are scarce, and the system cannot afford maximum treatment for all patients, trade-offs must be made. An efficient allocation of resources requires valid information on how potential beneficiaries and payers value health services. In publicly financed health care systems, the general population pays for the health services of insured individuals via taxes or insurance contributions. The public is, therefore, legitimate to be surveyed in WTP studies [9]. Previous research has shown that the general population, as a heterogeneous group with little specific knowledge of and experience with health services, can determine actual WTP more accurately and consistently than patients or policy-making bodies [10].

Comprehensive knowledge about factors determining the WTP is crucial when planning the study design, data collection, and analysis of a CV study, either as mere statistical predictors or as causal factors of WTP, mediators, effect modifiers, or potential confounders in specific research questions on the determinants of WTP. Some aspects related to CV in health care have already been investigated and published. Therefore, the research topics of four recently published systematic reviews with meta-analysis were outside the scope of this systematic review. The first review, meta-regression analysis of CV studies evaluating the WTP for health care interventions, is from the perspective of chronically ill patients, focussing on the impact of social and cultural aspects at the country level [11]. The second one evaluated health services focussing on the discrepancy between WTP and the willingness to accept [12]. The third and fourth systematic reviews with meta-regression [13, 14] aimed at predicting the value that a population assigns to one quality-adjusted life-year (QALY) to inform allocation decisions in

health policy when trade-offs are necessary. However, to our best knowledge, there is no systematic review of CV studies that evaluates the range of determinants used to analyse WTP based on the valuation of persons that are not (yet) directly affected. Such information is needed to measure relevant variables and select relevant explanatory variables for regression models to analyse factors determining WTP, particularly if adjustments for covariates are planned. Considering relationships between potential determinants and the outcome(s) is the basis of any good (causal) research question.

Common approaches for variable selection are *p* value-based selection (forward, backward, or stepwise selection), as common in medicine and public health, or theory-based selection, as common in economics. Economic (theory) models are helpful to derive which factors influence the value of or demand for services and goods. For example, the Health Belief Model, by Rosenstock [15], describes the relevance of perceived susceptibility, perceived severity, perceived benefits, or perceived barriers on the perceived value of a health service. However, the relationships assumed in economic theory are often challenging to implement empirically because the required data are not available or cannot be recorded precisely. Thus, the question arises, which variables can be used best to represent or approximate the relationships assumed in theory.

We conducted this systematic exploratory review of CV studies in health care from an ex-ante perspective to summarise the currently available evidence on determinants used to analyse WTP for health services. This systematic review merges the approach of theory-based variable selection, as typical in economics, in causal inference, or epidemiology, and *p* value-based variable selection, as common in finding predictors in clinical prognosis or public health. Combining both approaches helps to improve the regression models by conducting better variable selection and raises awareness for the many facets influencing the perceived value of a health service. We provide an overview of potentially neglected explanatory factors and justify including explanatory variables that lack statistical significance in univariate analysis but are likely to impact WTP. Our intention is not to systematically (and quantitatively) summarise the unbiased effect estimates of WTP determinants. We rather focus on guiding those who plan the analysis of future WTP studies in health care by providing an overview of determinants used in previous studies so that the relevant variables can be considered in the planning of the survey and an explicit decision can be made on including or excluding them in the data collection. Our aim was, therefore, to show which determinants have been used in multivariate regression models with the outcome WTP and which of them actually showed a statistical significance as an indication for potential relevance.

Methods[1]

Inclusion and exclusion criteria

We included publications that reported determinants influencing WTP for health services. The studies had to report the independent variables, which are the basis for our determinants, for the regression model with WTP as the dependent variables. We assessed electronically available full papers published in English or German between January 1999 and October 2021. Our search period starts in 1999 because there is already a comprehensive and transparently reported systematic review until 1998 [5]. For a publication to be included in our review, the study design had to apply the CV method. However, neither the type of the CV method, for example, bidding game, open-ended questions, payment card or discrete choice questions, nor the format of WTP or the type of the regression analysis model, including survival analysis, were restricted. Assessed interventions could be real or hypothetical (e.g. a hypothetical vaccination or treatment). Exclusion criteria included the use of utilities or QALYs as the dependent variable. We also excluded CV studies that asked participants to evaluate the WTP from another person's perspective.

The health services assessed had to be related to human health and medicine. They may concern the area of primary prevention, early detection, diagnostic testing, acute and emergency care and the care of chronically ill persons—in both inpatient and outpatient settings. We did not consider behavioural prevention programmes, assuming that the benefit of the service is challenging for unaffected persons to operationalise and capture the benefit of the intervention. We also excluded studies with veterinary or environmental topics, including disease transmission by animals, for example, via dogs, flies, or mosquitos, dental medicine, and genetic testing for the sole purpose of knowledge.

We applied an ex-ante perspective instead of an ex-post perspective. Numerous studies show that the need of oneself or dependants and the perceived risk impact the WTP [16–19]. Hence, we excluded all studies with pre-selected study populations that already had or currently have the disease of interest that should be cured, treated, or identified. Only restrictions of the study population to a sociodemographic group, such as mothers, men, or elderly persons that can still be considered representative of (parts of) the population, were allowed. Since the results shall be transferable to populations with compulsory health insurance for at least necessary hospital care, studies on supplementary and long-term care insurances were included. In contrast, studies on a general WTP for compulsory health insurance were excluded.

Search strategy

Our primary sources were databases from various disciplines, supplemented by an unsystematic internet search. The database search included ten electronic databases from economics, health and medicine, psychology, and sociology. The databases were *EconLit, ERIC, SocINDEX, PsycINFO, PsycARTICLES, MEDLINE, and PubMed Central (PMC)* via *PubMed, EMBASE, BIOSIS Previews,* and *MEDLINE(R) Ahead of Print* via *OVID*. In addition, the interdisciplinary database *Web of Science* was searched. The search period was from 1 January 1999 to October 2021.

The following search terms were used for the search: "contingent valuation" OR "willingness to pay" combined with a range of search terms describing types of regression analyses, "determinant*", or "predictor". Only for the interdisciplinary database *Web of Science*, the search term "medical" (all fields) was added to filter the results for our research question. The exact search strings are reported in Appendix A. We also browsed the reference lists for the included full texts to ensure we did not overlook research similar to our review or relevant publications for our analysis.

Selection procedure

All references found in the 11 databases were collected in the literature management program EndNote and checked for duplicates. Two authors (C. S. and M. F. T.) reviewed the titles and abstracts independently and checked for relevance. For all references that may contain results relevant to the review, the full texts were obtained and again independently checked for eligibility by these two authors. Any discrepancies were resolved by discussion. We applied the same eligibility criteria for an additional article from another source (expert referral); only the documentation in the flow chart in Fig. 1 is different, as only suitable publications were included.

The methodological quality of the included studies was not assessed. The wide variation in question types and elicitation formats makes classification and appraisal of the literature difficult. There is a lack of an appropriate quality assessment tool for CV studies. The applicability of the guidelines issued by the National Oceanic and Atmospheric Administration (NOAA) panel [20] for environmental economics is unclear for our health care setting, as also stated by Diener et al. [7]. A suitable appraisal of the quality of CV studies would include questions on the research aim,

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[1] A protocol for this systematic review has been submitted to the Research Committee for Scientific Ethical Questions (RCSEQ) at UMIT - University for Health Sciences, Medical Informatics and Technology. The approval is not available publicly but we can send it if requested.
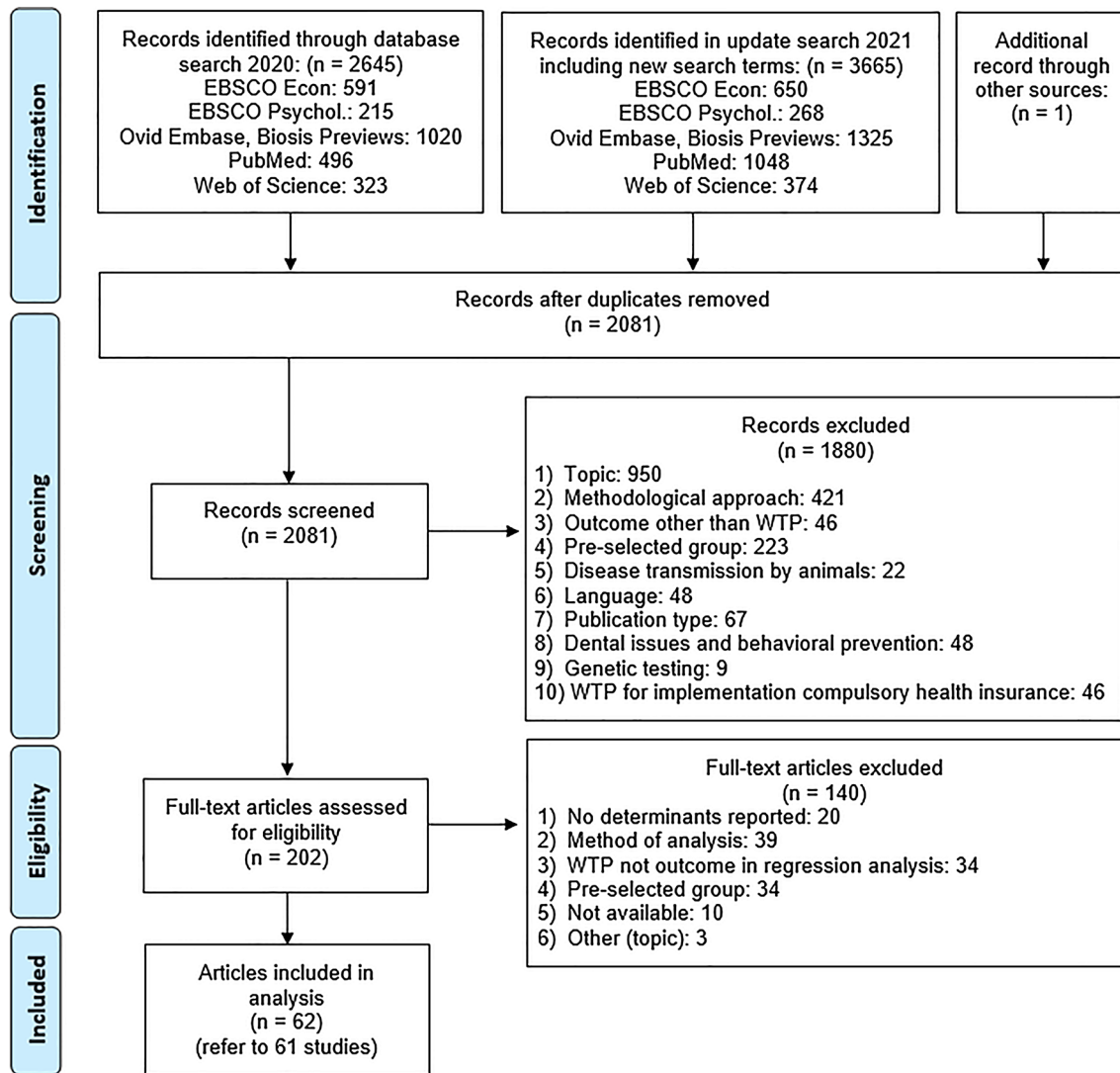
Fig. 1 PRISMA flow chart for the selection of studies

the scope of the research question, which type of measure is used (compensation or equivalent valuation), and with which direction (WTP or willingness to accept) [21]. Since our inclusion and exclusion criteria are specific for the research aim of this systematic review, we eliminated some of the potential biases by focussing on studies from an ex-ante perspective evaluating WTP for health services that imply a gain for the user/respondent (directly or indirectly) and the stated WTP serves as compensation for receiving the option for the health service. The validity of an included study as cost–benefit evaluation would not be relevant for the primary research question of this review: which determinants were used in the full regression models evaluating WTP for health services and which of these had, according to the authors, a statistically significant influence on WTP?

Data extraction and synthesis

Systematic extraction forms and evidence tables were developed before the literature search, which contained the following parts to summarise the content of the included publications:

1) Study characteristics: name of the first author, year of publication, objective of the study, location of the study, time of recruiting and data collection, study population and study centres, number of participants analysed in the regression model, gender, and age of the participants (Table 1).
2) Methodological information: data collection, attributes of the CV method used, and the type of regression analysis (Table 2).

3) Determinants used as explanatory variables in the full regression models with information on the frequency of use and the level of statistical significance (Tables 3 and 4) are the primary outcomes of our review.

The determinants result from the text analysis of the included publications. We defined a "determinant" as an individual independent factor in a regression model. Each determinant may comprise a thematic set of synonymous or comparable explanatory variables. In addition to age and gender, we generated new determinants deductively during the extraction process based on the aspects used in the regression models reported in the publications. We summarised the used determinants thematically and yielded superordinate domains. In addition to the domain "sociodemographic factors", we used the concepts from the Health Belief Model [15] as separate domains that allow a clear distinction. The four original concepts of the theoretical model are "perceived threat" (including perceived susceptibility and severity of disease), "perceived barriers", and "perceived benefits". Table 6 describes the domains in more detail.

Each publication was summarised in one table row in the systematic evidence tables, even if multiple regression models were described with WTP as the dependent variable. If multiple regression models were compared in one publication or there was more than one variable or variable characteristic addressing the same determinant (e.g. several dummy variables describing multiple income categories), the most decisive result, respectively, the lowest p value reported, was used, regardless of how many other variables had a higher p value. If a pooled model was reported for the entire study population, the results of the pooled model were chosen. While this simplification tends to yield more statistically significant determinants relative to the determinants used, this adjustment was necessary for the summary of results. Since the aim of the review is exploratory, this simplification is not expected to result in a loss of information.

To compare the frequency of use of determinants in regression models, we generated three different scoring options per determinant:

1) Statistically significance/trend: the explanatory variable showed an association with WTP that was statistically significant ($p < 0.05$) or indicated a trend (i.e. $p \leq 0.1$)
2) No statistically significance/trend: no explanatory variable showed a statistically significant association (or trend) with WTP (n.s.)
3) The determinant was not used in the full regression model (n.u.)

Data were extracted from the publications by one author (C. S.) and verified by a second author (M. F. T.). Questions arising during the extraction process were solved by discussion. We report use and statistical significance per determinant and study in an extraction table (Table 3) and summarise determinants and frequency of use in a systematic evidence table (Table 5). The detailed results of the evaluation according to the characteristics "*statistically significant impact on WTP*", "*no statistically significant impact*", and "*not used*" are reported in Table 3. For each determinant, we calculated the relative frequency for the use of this determinant about all publications (see column 2 in Table 5) and the proportion of being statistically significant compared to all studies in the review (see column 3 in Table 5). We did not calculate average values for "additional information".

Finally, we derived thematic domains based on the determinants identified. The determinant labels and descriptions of the domains were critically discussed between all the authors until consensus was reached.

Results

Study selection

The database search yielded 6310 hits, and one additional publication was included due to an expert recommendation. After removing duplicates, 2081 titles and abstracts were checked for eligibility and inclusion in the review. After this step, 202 publications were checked as full texts for eligibility. Sixty-two publications met the inclusion criteria and were included in the review. The selection process documentation with reasons for exclusion is shown in the PRISMA flow chart in Fig. 1.

Most records were excluded because the topic of the publication did not fit the research question or had no relation to health or medicine (e.g. addressing environmental issues, nutrition, societal or social issues, or methodological aspects). Further records were removed as they did not apply the CV method (e.g. cost-effectiveness studies or discrete choice experiments without explicit results for determinants or health services). A list with the references of all excluded full texts can be found in Online Resource 1. The 62 publications included refer to 61 different CV studies.

Description of studies

As described in Table 1, the studies included in this review were conducted in 45 countries in Asia, Africa, Europe, North and South America. Across the 62 studies, data of a total of 61,983 participants were included in the regression analyses. In 31 publications referring to 30 studies, data were collected via interviewer-administered CV

Table 1 Characteristics of the publications included in the evaluation ($n=62$)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
1	Al-Hanawi [23]	To investigate the WTP of Saudi people for improvements to the quality of public health care services	Saudi Arabia	Heads of households in Jeddah	1187
2	Arize [24]	To examine the level of awareness, acceptability, and consumers' WTP for telemedicine services	Nigeria	Nsukka senatorial district in Enugu State, Nigeria; persons who were either residents or pursuing livelihood activities	370
3	Baji [60]	To gain knowledge on the acceptance of user fees for health services (specialist examination or planned surgery) with good quality and quick access and to evaluate the influence of prior informal payments	Hungary	Sample from the ASSPRO CEE 2007 study, which is representative of the population	1037
4	Banik [82]	To investigate the determinants of intention to receive a COVID-19 vaccine and WTP	Bangladesh	Social-media users (Facebook, WhatsApp, etc.) in Bangladesh (data anonymous)	894
5	Basu [25]	To determine how much support there will be for any pharmacological intervention for Alzheimer's disease prevention and how different demographic and socioeconomic groups may value new preventive strategies for reducing future risks of getting the disease	United States	Data were obtained from the Health and Retirement Study (HRS)-2002; older US adults aged 50 or above who reached a cognitive score of normal cognition and better	678
6	Bishai [51]	To assess the determinants of demand for HIV/AIDS vaccine among prime-age and childbearing adults and estimate the impact of vaccination on risk behaviours in a high-prevalence, low-income country	Uganda	1071 households in 12 districts of Uganda, up to 3 persons per households could be interviewed; in total, 1677 participants	1677
7	Borges [72]	To understand the extent of society's willingness to finance other individuals' healthcare expenditures through out-of-pocket payments and the effect of personal characteristics and risky behaviours on WTP	Portugal	The general public in Portugal, the survey link was available on various social networks; the sample was representative of the population	296
8	Bouvy [61]	To determine the WTP for regulatory requirements related to reducing the risk of pure red cell aplasia associated with epoetin alpha use in the Dutch general public and dialysis patients	The Netherlands	General public and dialysis patients; survey conducted by survey sampling agency in public and in several dialysis clinics for patients	Public: 396; patients: 68
9	Brau [73]	To study the determinants of the WTP for long-term care insurance coverage, either funded by the public (taxes) or voluntarily (premium). WTP was queried for an extension of cost coverage from 75 per cent to higher	Italy	Sample of families in the Italian region Emilia-Romagna	1415
10	Carlsson [26]	To estimate the benefits of on-demand and prophylaxis treatment strategies for severe haemophilia in monetary terms	Sweden	The general public (household panel representative for Swedish population); recruited via phone, informed via letter, followed by a phone call from an interviewer from GfK Sverige AB	609
11	Catma [27]	To estimate the individual WTP for a COVID-19 vaccine and evaluate its predictors	United States	General public (convenience sampling), online recruiting via email by QuestionPro	1285
12	Cerda [28]	To estimate WTP for a COVID-19 vaccine and to identify determinants influencing individual vaccination decisions	Chile	General public with internet access, recruited via open invitations in social media networks and promoted via advertisements	531

Table 1 (continued)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
13	Dieng [29]	To compare the WTP of women of childbearing age to receive drug treatment in the event of failed ovulation according to 3 different contingent valuation methods	Canada	Women in Quebec being able to complete the survey in French; distribution of question-naire via email list from previous study and web-based	610: 199 DC, 230 DC-OE, and 181 MBDC
14	Frew [62]	Investigating two types of screening for colorectal cancer (faecal occult blood test and sigmoidoscopy) using either open-ended questions or payment scale as contingent valuation format	UK	General population living in Trent region of east-central England; 22 general practitioner practices distributed questionnaires	2214
15	Gonen [30]	To investigate fertility intentions of men aged 18–59, as expressed in a willingness to cryopreserve sperm for future use in procreation, measured in WTP for cryopreservation	Israel	Israeli Jewish from Tel Aviv, Jerusalem, Haifa, and Beer Sheba. First contact by telephone, the questionnaires were sent to participants and completed in Google Docs	499
16	Habbani [52]	To analyse the extent of WTP for good quality public health services in relation to respondents' demographic and socioeconomic characteristics. Two groups are evaluated separately: group 1 already pays for the services assessed, and group 2 does not	Sudan	The general public in Khartoum	Group 1: 388; Group 2: 62
17	Hansen [31]	To investigate the WTP for rapid diagnostic tests performed by drug-shop vendors	Uganda	25 drug shops in the Mukono District were randomly selected	519
18	Harapan [32]	To measure the willingness to pay (WTP) for a COVID-19 vaccine and its determinants in Indonesia	Indonesia	Community members in six provinces (Aceh, Bali, DKI Jakarta, Jambi, West Sumatra, and Yogyakarta), recruited by snowball sampling	1359
19	Himmler [33]	To determine whether investing in an early warning system for infectious diseases and foodborne outbreaks offers value for money by estimating people's WTP in six European countries	UK, Denmark, Germany, Hungary, Italy, and The Netherlands	Public sample (online)	2713
20	Kim [34]	To justify the use of the CVM to elicit the WTP for counsel-ling services and to analyse the sociodemographic and psychological factors, which influence WTP (through an increase in insurance premiums) for counselling services	South Korea	448 college students and 113 office workers	555
21	Kim [74]	To assess the need and WTP for physician home visits among the community-dwelling Korean older population and determine the most critical factors influencing older adults to use the service	South Korea	People aged 60 years or older from five regions, who were randomly selected from a nation-wide dataset	797
22	Kim [35]	To provide crucial information on identifying the public's WTP for hospice care services and its preferences for the decision of reimbursement level of hospice care	South Korea	Seoul, five other metropolitan cities, seven small and mid-sized cities, and three counties	490
23	Kitajima [53]	To estimate the valuation of long-term care insurance in residents of Tokyo using the WTP approach comparing two age groups—Group 1: 65 years and over and Group 2: 40–64 years	Japan	Residents of a municipality located in a subur-ban area of Tokyo received the questionnaire via mail and returned it at their residence	Group 1: 305; Group 2: 355

Table 1 (continued)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
24	Lakic [54]	To determine the general population WTP for cognitive pharmacist service in community pharmacy, describe the behaviour of participants regarding health care issues, and evaluate the correlation between participants' sociodemographic characteristics or attitudes and their WTP	Serbia	General population visiting community pharmacies	431
25	Lamiraud [63]	To assess the impact of information on patients' preferences in prescription versus over-the-counter delivery systems	Switzerland	Outpatient clinics of the University Hospital of Lausanne; laypeople and health professionals	534
26	Mavrodi [36]	To elicit the Greek population's WTP for a health improvement (recovery to perfect health), examine attitudes regarding healthcare services provision, and investigate factors influencing their intention to pay for health, reported separately for persons with and without WTP	Greece	Greek population, a representative sample from all 9 geographical regions in Greece	1342; 883 analysed
27	Milligan [37]	To analyse the socioeconomic and demographic factors that are related to the willingness to pay (WTP) for cancer prevention of US middle-aged and older adults	United States	Data from the 2002 Health and Retirement Study (HRS) were analysed, which are representative of the US population	466
28	Nayak [55]	To examine older adults' test preferences for osteoporosis screening, their willingness to travel for screening, and willingness to pay $100 for a better screening test	United States	Residents aged 60 and older, living in the greater Pittsburgh region, who are listed in a study registry (seems representative for the older community)	1268
29	Onwujekwe [56]	To provide information on the potential role of community solidarity in increasing access to contraceptives for the most-poor people through exploration of the role of altruism by determining the level of altruistic WTP for modern contraceptives across different geographic contexts	Nigeria	720 randomly selected households per state in 6 Nigerian states, from each an urban and a rural area (targeted respondents were females of childbearing age)	4517
30	Onwujekwe [38]	To determine WTP and the benefit–cost of modern contraceptives delivered through the public sector in Nigeria	Nigeria	Randomly selected households in 6 Nigerian states, from each an urban and a rural area (preferred respondents were females)	4517
31	Oremus [39]	To determine Canadians' acceptance of an increase in annual income tax to fund a public program for unrestricted access to Alzheimer's disease medications	Canada	Randomly chosen households from all 10 provinces, aged 18 years or older	500
32	Pavel [75]	To estimate WTP of consumers for specific attributes to improve the quality of health care they received. Attributes were geographical proximity, waiting time, the attitude of hospital staff, seeing the same doctor, doctor-patient relationship, drug availability, and a chance of recovery	Bangladesh	Patients seeking care in one of three locations: MAG Osmani Medical College Hospital, Jalalabad Ragib-Rabeya Medical College & Hospital or Women's Medical College & Hospital	252
33	Pavlova [64]	To investigate the ability and WTP for outpatient, inpatient and dental services	Bulgaria	Consumers of public health services living in municipalities in the city of Varna and small towns and villages in this region	990

Table 1 (continued)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
34	Poder [9]	To measure the willingness to pay (WTP) of women aged 18–45 years to receive drug treatment for ovulation induction (i.e. the social value of regular cycles of ovulation for a woman of childbearing age) to inform funding decisions on fertility care	Canada	Female Quebec residents aged 18–45 years The general population of Quebec	327: Paper: 136 Internet: 191
35	Poder [22]	To evaluate whether the population of Quebec has a WTP higher than initial costs to establish interdisciplinary musculoskeletal clinics, which are needed due to a lack of orthopaedic surgeons	Canada	Quebec residents aged 18 or over	3822; 3422 analysed
36	Rajamoorthy [57]	To investigate and ascertain the determinants of WTP for adult hepatitis B vaccine	Malaysia	Nine districts of Selangor state, Malaysia	728
37	Rezaei [76]	To assess the willingness to accept and WTP of mothers attending primary health centres for vaccines to their children during 2019	Iran	Mothers attending primary health centres to receive vaccines for their children aged 2 to 18 months, Kermanshah city/western Iran (metropolitan city)	667
38	Rheingans [40]	To explore community valuation of lymphatic filariasis elimination efforts by estimating household and community WTP to prevent transmission and treatment	Haiti	Community of Leogane, Haiti	583
39	Saengow [41]	To elicit the WTP for a nationwide screening programme for colorectal cancer with a co-payment. The two proposed screening alternatives are annual faecal immunochemical test (FIT) and once-in-10-year colonoscopy	Thailand	Screening patients without cancer or screening experience visiting the primary care clinic, Songklanagarind Hospital in Songkhla province	437
40	Sarasty [42]	Determine the demand for a COVID-19 vaccine by identifying individuals' hypothetical WTP for the vaccine, incorporating vaccine characteristics (duration of protection and efficacy) and participant characteristics	Ecuador	Online panel of Ecuadorian individuals	1050; 972 analysed
41	Sarker [43]	To measure the private demand for oral cholera vaccines in Bangladesh and to investigate the key determinants of this demand, reflected in the household's WTP	Bangladesh	Heads of households, their spouses or a major economic contributor of the households from the high-risk urban areas Kamrangirchar, Hazaribagh, and Rayer Bazar	1051
42	Schulz [77]	To assess WTP of potential users of "Quality of Life Technologies" designed to enhance functioning and independence	United States	Members of the Knowledge Networks (KN) Knowledge-Panel, a probability-based, online, non-volunteer access panel; sampled non-Internet households were provided with a computer and free Internet service	530
43	Seyedin [78]	To estimate private and altruistic WTP to improve hypothetical health status in the emergency department	Iran	Patients visiting a hospital emergency department in Tehran	300
44	Terashita [79]	To measure residents' WTP for municipality hospital services and evaluate municipality hospital valuation based on WTP	Japan	Residents of K town, located in the Hokkaido prefecture of Japan	40

Table 1 (continued)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
45	Ternent [44]	Evaluate the influence of gender in the monetary valuation of the benefits of maternal health improvements	Burkina Faso	Members of the local community in Nouna District, Burkina Faso; randomly selected households; (male) head and another female member of the household with household decision-making responsibilities	409 married couples
46	Tran [45]	To investigate barriers related to knowledge–attitude–practice about the HPV vaccine and WTP for the vaccine among those using services in an urban vaccination clinic	Vietnam	Patients of an urban vaccination clinic in Hanoi, Vietnam	432; 273 analysed
47	Trudeau [58]	To evaluate regional attitudes towards the emerging COVID-19 outbreak and WTP for COVID-19 testing	Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Rep., Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Uruguay	Social-media users in 16 Latin American countries	5504
48	Udezi [65]	To determine the WTP for 3 hypothetical malaria vaccines with different levels of protection (in years), effectiveness, and adverse effects; and to identify factors that influence the price, which people are willing to pay	Nigeria	A convenience sample of individuals who were at the pharmacy waiting area of the state-owned hospitals located in Benin City and Warri, Nigeria	359
49	Wang [46]	To estimate WTP for long-term care insurance and to explore the determinants of demand for long-term care insurance	China	Citizens in Qinghai and Zhejiang	1743
50	Wang [80]	To investigate individuals' WTP and financing preference for COVID-19 vaccination during the pandemic	China	The general public, network stratified random sampling; an anonymous survey on the largest online survey platform in China, Wen Juan Xing	2058
51	Whittington [81]	To evaluate WTP as a proxy for private demand for a hypothetical vaccine that would provide lifetime protection against HIV/AIDS to an uninfected adult	Mexico	Recruiting citizens using the intercept approach in plazas, shopping malls, and other public places in Guadalajara, Mexico	234
52	Whynes [66]	To investigate metrical properties of two WTP formats, the open-ended question versus the payment scale, in the context of screening for colorectal cancer (faecal occult blood versus Flexi-scope)	UK	Questionnaires were distributed via a group of primary care physicians in the Trent region of east-central UK	2767
53	Wolff [67]	To investigate whether there was a difference in willingness to pay (WTP) between prevention and treatment for health benefits of equal magnitude	Sweden	Swedish general population via a web-based survey instrument, the "Health Report"	1901
54	Wong [68]	To assess predictors of the intent to receive the COVID-19 vaccine and the WTP for the vaccine using the items from the health belief model	Malaysia	Malaysian residents who were between 18 and 70 years and on social network platforms (Facebook, Instagram, and WhatsApp)	1159

Table 1 (continued)

ID	References	Objective (as stated by the authors of the study)	Country	Study population and study centres	n participants[a]
55	Yang [59]	To investigate the WTP for a medical device to prevent diabetic foot ulceration among the general public	UK	Recruitment via "Research Now", an online market research company that has access to a panel of over 600,000 UK residents	1051
56	Yasunaga [69]	To (1) measure WTP for cardiovascular disease treatments in Japan's health care system, (2) analyse various factors affecting WTP, and (3) discuss the health policy implications of the results	Japan	Citizens	547
57	Yasunaga [70]	To measure the general public's WTP for cancer screening with positron emission tomography (PET) and determine consumer characteristics influencing WTP by comparing two groups: with and without information on 'false negative' and 'false positive' results	Japan	The general public (registered internet users living in Japan)	274
58	Yasunaga [71]	Testing the hypothesis if having sufficient information on prostate cancer screening reduces men's desire for screening	Japan	The general public (registered internet users living in Japan)	110
59	Yasunaga [49]	To measure the general public's willingness to pay (WTP) for mammography screening to quantify anxiety or peace of mind in mammography screening	Japan	The general public (registered internet users living in Japan)	397
60	Yasunaga [47]	The aim was to test the hypothesis of whether sufficient information reduces WTP for PSA screening. Further development of previous research design with a larger sample, DBDC questions instead of payment cards, and examination of participant backgrounds	Japan	The general public (registered internet users living in Japan)	400
61	Yasunaga [48]	To measure the general public's WTP for whole-body fluorodeoxyglucose-positron emission tomography (FDG-PET) after providing them with sufficient information regarding the efficacy and limitations of the service	Japan	The general public (registered internet users living in Japan)	390
62	Yasunaga [50]	Compare the willingness of well-informed and ill-informed men to pay for prostate (PSA) specific antigen PSA screening	Japan	The general public (registered internet users living in Japan)	1800

ID	Gender/sex, n (%)[b]	Age in years (mean)	Time of study	Study design/data collection
1	Gender female: 152 (12.8)	39 (range: 20–75)	October 2014–February 2015	Pre-tested interviewer-administered CV questionnaire
2	Gender female: 163 (44.0)	43 (SD: n.d.)	n.d.	Pre-tested interviewer-administered CV questionnaire
3	Gender female: 556 (53.6)	46.3 (SD: 17.57)	July 2010	Pre-tested interviewer-administered CV questionnaire
4	Sex female 450 (50.3)	30 (SD: 9.2) (range: 18–60)	10 December 2020–10 January 2021	Online survey (tool: Google Forms)
5	Gender female: 359 (53.0)	68 (range: 50–96)	Sample of HRS-2002 survey (biennial Health and Retirement Study)	Interviewer-administered CV questionnaire

Table 1 (continued)

ID	Gender/sex, n (%)[b]	Age in years (mean)	Time of study	Study design/data collection
6	Sex female: 947 (56.5)	18–29: 45.9% 30–39: 29.2% 40–49: 15.4% 50–60: 9.5%	December 2001–March 2002	Interviewer-administered CV questionnaire
7	Sex male: 127 (42.9)	18–25: 12.8% 25–35: 37.8% 36–45: 32.1% 46–55: 13.2% 56–68: 4.1%	6 months in 2015	Online survey (pre-tested)
8	Sex male: general public: 50 (12.6); patients: 60 (88.2)	General public: 41 (SD: 0.7); patients: 62 (SD: 1.8)	April 2009	Interviewer-administered CV questionnaire (Survey via agency)
9	Sex female: 637 (45.0)	49.0 (SD: 12.7)	Winter 2002 and spring 2003	Open-ended face-to-face interviews (survey company)
10	Gender male: n.r. (49)	20–29: 19% 30–39: 20% 40–49: 20% 50–59: 20% >59: 20%	30 November 2002–15 January 2003	Computer-assisted telephone interview (pre-tested)
11	Gender female: 904 (70)	18–24: 14% 25–35: 25% 36–45: 16% 46–55: 14% 56–65: 15% >65: 18	1st week in November 2020	Online survey
12	Gender female: 212 (40)	18–29: 12% 30–39: 22% 40–49: 26% 50–59: 25% $\geq$60: 15%	10 July–10 August 2020	Online survey
13	Gender female: 610 (100)	(Range in all groups: 18–45)	January 2009–February 2010	Online survey (via survey company)
14	Gender female: 1400 (63.2)	Median: 49.0 (IQR: 37–60); <45: 38.4%	n.d.	Self-administered questionnaire
15	Gender male: 499 (100)	18–22: 6.6% 23–27: 45.2% 28–32: 20.3% 33–37: 9.6% 38–42: 7.2% 43–47: 5.9% 48–59: 5.2%	n.d.	Online survey (via survey company)
16	Gender female: 283 (62.9)	31–40: 79.1%; 41–50: 20.9%	2001	Interviewer-administered household survey

Table 1 (continued)

ID	Gender/sex, n (%)[b]	Age in years (mean)	Time of study	Study design/data collection
17	Gender female: 244 (47.0)	15–24: 22.2% 25–29: 15.6% 30–34: 14.8% 35–39: 14.3% 40–49: 15.6% >50: 16.4%	5 weeks, June–July 2009 during the peak of the rain season	Exit interviews with drug-shop customers
18	Gender female 729 (68.5)	<20: 14.6% 21–30: 53.1% 31–40: 22.3% 41–50: 5.0% >51: 5.0%	25 March–6 April 2020	Online survey
19	Gender female: 1601 (51.0)	42.2 (SD: 14.0)	February–March 2018	Online questionnaires
20	Gender female: 315 (56.8)	Students: 22.9 (SD: n.d.) Office workers: 38.4 (SD: n.d.)	n.d.	Interviewer-administered CV questionnaire
21	Gender female: 445 (55.8)	70.6 (SD: 7.5)	n.d.	Interviewer-administered CV questionnaire
22	Gender female: 329 (65.8)	42.7 (SD: 10.7)	4–18 April 2008	Interviewer-administered survey (survey company)
23	Sex female: Group 1: 49.2%; Group 2: 52.1%	Group 1: ≥65 Group 2: 40–64	1997	Self-administered questionnaire
24	Gender female: 271 (62.9)	45.1 (SD: 16.1)	25 April–25 May 2016	Self-administered questionnaire
25	Gender male: 321 (60.2)	32.0 (SD: 13.4)	Winter 2000/2001 and summer 2001	Self-administered questionnaire
26	Gender female: pos. WTP: 281 (53.2); no WTP 227 (57.5)	Pos. WTP: 46.2 (SD: 16.6); no WTP 53.9 (SD: 17.7)	January–February 2019	Computer-assisted telephone interview
27	Gender female: 44.6%	68.51 (SD: n.r.)	February 2002–March 2003	Interviewer-administered survey
28	Sex female: 664 (58.7)	73.3 (SD: 7.3; range: 60–93)	Email request in November 2007, 6-month period to complete the survey	Self-administered questionnaire
29	Sex female: 4123 (91.0)	31.4 (SD: 7.1)	n.d.	Interviewer-administered CV questionnaire
30	Sex female: 4125 (91.3)	31.4 (SD: 7.1)	1 August–31 October 2010	Interviewer-administered CV questionnaire
31	Gender female: 305 (61.0)	Median: 51 (IQR: 40–64)	n.d.	Interviewer-administered CV questionnaire/telephone survey
32	Gender n.d.	n.d.	2011	Face-to-face interviews
33	Gender female: 473 (47.8)	46.2 (SD: 17.0)	May–June 2000	Interviewer-administered questionnaire
34	Gender female: 100	Paper: 30.38* Internet: 32.25*	2 January 2009–31 July 2010	Internet surveys and self-administered paper surveys
35	Male n.r. (0.49)	49.2 (SD: 15.5)	February–October 2010	Internet surveys, telephone surveys, and self-administered paper surveys
36	Gender female: 331 (45.5)	40.0 (SD: 11.0)	January–May 2016	Questionnaire-based face-to-face interviews
37	Sex female: 676 (100)	30.8 (SD: 6.6)	September–December 2019	Self-administrated open-ended questionnaire

Table 1 (continued)

ID	Gender/sex, n (%)[b]	Age in years (mean)	Time of study	Study design/data collection
38	Sex female: 416 (71.4)	39.1 (SD n.d.)	November–December 1997	Face-to-face interviews
39	Gender female: 254 (58.1)	50–54: 27.2 55–59: 31.6 60–64: 25.4 65–69: 15.8	June–August 2013	Face-to-face interviews
40	Gender female: 379 (0.39)	33.21 (SD: 11.4)	2–7 April 2020	Online survey
41	Sex female: 848 (80.7)	33.0 (SD n.d.)	23 December 2015–16 January 2016	Interviewer-administered CV questionnaire in respondent's house
42	Gender female 51.7 (274)	45–54: 42.6 55–64: 35.3 65+: 22.1	n.r.	Online survey
43	Sex female: 123 (41.0)	<40: 36% ≥40: 64%	June–July 2018	Open-ended face-to-face interviews
44	Sex female: 19 (47.5)	<59: 30% 60–69: 30% >70: 40%	3–24 September 2009	Face-to-face interviews
45	Gender female: 409 (50.0)	Males: 47 (SD: n.d.) Females: 39 (SD: n.d.)	June–July 2005	Interviewer-administered CV questionnaire
46	Gender female: 314 (72.7)	27.0 (SD: 5.7)	March–April 2016	Interviewer-administered CV questionnaire
47	Sex female: n.r. (58.4) (weighted mean)	40.0 (SD: n.r.) (weighted mean)	19 March–5 April 2020	Online survey
48	Sex female: 216 (60.2)	18–24: 25.6% 25–34: 43.7% 35–44: 24.5% ≥45: 6.1%	n.r.	Interviewer-administered CV questionnaire
49	Gender female: 668 (38.3)	<35: 21.2% 35–65: 55.8% >65: 23.0%	Summer 2010	Interviewer-administered CV questionnaire
50	Gender female: 1115 (54.2)	18–25: 23.1% 25–30: 19.4% 31–40: 25.4% 41–50: 24.8% 50+: 7.3%	1–18 March 2020	Online survey
51	Gender male: 117 (50.0)	n.r. (range: 18–60)	November 1999	Interviewer-administered CV questionnaire
52	Gender female: 1716 (62.9)	49 (IQR: 37–61)	n.r.	Randomised questionnaire survey
53	Sex female: 1008 (53.0)	51.78 (SD: 16.58)	October 2017 (until 6 weeks after sending questionnaire)	Online survey

Table 1 (continued)

ID	Gender/sex, n (%)[b]	Age in years (mean)	Time of study	Study design/data collection
54	Gender female 765 (66.0)	18–30: 31.6% 31–40: 32.3% 41–50: 21.1% > 50: 15.0%	3–12 April 2020	Online survey
55	Gender female: 536 (51.0)	45.9 (SD: 16.6)	December 2016	Online survey
56	Sex female: 246 (45.0)	n.r. (range: 40–49)	Email request on 22 February 2005, open for 2 days	Online survey
57	Sex female: 137 (50.0)	48.8 (SD: 5.7) (range: 40–59)	Email request on 21 December 2005	Online survey via internet research company
58	Sex male: 137 (100)	49.2 (SD: 5.6) (range: 40–59)	Email request on 21 December 2005	Online survey via internet research company
59	Sex female: 397 (100)	53.7 (SD: 2.7) (range: 50–59)	Email request on 17 January 2006	Online survey via internet research company
60	Sex male: 400 (100)	53.7 (SD: 2.7) (range: 50–59)	Email request on 17 January 2006	Self-administered online survey
61	Sex female: 196 (50.6)	48.9 (SD: 5.8) (range: 40–59)	Email request on 21 December 2005	Online survey via internet research company
62	Sex male: 1800 (100)	50–59: 50.0% 60–69: 50.0%	Email request on 12 February 2010	Online survey via internet research company

CVM contingent valuation method, *DC* dichotomous choice, *DC-OE* dichotomous choice followed by an open-ended question, *excl.* excluding, *HPV* human papillomavirus, *IQR* interquartile range, *MBDC* multiple-bounded discrete choice, *n.r.* not reported, *pos.* positive, *WTP* willingness to pay

[a]Refers to persons analysed in the regression model if not stated differently

[b]Information on number and proportion of females, respectively, males are reported as described in the publication. Therefore, there may be deviations in the proportion of the population analysed

Table 2 Type of regression analysis and CV method used

References	Type of regression analysis	CV method used to collect WTP values
Al-Hanawi [23]	OLS multiple regression; Tobit regression for factors on quality improvement	Bidding game (DBDC) with an open follow-up question; separately analysed for 6 attributes
Arize [24]	Logistic regression (outcome: WTP); Tobit regression as validity check	Bidding game (DBDC) plus maximum WTP if price increases
Baji [60]	Linear regression (separate for users and non-users)	Referendum question, payment intervals indicated on the visualisation card, and open-ended question
Banik [82]	Adjusted multivariable logistic regression	Dichotomous choice (yes/no); follow-up question on maximum WTP
Basu [25]	Interval regression/logarithmic transformation of upper and lower bound of interval (ln(WTP))	Bidding game (DBDC)
Bishai [51]	Multivariate regression analysis	Bidding questions; answer options: "Yes", "No" and "Yes, if I had the money"; if "No" or "Yes, if I had the money", follow-up question on willingness to be vaccinated if the vaccine is for free
Borges [72]	Ordered logit model	Open-ended question (answers were grouped into categories including Euro 0)
Bouvy [61]	Tobit regression (outcome: stated WTP) and interval regression (outcome: lower and upper bounds from payment scale)	Payment scale and open-ended follow-up question (FU-Cert)
Brau [73]	Tobit regression (separate for public and private payments)	Open-ended question
Carlsson [26]	Logistic regression (of absolutely certain yes-responses)	Bidding game (DBDC) (range: 0.71 Euro EUR 130) (FU-Cert)
Catma [27]	Interval regression	Bidding game (DBDC) with an open follow-up question
Cerda [28]	Probit regression	Bidding game (DBDC)
Dieng [29]	Probit regression	Dichotomous choice, dichotomous choice and open-ended question, or multiple-bounded discrete choice (MBDC) (FU-Cert)
Frew [62]	Linear regression (stepwise selection)	Open-ended question or payment scale
Gonen [30]	Multiple linear regression (OLS)	Double-bounded questions (closed-ended)
Habbani [52]	Logistic regression	Dichotomous choice (yes/no)
Hansen [31]	Linear regression	Bidding game (DBDC)
Harapan [32]	Linear regression	Bidding game (DBDC)
Himmler [33]	Linear regression	Bidding game (DBDC) (FU-Cert)
Kim [34]	Survival analysis/log-normal distribution	Bidding game (DBDC)
Kim [74]	Logit and Tobit regression	Open-ended question
Kim [35]	Survival analysis/Weibull distribution	Bidding game (DBDC)
Kitajima [53]	Logistic regression	Dichotomous choice (yes/no); 12 initial prices were randomly assigned to participants
Lakic [54]	Logistic regression	Dichotomous choice (yes/no); if "yes", follow-up question to choose one of five defined values
Lamiraud [63]	Random-effects interval regression	Payment card (intervals)
Mavrodi [36]	Logistic regression	Iterative closed-ended bidding game (MBDC) (FU-Cert)
Milligan [37]	Ordered logit regression and double-boundary maximum likelihood model	Bidding game (DBDC)
Nayak [55]	Multivariable logistic regression	Dichotomous choice (single-bounded)
Onwujekwe [56]	Tobit regression	Dichotomous choice (yes/no); follow-up question on maximum WTP
Onwujekwe [38]	Tobit regression	Bidding game (DBDC) and follow-up question on maximum WTP
Oremus [39]	Logistic regression	Dichotomous choice (yes/no) on the support of the program; if "yes", follow-up bidding questions on specific bids; if always "yes", open question
Pavel [75]	Seven partial Tobit regressions (on seven different attributes)	Open-ended question
Pavlova [64]	Generalised Tobit regression	Payment card and open-ended questions
Poder [9]	Probit model	Dichotomous choice (single question) (FU-Cert)
Poder [22]	Probit regression and Wang's models	Dichotomous choice (single question) (FU-Cert)

Table 2 (continued)

References	Type of regression analysis	CV method used to collect WTP values
Rajamoorthy [57]	Logit regression	Dichotomous choice (single-bounded)
Rezaei [76]	Multiple linear regression	Open-ended question
Rheingans [40]	Single bound probit regression	Two dichotomous choice WTP exercises
Saengow [41]	Probit regression and linear regression for positive WTP	Bidding game (DBDC) and follow-up question on maximum WTP
Sarasty [42]	Regression models (normal, Weibull, log-normal, exponential and log-logistic)	Bidding game (DBDC)
Sarker [43]	Natural log-linear regression	Bidding game (open-ended)
Schulz [77]	Logit regression	Open-ended question
Seyedin [78]	OLS regression	Open-ended question
Terashita [79]	Logistic regression	Open-ended question
Ternent [44]	OLS regression	Bidding game with up to 5 steps
Tran [45]	Stepwise logistic and interval regressions	Bidding game (DBDC) and open-ended questions
Trudeau [58]	Logit model	Dichotomous choice (yes/no) (FU-Cert)
Udezi [65]	Linear multiple regression analysis	Payment cards with different price options
Wang [46]	Random-effects logistic regression	Bidding game (MBDC); follow-up questions if open interval
Wang [80]	Tobit regression	Open-ended question and payment scale
Whittington [81]	OLS regression	(1) Highest price on the list absolutely certain to pay (lower bound) and (2) lowest price absolutely certain not to pay (upper bound)
Whynes [66]	Linear regression	Payment scale or open-ended format
Wolff [67]	Logistic regression (1st part) and OLS regression on ln(WTP)	Payment scale
Wong [68]	Multivariable multinomial logistic regression	Payment card (six-point scale)
Yang [59]	First part: logistic regression on probability for positive WTP; second part: general-ised linear regression if WTP is positive (outcome: ln(WTP))	Dichotomous choice (yes/no); if "yes", one of four categories had to be selected for an annual WTP; follow-up question on maximum WTP
Yasunaga [69]	Ordinal regression analysis	Payment cards (selecting one of 7 prices)
Yasunaga [70]	Categorical regression analysis	Payment cards, if no WTP, open follow-up question on willingness to receive service for free
Yasunaga [71]	Categorical regression analysis	Payment cards
Yasunaga [49]	Parametric survival model (Weibull)	Bidding game (DBDC) with 4 sub-groups
Yasunaga [47]	Weibull regression	Bidding game (DBDC) with 4 sub-groups
Yasunaga [48]	Parametric survival model (Weibull)	Bidding game (DBDC) with 4 sub-groups
Yasunaga [50]	Parametric survival model (Weibull)	Bidding game (DBDC) with 4 sub-groups

DBDC double-bounded dichotomous choice, *FU-Cert* follow-up question on the certainty of answer on WTP, *OLS* ordinary least squares, *MBDC* multiple-bounded dichotomous choice, *WTP* willingness to pay

questionnaires, either in person or via telephone. In 33 studies, participants filled the questionnaires themselves, either online or anonymously in printed form. Two studies used both administration modes [9, 22]. The proportion of women and men differed across studies. Differences were usually related to the study setting, the accessibility of respondents, or the research question. Twenty-two studies were published from 1999 to 2010 and 40 since 2011.

The CV study design, the types of the regression models, and the format of the WTP variable differ between studies, as described in detail in Table 2. Twenty-eight studies [23–50] applied a bidding game with double-bonded dichotomous-choice questions or more than two bidding questions, 13 studies [9, 22, 29, 51–59] used single dichotomous choice, 13 studies [60–71] applied payment cards, and 13 studies [62, 64, 66, 72–81] applied open questions as the primary survey method for WTP. Five studies [29, 62, 64, 66, 80] applied more than one WTP format. Of the studies using a bidding game, single dichotomous choice, or payment cards, 13 [23, 24, 27, 29, 38, 39, 41, 46, 54, 56, 59, 60, 82] added an open-ended follow-up question on WTP and eight [9, 22, 26, 29, 33, 36, 58, 61] used a follow-up question on the certainty of their answer on WTP. According to the research question and variable definition, regression methods applied included multiple linear, log-linear, logistic, ordinal, Tobit, Probit, and interval regression analyses as well as (parametric) survival analyses (see Table 2).

Identified determinants and domains

A total of 22 determinants were found, plus the category "other variables", as described in Table 4. Each table cell represents one of the 1364 evaluations—separately for 62 publications and 22 determinants each (additional variables excluded).

As shown in Table 5, over half of the studies used the following determinants in their multivariate regression models: "age", "gender/sex", "education", "income/wealth", "perceived own susceptibility", and "affectedness/perceived severity of disease". The category "other variables" comprises the determinant "methods and setting" of the study and fourteen additional variables (reported in Table 6) on heterogeneous factors that are relevant to specific research topics, for example, by describing differences in the study population or motivation for the health service. For example, we did not generate a new determinant for socioeconomic variables that were very specific to the context of a single country (e.g. "status of the respondent in the household" [38, 56]) or only used once and without a statistically significant influence on WTP (e.g. the number of persons with income in a household [79]). These variables were diverse and, therefore, summarised as "additional variables".

The number of variables used differed substantially between studies. The 62 publications, each including one or more regression models with WTP as the dependent variable, used on average 8.3 determinants (median 8; range 3–12) per study, of which on average five determinants (median 5; range 0–12) per study were statistically significant (see right column of Table 3). When comparing the groups, 61.1% of the determinants used showed a statistical significance or trend. Without the most used sociodemographic determinants "age", "gender/sex", "education", and "income/wealth", the number of determinants used is reduced to 5.1 per publication (median 5; range 1–10), of which 3.0 (57.7%) show statistical significance or trend. This narrow range of explanatory variables indicates a potentially too restrictive variable selection.

Based on the determinants used, five domains were derived: "sociodemographic characteristics", "perceived threat", "perceived benefits", "perceived barriers", and a group of variables that covered methodological aspects and study-specific aspects depending on the research question, called "other information". Table 6 shows the domains and the corresponding determinants and operationalisation, with a brief description of the domain. The labelling of three of the domains, "perceived threat", "perceived benefit", and "perceived barriers", is identical to the categories from the Health Belief Model (Rosenstock 1966) [15] because the established categories are separable and fit the determinants we found. It was not our original intention to map the determinants to the categories from the Health Belief Model; however, these categories were a perfect fit for our determinants. Some of the studies [27, 28, 32, 57, 68, 80, 82] also used the categories from the Health Belief Model for their data collection and thus reported corresponding variables.

By far the largest domain was "sociodemographic characteristics" ($n = 287$), followed by "perceived threat" ($n = 111$), including the susceptibility for and severity of condition or risk, "perceived benefit" ($n = 56$), including pre-knowledge and non-health benefits, and "perceived barriers" ($n = 58$) describing costs and barriers for access. Besides the most frequently measured socioeconomic variables in this domain [age ($n = 50$), gender ($n = 41$), education ($n = 45$), and income ($n = 57$)], over two-thirds of the studies used determinants describing the situation of the respondent: "perceived own susceptibility" ($n = 32$), "affectedness/perceived severity" ($n = 33$), and "personal mindset (affected relatives or attitude of living healthy)" ($n = 30$). These aspects help to understand the respondent's situation, subjective influence factors on WTP (e.g. perceived stigma [34]), and potentially conflicting interests for the money spent. For example, in one study, the mindset that the state should pay essential long-term care services to all versus only to the poor had a statistically significant association with WTP ($p < 0.01$).

Table 3 Determinants used in the studies and their statistically significant impact on willingness to pay[a]

ID	Age	Sex[b]	Marital status	Education	Size hh	Work activity	Income	Residence	Place of birth	Ethnicity	Confession	State of health	Susceptibility	Affectedness	Prior use	Pre-knowledge	Efficacy	Mindset[c]	Insurance status	Perceived access	Affordability	Method/setting	Σ n(det. sig.)/Σ n(det. used)
1	*	†	*	**			**	*				*		**					n.s.	**			9/10
2	n.s.	n.s.	n.s.	n.s.	n.s.		**	n.s.												n.s.			1/9
3	n.s.	†		n.s.		n.s.	*	**				**			n.s.				*	**			6/9
4	*	*	n.s.	**				**				**	*		n.s.	†	***						8/10
5	*	n.s.	n.s.	n.s.			**			**			**								*		4/7
6	***	*	*	**		n.s.	*						**	**		**	n.s.		*				9/10
7	n.s.	n.s.	n.s.	*			n.s.					n.s.	†						*				3/9
8												**	**					**					4/4
9	*	**		†		n.s.	**					**	**					**	**		**		7/8
10	**	n.s.			**	**	n.s.							n.s.								***	4/7
11	**	*		n.s.			**			n.s.		n.s.	n.s.	**	n.s.	n.s.	**	†	†		**		8/14
12				†			**							*									3/3
13	**			**		†	†					*	n.s.		n.s.			**					6/8
14		*		*			*						*		*			*				*	7/7
15	n.s.		n.s.				*				*			*			n.s.	n.s.			*		4/8
16				*	*	**	***						*	**	n.s.				*	n.s.			7/9
17	*			†		*	*						***	**	***					**			7/7
18						*	*				*	*	*			*		†					5/5
19	*	n.s.	n.s.	n.s.		n.s.	**					*	n.s.	n.s.	n.s.					n.s.			4/10
20	n.s.	n.s.				*	n.s.					n.s.		†	n.s.			**					2/6
21	n.s.	n.s.	†	*	n.s.	n.s.	n.s.	n.s.			n.s.	n.s.	n.s.	n.s.	n.s.			n.s.	n.s.	*			4/14
22		*	n.s.	n.s.	n.s.		**	**					**		*	n.s.		*	n.s.				3/12
23				*			**	n.s.					*		*	**				n.s.	***		5/5
24					*			n.s.						*		*							4/5
25	*	n.s.	†	†		n.s.	***	*				n.s.			n.s.	**		*	n.s.	*		**	6/11
26	*			***			***																3/3
27	**	n.s.	n.s.				**			†			**					n.s.		**			4/7
28[d]										**		***	*					**				***	6/6
29	***	†	†	***	n.s.	*	***	n.s.				n.s.		*				**	**				7/9
30	**	*	*	**	**	**	**	**				n.s.	*	*	*	*		**	*				12/12
31	*	n.s.		n.s.		n.s.	*	n.s.				n.s.	*	n.s.				*		**			5/11
32	**	†		†		***	**	n.s.										**				*	7/8
33	*	*		*	*	**	*	*				*			n.s.			n.s.					7/9
34	n.s.			***	n.s.	***	†					n.s.	n.s.	n.s.	n.s.		n.s.	n.s.			***	n.s.	4/13
35	**	n.s.	n.s.	**		**	**					*	n.s.	n.s.				n.s.		*	***	**	7/9
36				***			***			***			***	n.s.				n.s.		n.s.	***		5/8
37	*			n.s.	n.s.		*		n.s.										n.s.				2/5
38	**	n.s.					***						n.s.	*		**		***			***		6/9
39	n.s.	n.s.	*	†			n.s.						n.s.	*				*	†			†	6/10
40	n.s.	n.s.		n.s.	n.s.	†	**	†					n.s.	*		n.s.		n.s.	n.s.				4/11

Table 3 (continued)

ID	Age	Sex[b]	Marital status	Education	Size hh	Work activity	Income	Residence	Place of birth	Ethnicity	Confession	State of health	Susceptibility	Affectedness	Prior use	Pre-knowledge	Efficacy	Mindset[c]	Insurance status	Perceived access	Affordability	Method/setting	Σ n(det. sig.)/Σ n(det. used)
41	n.s.	*		n.s.	n.s.	*	**							*		n.s.		**		n.s.			5/10
42	n.s.	n.s.					*			*			*		n.s.			n.s.					3/7
43	n.s.	n.s.	n.s.	n.s.			**																1/5
44	n.s.	n.s.	n.s.	n.s.		n.s.	n.s.												n.s.	n.s.		n.s.	0/9
45	***	*		†			*							**							***		6/6
46	***		***	***	*		*							†		***		***					9/9
47	n.s.	**	n.s.	n.s.	n.s.	*	**						*	**						**	**		5/8
48	n.s.	n.s.	n.s.	n.s.		n.s.	*	n.s.				*	*	*					n.s.		n.s.		4/13
49	*	n.s.	n.s.	**			**	n.s.				n.s.							n.s.		**		4/9
50	†	n.s.	n.s.	†		n.s.	**	n.s.				n.s.	†					†		†			6/11
51	**	n.s.		n.s.		n.s.	**					n.s.	**		n.s.	n.s.							4/9
52	*		*	*			*							*				*				*	6/6
53	n.s.	***					***	*	**					***				***				***	7/8
54			*		**	***	*	n.s.					n.s.	**							***		5/8
55	*	**	n.s.	**		n.s.	*	n.s.		n.s.	n.s.	*	n.s.	**		***				*			8/13
56		***	***				***			n.s.		***		**		***			n.s.				6/7
57	n.s.	n.s.					**					n.s.	n.s.	n.s.		n.s.							1/6
58	†						**					n.s.	†	†		n.s.							3/5
59	n.s.						†					n.s.	***	***		**		***					5/7
60	n.s.						**					n.s.	*		n.s.	n.s.							2/6
61	n.s.	n.s.					†					n.s.	*	n.s.				*					3/7
62	**						**						**	**		**		n.s.					5/6
Σ sig.	30	18	9	30	5	14	51	7	1	5	2	13	23	25	4	13	2	22	8	11	12	8	
Σ n.s.	20	23	15	15	10	11	6	9	1	3	2	15	9	8	14	8	3	8	9	7	1	2	
Σ n.u.	12	21	38	17	47	37	5	46	60	54	58	34	30	29	44	41	57	32	45	44	49	52	

det determinant, *hh* household, *n* number, *n.a.* not applicable, *n.s.* not significant, *n.u. or empty cells* not used, *OOPP* out-of-pocket payment, *sig.* significance or trend

*** p<0.001

** p<0.01

* p<0.05

† p<0.1 (trend)

[a] The names of the determinants are used in an abbreviated form in this table. Please find the full names of determinants in Table 5. The order of the determinants is identical in both tables

[b] We combined gender and sex here. We included in Table 1 whether the information male/female refers to gender or sex if reported in the publications

[c] Refers to factors related to the general mindset of the respondent or the attitude of living healthy that comprises, for example, smoking, drinking, and dental visits

[d] The interaction term "Family history of osteoporosis × fall within past 5 years" was classified as "perceived own susceptibility" (refers to Nayak [55])

Table 4 Other variables (not assigned to other determinant categories)

References	Variable	Significance level
Baji [60]	Respondent is on sick pension	n.s
Catma [27]	Perceived effectiveness of policy measures	*
Lakic [54]	Pharmacists are seen as a source of information about medicines	*
Onwujekwe [38, 56]	Status in household	n.s./**
Pavel [75]	Nature of the setting, private versus governmental hospital	*
Pavel [75]	Reason of medical visit acute	n.s.
Poder [9]	Having a child	n.s.
Rezaei [76]	Sex of the child	n.s.
Schulz [77]	Concern about privacy	*
Terashita [79]	Number of persons with income	n.s.
Wang [80]	Employee size in the workplace	**
Whynes [66]	protest expressed at the idea of payment	*
Wong [68]	I am concerned if the new COVID-19 vaccine is halal	***
Wong [68]	I will only take the COVID-19 vaccine if the vaccine is taken by many in the public	n.s.

n.s. Not significant

$*p < 0.05$

$**p < 0.01$

$***p < 0.001$

$^{†}p < 0.1$ (trend)

A comparison between the six geographical regions according to the World Bank [83], Africa, East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, and South Asia, indicates very little influence of the World Bank region on the type of sociodemographic variables seen as relevant to describe the study sample. There were no major differences in the determinants used, as presented in Table 3. Variables on cultural differences might be more present in studies with high heterogeneity of the study population, which is more likely in countries with international citizenship and different main confessions. For example, "ethnicity" was primarily assessed in societies with a heterogeneous population as the United States, UK, and Malaysia [25, 27, 37, 55, 57, 59, 68]. The determinant "number of persons with income" was only assessed in a study from Japan [79]. "Confession/level of religiosity" only had a statistically significant influence in Israel and Indonesia. Only one study [33] comparing six European countries addressed cultural differences between countries in more detail and identified variations in income and risk aversion as the main differences between countries.

Discussion

This systematic review provides an overview of determinants used in multivariate regression models to analyse WTP for health services in the specific context of ex-ante evaluations of a health service by the general public using CV. We compiled this review of CV studies published since 1999 to show potentials for improvement in the current practice of analysing CV studies. We extracted the explanatory variables used in multivariate regression models, summarised them in 22 determinants, which could be compared across studies, and derived five thematic domains: "sociodemographic characteristics", "perceived threat", "perceived benefit", "perceived barriers", and "other information".

In this review, all determinants showed a statistically significant association (or trend) with WTP in at least one study. Such statistical association does not necessarily imply an independent causal relationship between the determinant and WTP. While the integration of sociodemographic variables was relatively common, other domains were mainly neglected. This fact is important because the variables from the lesser used domains predominantly show statistically significant impact on WTP if they were used. Consequently, based on the reviewed scientific literature, we suggest considering also rarely used variables as potential determinants for WTP. Examples of potentially relevant determinants that are rarely used are prior knowledge, information, attitude towards the health service, perceived risk, and affectedness. The narrow range of explanatory variables used (median 8; range 3–12) with a high proportion of statistically significant determinants (61.1% of determinants used) might be a problem since *p* value-based and model-based variable selection methods do not always adequately control for confounding [84]. Some explanatory factors or interactions between variables might be overlooked, even if they make the difference.

Table 5 Summary of determinants used in regression models

Determinant including different characteristics	Studies using determinant n (%)[a]	Statistical significance/ trend n (%)[b]
Age (in years or as a grouped variable)	50 (80.64)	30 (60.0)
Gender/sex[c] (reference category "male" or "female")	41 (66.12)	18 (43.9)
Marital status	24 (38.70)	9 (37.5)
Education	45 (72.58)	30 (66. 7)
Size household/family	15 (24.19)	5 (33.3)
Work activity/job type	25 (40.32)	14 (56.0)
Income/wealth	57 (91.93)	51 (89.5)
Geographic location and residence setting	16 (25.80)	7 (43.8)
Place of birth (country or urban/rural)	2 (3.22)	1 (50.0)
Ethnicity (nationality/race)	8 (12.90)	5 (62.5)
Confession/level of religiosity	4 (6.45)	2 (50)
State of health	28 (45.16)	13 (46.4)
Perceived own susceptibility	32 (51.61)	23 (71.9)
Affectedness/perceived severity of disease	33 (53.22)	25 (75. 8)
Prior use/disease history	18 (29.03)	4 (22.2)
Pre-knowledge/information	21 (33.87)	13 (61.9)
Efficacy/effectiveness	5 (8.06)	2 (40.0)
Personal mindset (affected relatives)/attitude of living healthy (smoking, drinking, dental visits)	30 (48.38)	22 (73.3)
Insurance status (including prior OOPP)	17 (27.41)	8 (47.1)
Perceived access (incl. waiting time and forgoing use)	18 (29.03)	11 (61.1)
Price of treatment and affordability	13 (20.96)	12 (92.3)
Methods and setting	10 (16.12)	8 (80.0)
Marital status	24 (38.70)	9 (37.5)

incl. Including, *N* number, *n.a.* not applicable, *OOPP* out-of-pocket payment

[a]Proportion refers to all 62 studies

[b]Refers to the number of regression models using the determinant and describes the proportion of determinants with statistical significance or trend (i.e. level of $p < 0.1$) among all studies that used this determinant

[c]We combined gender and sex here. If reported in publications, we included in Table 1 whether the information male/female refers to gender or sex

Table 6 Domains/areas of determinants

Domain	Determinants/operationalisation of domain
1. Sociodemographic characteristics	Age, gender/sex, marital status, education, size household/family, work activity/job type, income/wealth, geographic location/residence setting, place of birth (country or urban/rural), ethnicity (nationality/race), confession/level of religiosity
2. Perceived threat (= susceptibility for and severity of condition or risk)	State of health, perceived own susceptibility, affectedness/perceived severity of disease, prior use/disease history
3. Perceived benefit (also non-health-related benefits) and pre-knowledge	Efficacy/effectiveness, personal mindset (affected relatives)/attitude of living healthy (smoking, drinking, dental visits), pre-knowledge/information
4. Perceived barriers (= belief about tangible and psychological cost)	Insurance status (including prior OOPP), perceived access (incl. waiting time and forgoing use), price of treatment and affordability
5. Other information	Methodological variables and study setting, Additional variables ($n = 14$, reported in Table 4)

For example, suppose a disease is not perceived as severe. In that case, there is already an explanation as to why a bad state of health or one's own susceptibility does not have a statistically significant impact on WTP even if there is a realistic threat based on scientific evidence. We excluded the domain "other information" from the quantitative comparison of use and statistical significance. Variables in this domain were related to the analysis method, the setting, and the research question (listed in Table 4). These aspects are just as important as other domains but were diverse and difficult to summarise.

Unexpectedly, the main variables describing the scope of the health service, the price of the treatment, and efficacy were rarely used as determinants. In addition, hypothetical bias and scope effect were often addressed as a typical bias of CV studies in the introduction or discussion sections of the studies. Still, only a few studies took sufficient action to reduce the bias; for example, eight studies [9, 22, 26, 29, 33, 36, 58, 61, 81] asked the respondent in a follow-up question for their certainty regarding stated WTP. Previous literature has shown that methodological issues as different payment vehicles (e.g. tax, donation, or lump sum [22]), the anchoring effect (relates to the amount of starting bid) [44], the CV method used [29], the scope effect [9, 85], or the framing effect [66] can bias WTP estimates. Nevertheless, only ten studies [9, 22, 26, 41, 62, 63, 66, 67, 75, 79] included variables on the study design in the regression model to explain a possible influence on WTP. This result suggests that methodological variables, which could be helpful to control for bias related to the study design, are underrepresented in regression models analysing WTP. We did not expect further aspects to be addressed regarding the range of the determinants found. How the determinants are operationalised within a specific CV study depends on the research question and the setting. Consulting experts in the field of study will be helpful.

Instead of judging which explanatory variables are the most important determinants to use for further analyses, we aimed to create awareness for potentially significant relations between more neglected determinants and WTP. The main benefit of our research is the summary of relevant studies to show a potential lack of addressing relevant determinants in regression models. In addition, we provide studies that can be cited for theory-based variable selection or to justify the inclusion of less commonly addressed issues in CV questionnaires. We hope to contribute to a worthwhile and meaningful variable selection by sensitising researchers to the importance of perceived benefits and barriers related to the health services assessed, perceived susceptibility for the condition assessed, previous experiences, sociocultural, environmental, and other factors influencing the value of a health technology. For example, cultural aspects will help interpret differences in WTP between countries if social desirability, shaped by moral values of a society [30], and perceived stigma by society [86], as motivations for use, differ. The monetary value of WTP and well-chosen determinants provide important information for policymakers to understand what determines the value of a health technology for the public. Ultimately, our review may lead to better studies and better health policy decisions based on insightful information derived from a broad range of relevant determinants on what constitutes the value of a health technology to the population, regardless of the biases in the level of monetary WTP. Knowing the determinants helps to define actions, for example, information campaigns.

To our best knowledge, we are not aware of any studies directly comparable to our review. However, our results align with the limited comparable results from other published reviews. Most similar, but with a different study population and perspective, is a meta-regression by Chaikumbung [11] that evaluated WTP of chronically ill patients. Our results align with this study, showing that socioeconomic factors have a statistically significant impact on the WTP. In contrast to Chaikumbung [11], who evaluated the WTP of chronically ill patients, our review provides an overview of which factors affect WTP among citizens that are not (yet) directly affected. This does not exclude subjects indirectly affected, for example, by having risk factors or vulnerability to the illness and having learned about them or having friends or family members who have been directly affected. Another systematic review by McDougall et al. [87] pursued a different research aim but also included studies on the WTP for health. McDougall et al. [87] investigated the validity and accuracy of WTP values by comparing values from 18 studies on WTP for health or the value of a statistical life-year with national guidelines of cost-effectiveness thresholds. Consistent with our studies, they find substantial heterogeneity in the methods of eliciting WTP, resulting in a wide range of monetary values [87].

In our review, we assessed determinants of hypothetical WTP, which may or may not appropriately reflect actual WTP. A systematic review by Kanya et al. [88] using a meta-regression of 84 studies, including nine from the health care sector, has shown that the hypothetical WTP is a weak indicator of actual WTP and hypothetical WTP was 3.2–5.7 times higher than the actual WTP. The extent of the variation between actual and hypothetical WTP is likely influenced by methodological aspects, such as the different study designs [88].

However, a study performed by Quaife et al. [89] evaluated the use of discrete choice experiments in health care. Eight studies comparing hypothetical choices (predictions from the models) and real choices showed that discrete choice experiments could produce reasonable predictions if the sample represents the population [89]. According to Smith [90], the extent of the divergence between actual and

hypothetical WTP can be accounted for since the validity of WTP increases by describing the health services assessed realistically and credibly to the respondent. The way the WTP is asked for, the time of the survey and how the respondents' risk of using the services is perceived also influence the reliability of the CV survey's results [90].

Our systematic review has several limitations. One limitation is the heterogeneity of scope and methods of the included studies. This can be traced back to the fact that they were conducted in many different countries with different cultures, infrastructural and financial resources, and different health services assessed, which makes comparison or generalisation difficult. A lack of comparability of the results with other countries is also expressed in the discussion sections of included studies (e.g. [42, 57]). In addition, the methods of data collection, analysis, and presentation vary widely across studies. WTP has been collected in different currencies and formats, as dichotomous, continuous or interval variables, with or without respondents having a WTP of zero. Hence, we have chosen not to conduct a meta-regression and provide an overview of all the determinants used in the relevant literature. Due to the lack of an appropriate assessment tool to address methodological differences, we did not assess the study quality of the included CV studies in detail but tried to limit the heterogeneity of the study objectives via our inclusion criteria.

In addition, our review itself has limitations related to the search and subjective influence of the authors. We likely missed relevant papers due to our search strings focussing on multivariate regression analyses and several exclusion criteria. However, this restriction was necessary for a feasible search and having a focussed research question. We also might not have identified some types of survival analyses or causal methods (e.g. g-methods) [91]. But since using different types of regression analyses is the most common approach for analysing CV studies, we do not expect this restriction strongly biases our set of determinants. In addition, a publication bias due to the restriction on databases cannot be excluded. However, as we included multiple health and life sciences databases in our search, this seems unlikely. Our search might have yielded more studies if we had considered languages other than English or German and searched for original publications before 1999 instead of following up on the review by Olsen and Smith 2001 [5]. We intended to identify significant determinants after adjustments for multivariate covariates. We focussed on regression analyses because this is the most common method to adjust for covariates in health economics and epidemiology.

The labels of the determinants and domains are subjective since the process of synthesising the information is based on discussions among the authors. Although this is an appropriate way to summarise the many different variables and is common practice for qualitative syntheses, the reader should

not use the domains out of the context of our review. Our decision of which determinants belong to the domains "perceived threat", "perceived benefit", and "perceived barriers" is also independent of the Health Belief Model [15].

When summarising the determinants from the 62 studies, we made assumptions to simplify the synthesis and categorisation of determinants. For example, we combined several regression models presented within one publication into one assessment about the significance of the association per publication to be able to generate summary frequencies (see Table 3). We ranked these frequencies and proportions of use of the determinants (see Table 5). Still, we suggest not to interpret the 22 determinants as a suggested "core" standard set of variables or as proof for the relevance of variables. Instead, we suggest a minimum pool of potential variables to consider depending on the specific study purpose and research question. Our results should also motivate consideration of more rarely used determinants when examining the variation in WTP for health services. Explicit statements on economic theory and causal assumptions, expressed by causal diagrams [92] with theory-based variable selection instead of a solely statistically based approach, should guide the assessment of determinants and their effects. We particularly encourage including determinants describing the situation and the context of the research problem with the purpose of better understanding the complex situation of an individual when evaluating the value of health services. CV studies in health care help establish a detailed understanding of (societal) preferences and values to inform decision-making. Especially when trade-offs between different health services are necessary for allocation decisions to ensure against the background of economic efficiency, knowledge on societal preferences is useful.

Further research should evaluate whether using a similar set of explanatory variables in regression models analysing WTP positively affects the comparability of WTP values for different health services. Standardising the methodology of data collection and analysis could greatly facilitate the comparability of WTP results within society. As suggested by Perry-Duxbury et al. [93], the standardisation of (1) the number and order of questions and (2) the attributes and their levels could also help to assess the validity of the results of CV studies.

Conclusion

Our review provides comprehensive and quantitative evidence on 22 determinants used to analyse WTP for healthcare services from an ex-ante perspective. The thematic domains of the determinants were categorised in "sociodemographic characteristics", "perceived threat", "perceived benefit", "perceived barriers", and "other information",

including study design and setting. Determinants describing the respondent's perception added valuable information to understand what influences the perceived value of a health service for society. Our pool of determinants can guide the planning of future WTP surveys and the analysis of data in CV studies in health and medicine. To consider possible relationships between variables, which may include bias and confounding but also obvious variables, for example, perceived effectiveness of the treatment or severity of the condition, at the planning stage of the study can help ensure that the relevant variables are collected and that the goodness of fit of the regression models is improved. When used to inform health policy allocation decisions, more informative models will ultimately lead to more health for the money spent. Before interpreting these determinants as causal factors and potential intervention targets, actual causal relations, endogeneity, and the choice of causal inference methods should be carefully considered.

Appendix

Search strategy
Database and search strings with number of hits for the time from January 1, 1999, to October 21, 2021.

1. Web of Science
Search 2020 (323 hits—24 August 2020):
TS = ("contingent valuation" OR "willingness to pay" OR "willingness-to-pay) AND ALL FIELDS (regression) AND ALL = (medical); TS = topic, ALL = all fields.
Search 2021 (374 hits—07 April 2021).
TS = ("contingent valuation" OR "willingness to pay" OR "willingness-to-pay") AND ALL = ("regression" OR "predictor") AND ALL = (medical); TS = topic, ALL = all fields.

2. Medline via Pubmed
Search 2020 (496 hits—24 August 2020): ((contingent valuation[Title/Abstract]) OR (willingness to pay[Title/Abstract])) AND ((regression[Title/Abstract]) OR (determinant[Title/Abstract])).
Search 2021 (1,094 hits—21 October 2021) (("contingent valuation"[Title/Abstract] OR "willingness to pay"[Title/Abstract])) AND (("survival function*"[Title/Abstract] OR "regression*"[Title/Abstract] OR "determinant*"[Title/Abstract] OR "predictor*"[Title/Abstract] OR "tobit"[Title/Abstract] OR "probit"[Title/Abstract] OR "stratification"[Title/Abstract] OR "structural equation modelling"[Title/Abstract] OR "g method*"[Title/Abstract] OR "propensity score"[Title/Abstract]) OR (("propensity score"[MeSH Terms] OR "latent class analysis"[MeSH Terms] OR "social class/statistics and numerical data"

[MeSH Terms] OR "Mediation Analysis"[MeSH Terms]) OR (analyses, regression[MeSH Terms]))).

3. EconLit, ERIC, SocINDEX (via EBSCO host) (591 hits)
Search 2020 (591 hits—24 August 2020):
TI ((contingent valuation OR "willingness to pay" OR "willingness-to-pay")) OR AB ((contingent valuation OR "willingness to pay" OR "willingness-to-pay")) AND TI (regression OR determinant OR predictor) OR AB (regression OR determinant OR predictor); Expanders: Apply equivalent subjects.

4. PsycINFO, PsycARTICLES (via EBSCO host) (215 hits).
Search 2020 (215 hits—24 August 2020): (TI (contingent valuation OR "willingness to pay" OR "willingness-to-pay) OR AB (contingent valuation OR "willingness to pay" OR "willingness-to-pay)) AND (TI (regression OR determinant) OR AB (regression OR determinant)); Expanders: Apply equivalent subjects.

5. BIOSIS Previews, Embase, Ovid MEDLINE(R) and Epub Ahead of Print (via Ovid)
Search 2020 (1,020 hits—24 August 2020): ((contingent valuation or willingness to pay or willingness-to-pay).ti.) OR ((contingent valuation or willingness to pay or willingness-to-pay).ab.) AND ((regression or determinant).ab. OR (regression or determinant).ti.)
Search 2021 (1,325 hits—07 April 2021): ((contingent valuation or willingness to pay or willingness-to-pay).ti. or (contingent valuation or willingness to pay or willingness-to-pay).ab.) and ((regression or predictor or determinant).ti.). or (regression or predictor or determinant).ab.)

Declarations

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