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Review Article

Stated Time Preferences for Health: A Systematic Review and Meta-Analysis of Private and Social Discount Rates

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ABSTRACT

Background: The present study aimed to provide better insight on methodological issues related to time preference studies, and to estimate private and social discount rates, using a rigorous systematic review and meta-analysis.

Methods: We searched PubMed, EMBASE and Proquest databases in June 2013. All studies had estimated private and social time preference rates for health outcomes through stated preference approach, recognized eligible for inclusion. We conducted both fixed and random effect meta-analyses using mean discount rate and standard deviation of the included studies. I-square statistics was used for testing heterogeneity of the studies. Private and social discount rates were estimated separately via Stata11 software.

Results: Out of 44 screened full texts, 8 population-based empirical studies were included in qualitative synthesis. Reported time preference rates for own health were from 0.036 to 0.07 and for social health from 0.04 to 0.2. Private and social discount rates were estimated at 0.056 (95% CI: 0.038, 0.074) and 0.066 (95% CI: 0.064, 0.068), respectively.

Conclusions: Considering the impact of time preference on healthy behaviors and because of timing issues, individual's time preference as a key determinant of policy making should be taken into account. Direct translation of elicited discount rates to the official discount rates has been remained questionable. Decisions about the proper discount rate for health context, may need a cross-party consensus among health economists and policy makers.

Introduction

It is widely held that people prefer to expedite receiving good things (benefits) and to postpone bad things (costs). In a simple word, one day in perfect health today is better than two days in the future. In behavioral economics this nature of human beings is called time preferences. Time preferences express individual's willingness to gain smaller utilities now or wait for greater utilities in the future. Time discount rates show the least amount of future gains necessary to compensate individual's waiting time[1].

Many studies demonstrated that the way people think about future costs and benefits, can influence their health relating behaviors such as, addiction, smoking, dietary habits or adopting healthy lifestyle[2-8]. This aspect of time preferences highlights the role it can play in policy making processes[9]. Therefore, the more insights on individual's time preferences could result in more precise policies for health promoting behaviors[9,10]. The need for time preference studies also derived from the fact that, decisions made at present, have significant repercussions in the future. Suppose program 'A' yields 1000 healthy days in the next year, alterna-

tively, program B produces the same amount in five years. How these alternatives would be compared? Are 1000 healthy days now equal to 1000 healthy days in five years? How many extra healthy days can justify program B? Because of timing issues and for a fair comparison, future values must be discounted to present values based on discount rates elicited from people's time preferences. It is worth notable that, discounting practice must be considered as crucial part of relevant Economic Evaluation (EE), Health Technology Assessment (HTA) and Disease Modeling (DM) studies[10-14].

Considering the fact that stated preferences approach gives better insight on health market behaviors, and general public preferences are more relevant to policy making purposes, the present systematic review as a pioneer work tries to: provide better insight on methodological issues using a comprehensive review of time preference studies, and calculate mean time preference rates from private and social perspectives through a meta-analysis of available studies.

Methodological issues in time preference studies

Preferences for health can be divided in two main categories; private and social. In the former, people express their preferences about own health. The latter, reflects individual's preferences on social aspects of health and people make decisions on behalf of society) [9,10,15,16].

There are two broad approaches for eliciting (estimating) individual's time preferences; revealed or field and stated or laboratory[1,17]. For the more insights, each has briefly explained below. Revealed preferences approach, is the economist or market approach in which individual's observed behaviors in the real world are taken into account. In this approach macroeconomic data is the focal point of time preference estimations. In stated preferences approach, participants are presented with hypothetical scenarios and asked for appropriate decisions in each case. This approach considers microeconomic data[18,19]. Despite the stated preferences approach has been criticized because of the hypothetical nature of scenarios, and the possibility of different types of bias including strategic, payment vehicle, starting point, interviewer and others[1,20], there is a growing tendency for this approach in recent literature particularly in health context. It can be rationalized by the lack of a real market for health-care [10,15].

In a routine practice of time preference (inter-temporal choice) studies, individuals are asked to choose between two alternatives: gain or loss. Typical scenarios suggest receiving smaller gain/loss today versus larger amounts in the future [21]. When respondents become indifferent in choosing one of the alternatives, discount rates could be calculated. There is an illustrating example: "Imagine that you will be ill (i.e. a hypothetical scenario) starting 2 years from now for 20 days. There is a minor, one-off, treatment available that will postpone this spell of ill health to a point further in the future. For instance, the treatment could have the following effects: your period of ill health would start 9 years from now instead of 2 years from now; and you would then be ill for 30 days instead of 20 days. What is the maximum number of days of ill health that would make you to postpone the illness?"[10]. Once the indifferent point of respondent determined, discount rate would be calculated using the discount function. Discounted Utility model, is a dominant model of discounting in economics and health economics literature, introduced by Samuelson in 1937[22,23].

In order to eliciting people's preferences, the variety of mechanisms has been employed. For example, Interviews, web based, telephone or postal surveys. Each method has own advantages and disadvantages[1]. Depending upon study participants, the literature has focused on general public or specific samples (students, health professionals or physicians). Time span, scenario context and magnitude of ill-health, as important determinants of time preferences have been considered in different combinations across studies.

Methods

Data Sources

We conducted the systematic review according to the Center for Reviews and Dissemination (CRD) [24] and PRISMA statement methodologies[25].

PubMed, EMBASE and Proquest databases were searched in June 2013. The keywords combination used in the search strategy were as follows: (calculat*[tiab] OR measur*[tiab] OR estimat*[tiab] OR elicit*[tiab]) AND (discount*[tiab] AND rate [tiab])), #2 ("time preference*"[tiab] OR "time discount" OR "intertemporal choic*"). In order to find further studies, reference list of retrieved articles were manually searched. We applied no filtration on year, study design or country. All titles and abstracts were independently screened by two authors (A.P and A.M.A). In case of discrepancies, the problem was resolved through discussion. The relevance of full texts was examined by two reviewers, in accordance with study inclusion and exclusion criteria, then (A.A.S) rechecked the results as third reviewer.

Inclusion and exclusion criteria

All studies estimating private and social time preference rates for health outcomes using stated preferences approach, recognized eligible for inclusion. General public surveys were the core interest of the study. Therefore, researchers excluded the studies had focused on specific samples such as students, professionals, GPs, addicted people, smokers or animal.[21,26-28] We did not include studies adopted revealed preferences approach[29,30]. Studies not reporting mean estimated discount rates also were excluded from the analysis[6,31]. Finally, studies included risk in their scenarios[32,33] or examined intergenerational time preferences[23,34], did not recognized eligible for inclusion.

Data extraction

Necessary data from selected studies were extracted using a structured data sheet. We assigned codes to each study, the (A.M.A) necessary data. (A.P) rechecked extracted data for more precision. In case of missing data we contacted the authors of included studies.

Quality Assessment

For quality assessment (QA) of the included studies, we used Evaluation Tool for Quantitative Research Studies[35] developed by Health Care Practice R&D Unit (HCPRDU) at the University of Salford. The tool contains six subsections: study evaluative overview; study setting and sample; ethics; group comparability and outcome measurement; policy and practice implications; and other comments. It provides a template of key questions to assist in the critical appraisal of quantitative research studies[35].

Mean discount rate

Mean discount rate reported by included studies, was considered as effect size (ES). We conducted meta-analysis using ES and SD reported by the included studies. Since some studies reported two or more ESs for each study, in order to calculate mean ES of included studies two steps were taken. Firstly, we calculated Weighted Mean (WM) and Variance for each study separately and used them for conducting meta-analysis. Both fixed and random effect meta-analytic approaches were examined. I-square statistics was used for testing heterogeneity of the studies. It represents the extent of between-study differences[36]. We adopted Begg and Mazumdar adjusted rank correlation test and Egger et al., regression asymmetry test, for examining publication bias. Private and social discount rates were estimated separately in Stata11.

Results

Systematic review results showed that 8 studies (2 reports [9,10], 6 papers [15,16,37-40]) out of 44, met the inclusion criteria and 36 were excluded with reasons. Results have been demonstrated in Figure 1. All 8 included studies estimated private and social time preferences using stated preferences approach across households. The report by Cairns et al. [10] estimated time preference rate using both open-ended and discrete choices. Thus, two set of results were achieved for this report.

After data extraction and requests for missing data, five [9,10,15,16], seven studies [9,10,15,16,37,39,40] were included in the meta-analysis of private and social discount rates, respectively. Altogether, included studies were accounted for 3756 and 4453 sample sizes for private and social perspectives respectively. Table1 demonstrates study characteristics and results.

Quality Assessment of included studies

Quality assessment indicated that, almost all included studies suffered from some limitations, particularly with regard to response rate and questionnaire validation. It is useful to explain that, although the included studies had adequate sample size for robust statistical analysis, but most of them [9,10,16,39,41] reported low response rates which might have biased the results. An interesting finding of the quality assessment of included studies was the absence of any clear statement about the process of questionnaire validation.

There was a considerable disparity in all included studies in case of selecting scenario context. West et al. [9] adopted a miscellaneous combination of scenario context. This study involved a variety of vignettes such as the number of healthy days or years of life saved as a gain, and number of ill-health days, or years of life lost as a loss. Cairns et al. [10] Robberstad [15] and Van der Pol et al. [16] employed a single ill-health state scenario. While Bobinac et al. [37], Cropper et al. [40] and Olsen [39] used lifesaving scenarios for their studies. As the final step of quality assessment, all studies were ranked according to their quality score Table 1. None of them were excluded from the meta-analysis because of low quality.
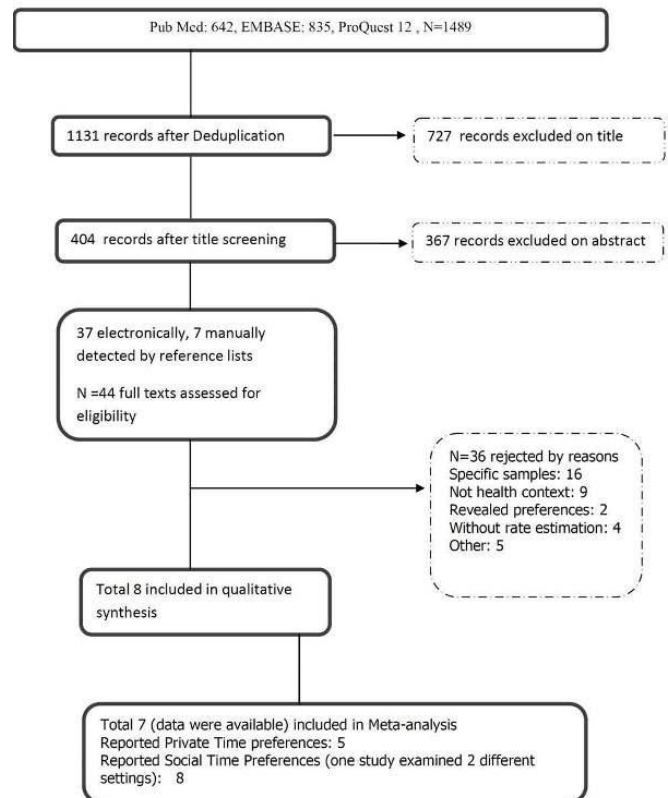

Figure 1: Systematic process of study selection

Table 1: Included studies characteristics, summary results and quality assessment ranking

Author (Year)	Population	Perspective	Data collection method	Scenario context	Time span (year)	Sample Size	Mean time preference rate	Quality Ranking
Bobinac et al. (2009)[35]	Netherland	Social	Web-based questionnaire	Gain/healthy life years	5, 10, 20, 40	153	0.17	3
Cairns et al. (1997)[36]	Aberdeen (UK)	Social	Postal questionnaire	Gain/life Saving	2 to 19	103	0.22	5
Cairns et al. (2000)[9]	UK	Private/ Social	Postal questionnaire (open ended)	Health states own/others	2 to 15	897/882	0.07/ 0.07	2
Cairns et al. dis [a] (2000)[9]	UK	Private/ Social	Postal questionnaire (discrete)	Health states own/others	2 to 13	385/382	0.036/ 0.038	2
Cropper et al. (1992)[38]	Maryland (US)	Social	Postal questionnaire	Gain & loss levels	5, 10, 25, 50, 100	475	0.17	6
Olsen. (1993)[37]	Norway	Social	Postal questionnaire	Gain/ lifesaving, health improvement	5,20	206	0.15	4
Van der Pol et al. (2001)[15]	UK	Private/ Social	Postal questionnaire	Health states	2 to 15	385/381	0.063/ 0.044	5
Robberstad. (2005)[14]	Northern Tanzania	Private/ Social	Interview	Health states own/others	3, 6	1794	0.071/ 0.068	1
West et al. (2003)[8]	Glumorgan (UK)	Private/ Social	Interview	Health states own/others	2, 3, 4, 5, 10, 20	295/180	0.07/ 0.05	2

[a] discrete choice experiment

Implied time preference rates

Reported time preference rates for private/own health were from 0.036 to 0.071 and of social /on behalf for society's health, were 0.04 to 0.2 (Table 1). Since some of the studies reported more than one rate, then mean discount rates presented in Table 1 are calculated by present study.

Inputs for meta-analysis of private time preference rate were available from 5 out of 8 included studies. Private time preference rate estimated at 0.056 (95% CI: 0.038, 0.074,

$I^2=0.0\%$, Z (Begg)=0.0, $P>0.5$). WM, CI and assigned weights of included studies are presented in Figure. 2a.

From 8 included studies, seven studies reported adequate inputs for meta-analysis in which study by Cairns et al.[10] reported two sets of results for different samples. Therefore
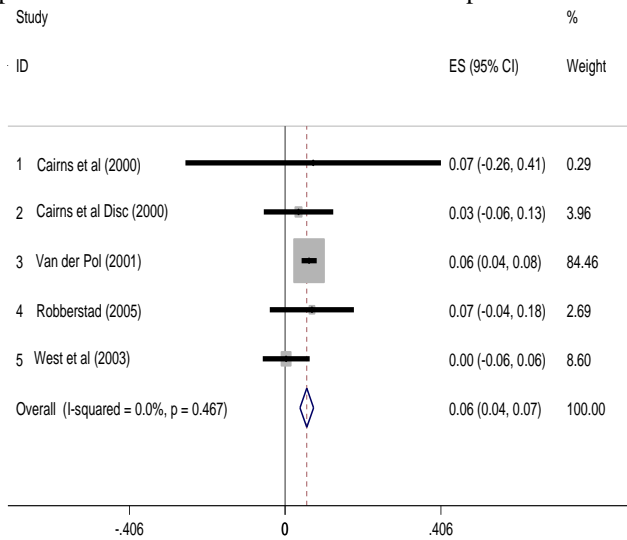
8 inputs for meta-analysis of social time preference rate were extracted from seven studies. The estimated rate of social time preference was 0.066 (95% CI: 0.064, 0.068, $I^2=0.0\%$, Z (Begg)=-0.07, $P >0.05$). WM, CI and assigned weights of included studies are presented in Figure. 2b.
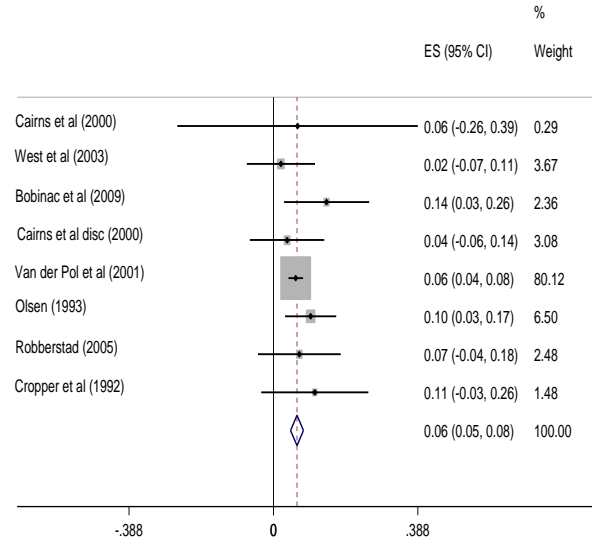

Study ID	ES (95% CI)	% Weight
1 Cairns et al (2000)	0.07 (-0.26, 0.41)	0.29
2 Cairns et al Disc (2000)	0.03 (-0.06, 0.13)	3.96
3 Van der Pol (2001)	0.06 (0.04, 0.08)	84.46
4 Robberstad (2005)	0.07 (-0.04, 0.18)	2.69
5 West et al (2003)	0.00 (-0.06, 0.06)	8.60
Overall (I-squared = 0.0%, p = 0.467)	0.06 (0.04, 0.07)	100.00

Study	ES (95% CI)	% Weight
Cairns et al (2000)	0.06 (-0.26, 0.39)	0.29
West et al (2003)	0.02 (-0.07, 0.11)	3.67
Bobinac et al (2009)	0.14 (0.03, 0.26)	2.36
Cairns et al disc (2000)	0.04 (-0.06, 0.14)	3.08
Van der Pol et al (2001)	0.06 (0.04, 0.08)	80.12
Olsen (1993)	0.10 (0.03, 0.17)	6.50
Robberstad (2005)	0.07 (-0.04, 0.18)	2.48
Cropper et al (1992)	0.11 (-0.03, 0.26)	1.48
	0.06 (0.05, 0.08)	100.00

Figure 2: Estimated time preference rates, for Private (a) and social (b) health outcomes.

Discussion

It is pointed out that individual time preferences as an underlying determinant of policy making process and a major input for health economic and social studies, should significantly be taken into account[2-4,7,12,42-44]. However the direct translation of estimated time preference rates to official social discount rates has been remained unanswered[15]. Moreover, it has been stated in the relevant literature that because of non-marketed behavior of individuals in seeking healthcare, stated preferences approach was developed[10,15,19], but it is not clear that how much consensus does exist among economists and social scientists on the validity of this method in comparison with the revealed preferences approach.

Quality assessment of included studies indicated that, questionnaire validation has not been mentioned in any of the included studies. Surprisingly the problem is relevant to another part of retrieved literature. This could be partly because of the subjective nature of preferences on one hand, and the interest of researchers for observing detailed differences of individuals.

Another limitation, relates to lower response rates of the included studies. Although it is evident that, judgments based on this rate are of controversial issues[45] if the generalizability issues were of interest, it can be considered as a substantial weakness of these studies. Despite the quality assessment made it easier to qualify included studies, no report was excluded for the reason of low quality. Thus two reasons might be arranged for this. Firstly we were interested to aggregate people's preferences in all settings. Secondly the appraisal tool employed in the present study was not completely relevant in some questions. Considering mentioned issues, developing a standard, comprehensive and acceptable time preference questionnaires for health context, such as the one which has been developed by Kris Kirby[46] for costs, seems to be in necessity.

Previous literature has shown that scenario context, study design and data gathering method can remarkably influence estimated time preference rates[9,47-50]. This study not only confirms it, but also emphasizes that a reasonable combination of these items should be considered in time preferences studies.

Considering the fact that, discount rate of 3-5 percent, has frequently used in numerous studies[11,51] the estimated rate at 6 percent seems to be high. The case of publication bias might not be serious problem of our systematic review. Because neither positive results, nor statistical significance are not considered as that in RCTs, then all well designed studies have equal chance of publication.

As the final note on estimated discount rate, there is no significant difference between private and social rates. This is in accordance with findings of cairns et al. [10] and Robberstad [15] studies. Both studies adopted the same scenario, but in different countries.

Conclusions

Individual's time preferences as a key determinant of policy making should be taken into account. Because of timing issues, proper private and social discount rates for health outcomes seem to be inevitable component of HTA, EE and DM studies. Stated preference approach, relying on microeconomic level data, can estimate implied rates of discount subject to study design, scenario context and data gathering methods. Although the discount rate of 3-5 percent has been applied frequently in relevant literature, however the decision about proper discount rate may need a cross-party consensus among health economists and policy makers.

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Conflict of interest statement

Authors declared that there is no case of conflict of interest.

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