PREFERENCES AND PERCEPTIONS

Studies in behavioural health economics

Sebastian Neumann-Böhme

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Sebastian Neumann-Böhme

born in Dortmund, Germany

Erasmus University Rotterdam

Doctoral Committee:

Promotor(s):	Prof. dr. W.B.F. Brouwer
Other members:	Prof. dr. E. Stolk
	Prof. dr. J. Polder
	Prof. dr. D. Wiesen
Copromotor:	Dr. A.E. Attema

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CHAPTER 1

Introduction

Humans are capable of rational thinking but are prone to reasoning failures.

To get to the bottom of this statement, some explanations of the terminology seem necessary. First, being rational or rationality; a whole stream of literature from different fields discusses what rationality and rational behaviour mean or entail. The philosopher Immanuel Kant viewed (practical) rationality and rational thinking as the capacity to act based on objective, practical principles (Kant, 1781). The actions of a rational agent are self-determined and result from an understanding and application of reasons and principles the agent accepts. Reath summarises Kant's elaborations on practical rationality and the capacity to be guided by normative considerations as "*you can do what you ought to do, regardless of what you desire*" (Reath, 2006). In economics, rational behaviour is traditionally seen as making consistent choices and maximising own welfare (self-interest) (Sen, 1990). This view has been challenged by empirical results and experiments but still appears to be prominent.

Second, reasoning failures describe a situation in which decisions don't serve the best interest of the decision maker, often against their better knowledge. Le Grand and New argue that behaviour that does not appear rational or contradicts our previous intentions can be described as a reasoning failure. They define a reasoning failure as a non-trivial error that a person would probably repeat in similar circumstances; the error has to be conceptual, not merely a verbal or technical misunderstanding, and the person should have known the correct answer or procedure to find it (Le Grand & New, 2015). These failures may manifest in relatively inconsequential and more critical decisions and can lead to non-optimal outcomes, including health-related ones. For example, a reasoning failure may cause patients to be anchored to suboptimal advice by a physician because it was the first opinion they heard. Due to the anchoring bias (Tversky & Kahneman, 1974), patients may attach more value/credibility to this opinion than to a second opinion or adjust their preferences or perceptions insufficiently, even if the second opinion is better supported by evidence or free of conflicting interests. Another example would be the availability heuristic (Tversky & Kahneman, 1974), in which individuals judge the likelihood of an event based on how easily they can recall similar events from memory. Studies on hygiene in hospitals show that physicians frequently underestimated their risk of getting infected (Klitzman, 2006) because it was challenging to recall instances in which poor hygiene led to an infection. Consequently, seemingly minor errors of judgement can have substantial consequences.

The discipline of health economics is broadly concerned with the efficient and equitable allocation of resources in the health(care) system. It investigates how the (health) benefits from the given resources can be maximised and how a fair distribution of the benefits can be ensured (Kernick, 2003). The specialisation of behavioural (health) economics complements the field by combining insights from economics and psychology. Behavioural (health) economics explains deviations between the behaviour economic theory expects

from "rational beings" (or Econs) and human behaviour that can be observed in empirical studies and everyday life (Kessler & Zhang, 2015). Describing the evolution of behavioural economics in his Nobel Prize Lecture, Richard Thaler (2017) stated, *"I believe that giving economics a more human dimension and creating theories that apply to Humans, not just Econs, will make our discipline stronger, more useful, and undoubtedly more accurate."* This dissertation addresses the effects of preferences and perceptions in the field of health economics since reasoning failures are a problem for health economics for (at least) two reasons.

First, rising healthcare costs require decision-makers to allocate funds according to the population's preferences that funds the healthcare system through insurance payments, taxes, or a combination of both. In 2020 the EU countries spent € 1,073 billion or 8.0 % of their gross domestic product (GDP) on health, up from 5.9% in 1995 (Eurostat, 2021). These increasing expenditures on healthcare sustain healthcare systems in general but also fund access to innovations for the users of these systems. With an increase in new, often expensive treatment options becoming available, one of the important drivers of increasing expenditures (Marino & Lorenzoni, 2019), choices regarding what to cover with publicly financed healthcare and what not, are indispensable. This holds since expenditures on (new) health interventions have opportunity costs within and outside the health sector. Therefore, policymakers must decide which treatments should be covered and how innovation can be rewarded financially while ensuring the affordability of healthcare systems. In this context, health economic evaluations are widely used to allocate scarce healthcare resources, e.g. by informing decision-makers about the value for money of different health interventions (Turner et al., 2021). In these evaluations, value is often expressed in terms of health gains or gains in health-related utility using the so-called Quality-Adjusted Life-Year (QALY) model. The latter metric combines length and quality of life and expresses quality of life on a scale anchored on dead (with value 0) and perfect health (with value 1). Imperfect health states are assigned an appropriate value between 0 and 1, or even negative values for states that are seen as worse than dead, based on individual preferences. The elicitation of such so-called 'health-related utility' used in health economic evaluation largely depends on the assumption that individuals are rational and make choices that maximise their utility (Richardson & Schlander, 2019). These assumptions are problematic as they probably do not hold when eliciting health state preferences in a general population sample. Instead, they describe an idealised decision-maker (Tversky & Kahneman, 1974). Furthermore, reasoning failures may distort preference elicitations due to framing effects, cognitive biases, or limited information on the good the individual is asked to value.

Second, reasoning failures can lead to suboptimal health choices and outcomes, such as not vaccinating against COVID-19, which can have severe health consequences, directly or indirectly, especially in more vulnerable groups in society. Of course, even when well-informed, some individuals may be unwilling to be vaccinated or opt not to live optimally

healthy because it aligns with their preferences. For them, an unhealthy choice, like eating unhealthy food or even smoking, may be considered rational (Becker & Murphy, 1988). A study by Diener et al. showed that respondents preferred a short life full of pleasure (ending abruptly) to a longer life that was only mildly pleasurable, which the authors labelled as the "James Dean[1] Effect" (Diener et al., 2001). Lifetime utility maximisation may therefore not necessarily equate to health maximisation through healthy choices. Other individuals may have a general preference or the intention to make healthy choices but fail to do so or follow through on healthy choices because of a lack of self-control or reasoning failures. A better understanding of the effect of reasoning failures on health choices remains important. It may ultimately lead to ways to help these individuals overcome their judgment error(s) and make better-informed health decisions in line with their preferences.

There are different ways to measure health outcomes or what a country's population gains from healthcare expenditures. Notwithstanding other influential factors than healthcare consumption, one measure is the average life expectancy which increased in the EU from 76 years in 1995 to 80 years in 2020 (World Bank, 2022). While this is a positive development, also related to increased medical care and possibilities, Europeans still need to live up to their full health potential. For instance, men, on average, could gain 5.8 years in life expectancy (women 2.3 years) by reducing the mortality linked to unhealthy behaviours such as smoking, unhealthy diets, lack of physical exercise, and excessive alcohol consumption (Janssen et al., 2021). In the COVID-19 pandemic, the EU recorded four distinct waves of excess mortality[2] between March 2020 and October 2022, with peaks of 25.2% in April 2020, the highest value of 40.0% in November 2020, 20.9% in April 2021 and 26.5% in November 2021 (Eurostat, 2022). It is unclear whether reasoning failures contributed to the number of life years lost due to COVID-19. While it seems clear that not all people followed the advice issued by governments and institutions like the World Health Organisation (WHO), much was unclear about the disease and optimal non pharmaceutical prevention measures in the early stages of the pandemic. In later stages, non-compliance may partly reflect individual preferences and risk-profiles, but also reasoning failures, including difficulties in dealing with probabilities and using trustworthy sources of information.

While non-pharmaceutical interventions such as limiting gatherings of people and school closures appear to have been very effective in controlling the spread of the disease (Brauner et al., 2021), it needs to be noted that they probably also had negative impacts on mental health and well-being. Especially the lockdowns and school closures led to questions regarding equity. For example, wealthier parts of the population benefitted from

1 Named after the actor James Dean (1931 – 1955), who died in a car accident at the age of twenty-four.
2 Excess mortality/deaths describe the difference in the total number of deaths in a crisis compared to those expected under normal conditions. Eurostat compares additional deaths in the pandemic to the period 2016-2019.

sufficient indoor space and good access to outdoor natural environments, contributing to their well-being during the work-from-home and lockdown periods (Moynat et al., 2022). It appears important to have a societal and scientific debate about the trade-offs between the costs and benefits of containment measures (Hajek et al., 2022; König et al., 2023)

This thesis consists of studies in behavioural health economics that address both issues raised above. Part I is concerned with deepening the knowledge in Behavioural Health Economics by reporting on improvements to measure preferences and investigating the effect of reference points on well-being. Part II focuses on analysing decision-making during the COVID-19 pandemic, reporting results from the European COVID Survey (ECOS) on the support of containment policies and factors influencing adherence. It furthermore reports on the willingness to be vaccinated against COVID-19 and the willingness to pay for access to vaccines.

Measuring preferences

Utility in economics refers to the satisfaction derived from consuming a good or a service. Modern economics uses decision utility, which assumes that individuals who choose coffee over cake, all else being equal, do so because coffee provides more utility than cake (to them). A large stream of behavioural research explored the limitations of this interpretation of decision utility, the observed violations of it and potential alternatives for it (e.g. Redelmeier & Kahneman, 1996; Kahneman et al., 1997; Oliver, 2008). When observing decisions that reveal a preference for certain goods or services over others, many economists assume that individuals make rational choices that maximise their expected utility. Expected utility theory (von Neumann & Morgenstern, 1947) relies on several axioms or assumptions that must be satisfied to predict (rational) decision-making under risk. While some argue that these assumptions are also part of a normative model describing how people should behave in complicated situations (Raiffa, 1961), empirical studies have shown that humans tend to violate one or more of the axioms of expected utility theory in how they do behave (e.g. Allais, 1953, 1979; Lichtenstein & Slovic, 1971; Sugden, 2004). One of the assumptions of expected utility is procedural invariance which assumes that preferences are stable, irrespective of the elicitation method. This assumption is essential since researchers use a variety of methods to determine people's preferences, such as willingness to pay (Harapan et al., 2020; Himmler et al., 2020) and time trade-off exercises (Robinson et al., 1997; Tilling et al., 2016), and discrete choice experiments (Poulos et al., 2018; Torbica & Fattore, 2010). In theory, all these methods should yield the same order of preferences, i.e., preferring one health state over the other - or coffee over cake as mentioned as an example before. When testing procedural invariance by comparing preference orderings from different elicitation methods, researchers reported the disturbing finding of preference reversals, meaning that different methods yield different preference orderings (Grether & Plott, 1979; Attema & Brouwer, 2013; Oliver, 2013). Many attempts have been made to reduce the number of preference reversals, e.g. by simplifying elicitation procedures (Oliver, 2013). Yet, preference reversals remain

a problem leaving researchers wondering which method, if any, may reveal the 'actual preferences' of respondents.

Chapter two of this thesis investigates whether preference reversals are more pronounced when making decisions in domains that are unfamiliar to respondents relative to those domains they are more familiar with. Moreover, it tests a simplified elicitation procedure in an online behavioural experiment with 129 medical and 119 economics students who were asked to make decisions in the health and financial domain. Choice lists will be employed as a simplified evaluation procedure to test if this reduces the number of preference reversals. Second, the effect of domain-relevant experience on preference reversals will be examined. More specifically, the analysis will show if experience gained as a medical or business student will lead to more stable preferences across different elicitation methods when deciding about health or financial outcomes on behalf of others.

Reference points and reference dependency

The importance of reference points was first formalised in prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992), which provided an important alternative to expected utility theory (Neumann & Morgenstern, 1947). Prospect theory shows that humans value gains/losses in relation to a reference point (reference dependency). Prospect theory further suggests that losses loom larger than gains of the same magnitude (loss aversion). Related to this, individuals are often risk averse in the gain's domain but risk seeking for losses; this situation is referred to as the reflection effect. Gamblers taking high risks trying to "win back" losses would be an illustration of the latter.

While many empirical studies highlight the relevance of reference points for decision-making, there is still no comprehensive theory of how reference points are formed (Wakker, 2010) or which reference point is or reference points are used. Humans often choose the status quo as their reference point (Wakker, 2010), e.g., their current salary against which they compare changes. Other reference points have also been shown to affect evaluations of income, e.g. the income of others (Carlsson et al., 2007; Luttmer, 2005). To illustrate, an individual will perceive a 2% wage increase as a loss if she knows her co-workers all received a 5% increase. Despite being an increase, the 2% raise now constitutes a negative deviation from the reference point (i.e., a 5% increase), with adverse effects on satisfaction. Reference dependency can also lead to reasoning failures if decisions or judgements are based on inaccurate reference points, when they are not updated if new information becomes available, or if more weight is given to losses than gains even if the reference point is correct. Several studies suggest that people use reference points not only for evaluations of wealth but also for health. Similar to the wealth domain, being sicker than others in the direct environment has been shown to affect health satisfaction negatively (Thiel, 2014).

Chapter three will contribute to filling this gap in the literature by analysing whether people use one or multiple reference points and whether these differ depending on the good being evaluated. Using a representative sample of the population (N=550) in the Netherlands, we test seven potential reference points for health and income derived from multiple discrepancy theory (Michalos, 1985). The analysis of multiple domain-specific reference points aims to show how well-being is affected if reference points are not met, contributing to our understanding of how reference dependency and relative comparisons affect well-being.

Behavioural Health Economics in the COVID-19 pandemic

Since the WHO declared COVID-19 a global pandemic in March 2020, many researchers around the world have studied topics related to the global pandemic. Health economists investigated, among other things, preferences for the allocation of vaccines (Luyten et al., 2022) and intensive care unit beds (Dieteren et al., 2022), factors why some healthcare systems were more successful in dealing with the pandemic than others (Bosa et al., 2021), and differences in physician remuneration schemes for vaccinating against COVID-19 (Milstein et al., 2022). The pandemic also sparked the start of multiple (panel) data collections; for example, COSMO, which collected data in Germany every week (Betsch et al., 2020), and ECOS, which collected data in seven (and sometimes eight[3]) European countries in bi-monthly intervals from April 2020 until December 2022. The pandemic and ECOS data collection offered the opportunity to investigate several relevant topics for behavioural health economics. For example, the willingness to be vaccinated against COVID in Europe (Neumann-Böhme et al., 2020), public sentiment and support for containment policies (Sabat et al., 2020), the link between altruism and pro-social behaviour during the pandemic (Neumann-Böhme et al., 2022) and the willingness to pay for immediate access to a COVID-19 vaccination (Neumann-Böhme et al., forthcoming). Other published papers from the ECOS project relate to the mental health dimension of the pandemic (Enzing et al., 2022; Hajek, et al., 2022a; Hajek, et al., 2022b) and changes in health-related quality of life during the pandemic (König et al., 2023).

Perceptions of containment policies and adherence to these policies

Early in the COVID-19 pandemic, governments used non-pharmaceutical containment strategies to "flatten the curve" of COVID-19 infections to avoid overburdening the capacities of healthcare systems and reduce excess mortality while vaccines were still under development. On an individual level, citizens were asked to follow the WHO protective measures, such as keeping their distance from others, frequently washing their hands, using alcohol-based hand rub, and following the sneezing etiquette (sneezing and coughing into a tissue or the elbow). Examples of measures on a public health or country level include that borders were closed to foreign travellers, schools and universities moved to online teaching, and non-essential businesses (e.g. restaurants, cinemas and bars) had

3 Spain was added as an additional country in wave 8 in July 2021.

to shut down (Koller et al., 2022). The Oxford COVID-19 Government Response Tracker (Hale et al., 2020) objectively recorded the stringency of these public health measures over the pandemic, as illustrated in Figure 1.

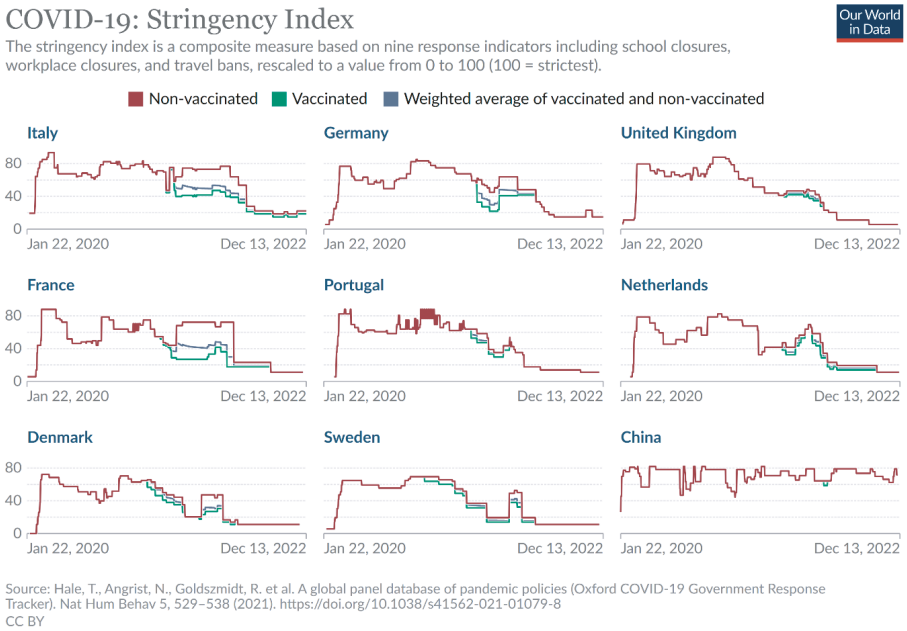

Figure 1. Oxford COVID-19 Government Response Tracker

Understanding the public support for containment policies proved critical to the adherence to measures and their chances of success. Investigations of the adherence to containment policies have highlighted the importance of trust in the government and its institutions for compliance with measures (Pak et al., 2021). Therefore, chapter four reports on an investigation of the public sentiment toward the first major containment policies implemented in EU countries in April 2020. It furthermore analyses respondents' worries about different aspects of the pandemic (e.g., that the health system would be overwhelmed) and trust in information sources.

On an individual level, various behavioural factors influence people's decision-making and adherence to COVID-19 measures. A study by Campos-Mercade et al. (2021) showed that most people are reluctant to put others at risk for their personal benefit and that pro-sociality predicted health behaviours during the pandemic. Certain pro-social behaviours (e.g., the correct and consistent use of masks) could even be seen as contributing to a public good, namely a low-risk environment that reduces the risk of a COVID-19 infection for oneself and others. Most behaviours that contribute to a low (infection) risk environment have in common that they require some sacrifice or discomfort for the individual (for

the benefit of others). An example would be standing in line outside to follow social distancing rules or wearing face masks in public places. Some of these behaviours mostly benefited the individual making a sacrifice, while many mainly benefited others. Chapter five of this dissertation will explore if there is a relationship between an overall altruistic disposition (i.e., a concern for others as opposed to self-interest) and behaviours in the COVID-19 pandemic that mainly benefit others. To do so, an investigation is undertaken to determine if altruistic individuals are more likely to behave pro-socially by wearing a mask when and where this is recommended or not going to the supermarket with COVID symptoms. Policymakers benefit from these behavioural insights into decision-making and protective behaviours during the pandemic because it allows them to understand and potentially increase compliance with containment policies. This can be achieved by framing information regarding measures in such a way that it is expected to nudge more individuals into pro-social behaviours.

The willingness to be vaccinated and the willingness to pay for access to COVID-19 vaccines

While governments around the world used containment policies to flatten the curve of infections, they also supported pharmaceutical companies in their efforts to develop effective vaccines against COVID-19. Historically, developing a new vaccine takes ten years from first trials until market approval, and even the accelerated process for the Ebola vaccine took five years (Thanh Le et al., 2020). The vaccines against COVID-19 were developed with new technologies, which allowed rapid vaccine development and benefitted from faster market authorisation through the rolling submission of data to regulators (Bok et al., 2021). The development of the Comirnaty vaccine by BioNTech and Pfizer may illustrate this fast process. After the SARS-CoV-2 genome was released in January 2020, the first preclinical studies began. Phase I/II trials established the safety and effectiveness of the vaccine in April 2020 (Ball, 2021). In November 2020, BioNTech and Pfizer announced interim results of their phase III trial, reporting effectiveness in preventing COVID-19 of 95% (Polack et al., 2020). Finally, the vaccine was recommended for authorisation in the EU and received conditional marketing authorisation from the European Commission on December 21, 2020 (European Medicines Agency, 2020). This highlights a pathway from the first trials to market authorisation of less than one year.

During the vaccine development phase, the population and decision-makers were already discussing vaccine types, potential side effects and accessibility. As indicated in figure 2, the willingness to be vaccinated (WTV) in seven European countries covered by ECOS varied considerably over time. Chapter six will report the willingness to be vaccinated in April 2020, when vaccines were not yet available and approved, and there was still much uncertainty about them (as well as about the disease). It also analyses why people were hesitant or unwilling to be vaccinated and compares the results between seven European countries. The increased demand for the vaccines that became widely available in early 2021 was illustrated by long queues in front of vaccination centres across Europe.

Countries rolled out vaccination campaigns in different ways to cope with the high initial demand. European countries prioritised access for older age groups and, in some cases (e.g., in Germany or the Netherlands), for at-risk occupations, such as healthcare workers. Moreover, some countries (e.g. Portugal or the Netherlands) extended the time until the necessary second shot to provide the first doses to as many people as possible (European Centre for Disease Prevention and control, 2021).

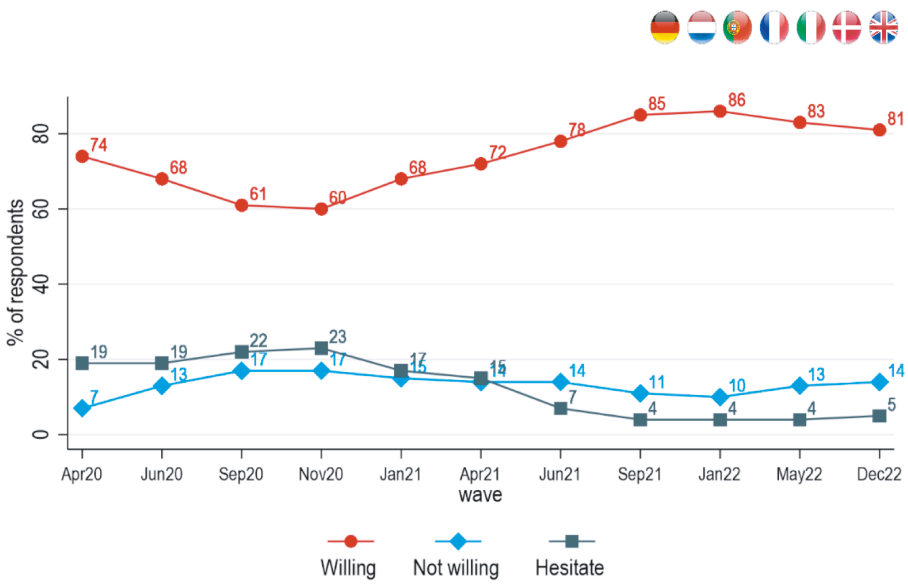

Figure 2. Willingness to be vaccinated in 7 European countries.

Question: Would you be willing to get vaccinated against the novel coronavirus?
Source: ECOS

Furthermore, different types of vaccines varied in their effectiveness and side effect profiles, leading to a situation where many people knew about the differences between vaccines and demanded those with a high efficacy and favourable side effect profile and turned down appointments for vaccines that did not meet their requirements (Eddy, 2021). To better understand the demand for vaccines and the factors influencing it, chapter seven measures the willingness to pay for immediate access to two COVID-19 vaccines with different efficacies. It uses a hypothetical scenario where respondents could skip the prioritisation lists of the public vaccination campaign and elicits their willingness to pay for this offer.

Aim of the thesis and Research Questions

This thesis aims to add to the literature on behavioural health economics and decision-making in the health context. It provides insights into preference measurement, the reference points that influence our evaluation of well-being, factors influencing the decision to seek vaccination against COVID-19, and aspects that affect adherence to and support for containment policies. The research questions addressed in this thesis are the following:

Part I: Increasing knowledge in Behavioural Health Economics

- Are preferences more consistent in one's area of expertise than in an unfamiliar domain, and can more straightforward elicitation methods lead to more consistent outcomes?
- Which absolute and relative comparisons in the health and income domain affect the subjective well-being of individuals?

Part II: Analysing decision-making in the context of the COVID-19 pandemic.

- What was the public perception of the pandemic and implemented containment measures, and to what degree did individuals follow the introduced measures?
- What factors influence the willingness to be vaccinated against COVID-19 and the willingness to pay for quick access to a vaccination?

This dissertation is structured as follows. Chapter two reports on improvements to measure preferences, while chapter three investigates the relevance and effect of reference points for health and wealth in evaluating well-being. Chapter four, reporting results from the European COVID Survey (ECOS), examines people's perceptions regarding and evaluation of government containment policies in response to the COVID-19 pandemic. Chapter five explores if altruistic people were more likely to follow the containment measures that would (especially) benefit others. Chapter six reports on the willingness to be vaccinated against COVID-19 in seven European countries, and chapter seven investigates the willingness to pay for immediate access to two hypothetical COVID-19 vaccines. The discussion in chapter eight reflects on the implications and limitations of the presented research and concludes the dissertation.

Note that the different chapters were written as separate papers, which means that they can be read independently, but also there may be a degree of overlap between them.

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PART I

Increasing knowledge in Behavioural Health Economics

2

CHAPTER 2

Preference reversals in decision-making for others

BASED ON

Neumann-Böhme, S., Lipman, S. A., Brouwer, W. B. F., & Attema, A. E. (2021). Trust me; I know what I am doing. Investigating the effect of choice list elicitation and domain-relevant training on preference reversals in decision making for others.
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ABSTRACT

One core assumption of standard economic theory is that an individual's preferences are stable, irrespective of the method used to elicit them. This assumption may be violated if preference reversals are observed when comparing different methods to elicit people's preferences. People may then prefer A over B using one method, while preferring B over A using another. Such preference reversals pose a significant problem for theoretical and applied research. We used a sample of medical and economics students to investigate preference reversals in the health and financial domain when choosing for patients/clients. We explored whether preference reversals are associated with domain-relevant training and tested whether using guided 'choice list' elicitation reduces reversals. Our findings suggest that preference reversals were more likely to occur for medical students, within the health domain, and for open-ended valuation questions. Familiarity with a domain reduced the likelihood of preference reversals in that domain. Although preference reversals occur less frequently within specialist domains, they remain a significant theoretical and practical problem. The use of clearer valuation procedures offers a promising approach to reduce preference reversals.

INTRODUCTION

The elicitation of preferences, i.e. finding out if one prefers A over B or vice versa, is central in economics, and therefore relevant to many topics studied in health economics, such as health state valuations, multi-criterion decision analysis (Baltussen & Niessen, 2006), patient preferences (Ryan et al., 2001), and studies on physician behaviour (Hennig-Schmidt et al., 2011). Many different methods are used to elicit preferences in the relevant target group, including well-known methods like willingness to pay (Himmler et al., 2020), time trade-off (e.g. Dolan et al., 1996), and discrete choice experiments (e.g. Green & Gerard, 2009).

A disturbing finding is that different preference orderings may be obtained, especially when using different methods. This phenomenon is typically referred to as *preference reversal*. For example, people may prefer option A over B when directly asked to choose between them, but have a higher willingness to pay for B than for A (Grether & Plott, 1979; Tversky & Thaler, 1990). To illustrate, imagine a person who, when given a direct choice, indicates that she prefers surgery over physiotherapy for a given condition. Given this observation, we would, *ceteris paribus*, expect her to also be willing to pay more (or at least not less) for surgery than for physiotherapy. If this is the case, her preferences could be classified as consistent. In practice, however, her willingness to pay for physiotherapy may turn out to be higher than that for surgery. This may be classified as inconsistent and constitutes a preference reversal. If such preference reversals occur, preferences may not be stable, but depend on and can reverse between different elicitation methods and procedures. As a result, it is no longer possible to determine which (if any) method yields 'true' preferences (Braga & Starmer, 2005). Hence, preference reversals offer substantial methodological challenges, but also form a general and fundamental problem to applied work and decision-making in health and other settings.

Unfortunately, preference reversals appear to be a robust phenomenon, which typically occur when comparing preferences for risky outcomes elicited using different methods (Seidl, 2002) or different operationalisations of the same method (Attema & Brouwer, 2008). In a classic example, Slovic and Lichtenstein (1971) offered subjects two risky lotteries, referred to as the P-bet and the $-bet. The former included a high chance of a moderate reward (e.g. 95% chance of winning 40$, or lose 10$ otherwise), while the latter involved a lower chance of a high reward (e.g. 15% chance of winning 160$ or lose 15$ otherwise). Preferences were first elicited using *direct choice*, i.e. subjects were asked to indicate which lottery they would choose. Next, subjects were asked to indicate the monetary values they would assign to both lotteries, i.e. their *valuation*. Slovic and Lichtenstein (1971) found that for lotteries with similar expected values, subjects chose the P-bet over the $-bet, but assigned a higher monetary value to the $-bet compared to the P-bet. This finding has been replicated frequently (e.g. Hamm, 1979; Reilly, 1982;

Seidl, 2002) and constitutes a preference reversal, as economic theory predicts that the preferred lottery should also have been assigned a higher valuation.

By now, preference reversals have been studied extensively for monetary outcomes, using many different settings and methods (for a review, see: Seidl, 2002). Preference reversals in decisions related to health outcomes have been documented in several studies as well (Bleichrodt & Pinto Prades, 2009; Oliver, 2006, 2013; Pinto-Prades et al., 2018; Stalmeier et al., 1997). To our knowledge, the only study directly comparing preference reversals in choices regarding health and money is that of Oliver and Sunstein (2019), who found a higher rate of preference reversals for health. Given that preference reversals pose a significant methodological and practical problem, improving our understanding of causes and potential ways to reduce preference reversals in different contexts remains crucial. Hence, we report the findings of an experiment in which preferences were elicited in a sample consisting of both medical and economics students for both health and monetary outcomes. This experiment expands earlier work in two directions.

First, in the seminal work by Lichtenstein and Slovic (1971), preference reversals were demonstrated by comparing direct choice and valuation, where the latter was obtained with open-ended questions. Subsequent work, instead, obtained valuations through choice-based procedures, and has shown this reduces preference reversal (Attema & Brouwer, 2013; Bateman et al., 2007; Bostic et al., 1990; Huber et al., 2002; Noussair et al., 2004). Furthermore, Oliver (2013) argued that people are unlikely to have fixed preferences for unfamiliar goods and may use unstable heuristics when asked to value them using open valuation. As a result, there have been attempts to simplify open-ended valuation elicitation for respondents. For example, Oliver (2013) tried an assisted valuation procedure by presenting respondents a selection of amounts to pay for a risky operation but found no notable differences with open valuation. In this study, we continue this line of research by using *choice list elicitation* (as popularised by Holt & Laury, 2002) for valuation. This choice-based method for preference elicitation is often applied in behavioral and experimental economics as it is easy to explain and implement (Andersen et al., 2006).

Second, while some authors have explored preference reversals from the perspective of a social planer (Baron & Ubel, 2001; Tversky & Thaler, 1990), preference reversals in decisions on behalf of others have received little attention (see Oliver, 2013, for an exception). Investigating preference reversal in this area may be an important avenue for health economics research, as for many real-life decisions about health, one often has to rely on the advice and actions of others, e.g. physicians proposing preferred treatment options. Indeed, Arrow (1963) identified reliance on physicians' expertise as one of the main reasons for a separate study of the economics of health. Similarly, one may also rely on experts in decisions about money, e.g. financial experts selecting investment portfolios. In both the health and monetary domain, the *outcomes* of decisions made by those with different or more expertise in a particular field have been extensively studied

(e.g. Abdellaoui et al., 2013; Bontempo et al., 1997; Chang et al., 2016; Fraser-Mackenzie et al., 2014; Hennig-Schmidt & Wiesen, 2014; Lawton et al., 2019). In this paper, instead, we extend this research by studying the *consistency* of decision-making, and by extension focus on an entirely new aspect of the preference reversal phenomenon: the consistency of those advising others inside (and outside) their field of expertise. In our experiment, consistency is tested with students from different disciplines, and throughout this paper, we will refer to any effects related to deciding in a domain relevant to their respective field of study as *domain-relevant training*.

Note that although some evidence exists suggesting that students and physiciancs have similar preferences (Brosig-Koch et al., 2016), students are obviously still training to become experts. Besides their field of study, the two groups of students in our study may also differ in terms of skills and traits. For instance, those that precede and affect self-selection into different educational tracks, like the wish to help others in medical students (e.g. Galizzi et al., 2015; Godager & Wiesen, 2013). Furthermore, earlier studies have aimed to implement a real patient benefit into the decision making process to create real incentives, for example by transforming the patient health benefits into a monetary amount that is then donated to a charity (Arrieta et al., 2017; Brosig-Koch et al., 2017),(Brosig-Koch et al., 2016; Brosig-Koch et al., 2017; Hennig-Schmidt & Wiesen, 2014). Our work instead uses hypothetical scenarios for *both* health and monetary decisions. This lack of incentive-compatibility may be seen as a limitation (Galizzi & Wiesen, 2018), but it enabled us to study preference reversals for decisions involving realistic stakes of moderate size in both domains (as in: Oliver & Sunstein, 2019). In particular, we aimed to describe a scenario that reflected the medicial decision context as realistic as possible. Converting the benefits in the scenarios to real health gains through donations to some health-related charity would likely result in very small and uncertain health gains, of a different nature than the ones studied here. This may also negatively affect the comparability between the two domains. Hence, also in order to prevent apparent procedural differences between health and money, preferences were elicited with hypothetical and relatively large and realistic stakes throughout the entire experiment.

The remainder of the paper is structured as follows; firstly, we will form hypotheses for our study. We then continue to explain our experimental procedure in the methods section and finish with presenting our results and discussing them in the context of the literature.

Hypotheses for effects of choice list elicitation and domain-relevant training

Preference reversals are often explained by overpricing of the $-Bet (i.e. low chance to gain a high outcome) as a result of scale compatibility (Tversky et al., 1990). This hypothesis suggests that people focus on different aspects of lotteries depending on the elicitation method. In direct choice, they give more attention to probabilities, which benefits the P-Bet (i.e. the high chance of winning a moderate amount), as this bet has a higher chance of yielding a positive result. In valuation, operationalised by using open-ended questions

(e.g. "For what price would you sell this lottery?"), subjects focus on the unit in which they should express their valuation. In the study by Tversky et al. (1990), this focus on monetary amounts favours the $-Bet and therefore could explain the relatively high rates of preference reversals. If, rather than open-ended questions, choice list elicitation is applied, both direct choice and valuation would involve choice. Seeing as earlier work has consistently shown that preference reversals are lower when valuation is choice based (Attema & Brouwer, 2013; Bateman et al., 2007; Bostic et al., 1990; Huber et al., 2002; Noussair et al., 2004), we formed our first hypothesis (H1):

H1: The use of choice list elicitation will lead to fewer preference reversals.

Furthermore, it is well-known that preference elicitation (for risk) may contain noise or imprecision (Bhatia & Loomes, 2017), which may be more likely if preferences are elicited for outcomes that one has no decision experience with or interest in. According to Butler and Loomes (1988; 2007), indicating the value of a risky gamble, such as a P-bet or $-bet (i.e. by providing a certainty equivalent) is a difficult task which leads to imprecision, and this imprecision may explain part of the systematicity of preference reversals. Hence, the relatively high rates of preference reversal observed in earlier studies on health outcomes (Bleichrodt & Pinto Prades, 2009; Oliver, 2006, 2013; Oliver & Sunstein, 2019; Stalmeier et al., 1997), may partly be explained by the fact that most samples in these studies are generally unfamiliar with decisions about health. Indeed, Beshears et al. (2008) indicate that a lack of experience and choice complexity increase the occurrence of decision-making errors in preference studies (such as preference reversals). Pinto-Prades et al. (2018) provided more support for the role of imprecision in producing preference reversals by showing how preference reversals for health outcomes can be reduced by repeating preference elicitations. Hence, domain-relevant training may reduce preference reversal by reducing such imprecision, as students through their (selection into) domain-relevant training may be more familiar with considering outcomes in one domain rather than another. Thus, our second hypothesis (H2) is:

H2: Participants with domain-relevant training will show fewer preference reversals in their area of expertise.

METHODS

Sample and experimental design

To ensure that every participant had at least some prior experience with choices in one of the domains, we aimed to only recruit economics, business and medical students beyond their first year of studies. Several screening questions were in place, to avoid recruiting students that did not meet these conditions. Our full sample of 252 students was comprised of 129 medical students, 121 business and economics students (henceforth: economics students) and two other students (removed from the sample). Additionaly,

two students were excluded who reported being in their first year of studies, yielding a final sample of 248 students. Recruitment of these students differed depending on their discipline. Economics and business students were recruited from the subject pool of the experimental laboratory at Erasmus School of Economics, while medical students were recruited through messages in the virtual learning environment of two University Medical Centres (in Rotterdam and Leiden). Subjects were paid a flat fee of 10 Euros (paid out as a gift voucher) for participating in the experiment. Both groups of students completed an online experiment, which was operationalised in Qualtrics Survey Software, with a two by two within-subjects factorial design applied in two samples, using the following two factors: i) outcome domain (health vs financial), and ii) valuation procedure (open-ended vs choice list)[4]. This design allows us to study preference reversals within-subjects in four blocks and allows between-subjects comparisons based on discipline (i.e. economics or medicine). An overview of our experimental design is provided in Figure 1. To avoid ordering and learning effects the order of outcome domains and valuation procedures was randomised.

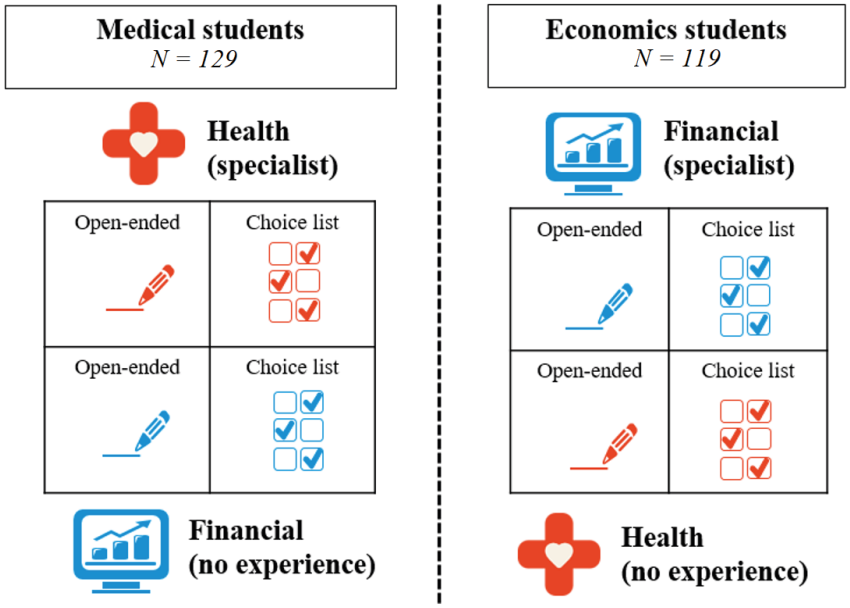

Figure 3. Survey design of the two domains and valuation procedures

4 We also piloted a condition aimed at reducing preference reversals by using natural frequencies to communicate risks, but due to a programming error this data could not be included.

Experimental procedure

The online experiment started with general instructions and a practice block (see Appendix A). Afterwards, participants completed a total of 12 questions eliciting their preferences for health and investment decisions (on behalf of others) with one choice and two valuation questions for each condition. Both scenarios began with an introduction page informing participants which role they would have in the experiment that followed. Graphical elements were added to inform respondents which type of question they were answering and to reduce the repetitiveness of the questions. After completing the 12 questions, demographics were collected. More specifically, we collected information on age, gender, statistical competency, and year of study (see Appendix B for an overview of questions used).

Eliciting preference reversals

The questions per condition all followed a similar structure, following the classic study by Slovic and Lichtenstein (1971): i) a strict choice between two risky lotteries with similar expected values (henceforth P-bet and $-bet), ii) valuation of P-bet, iii) valuation of $-bet (for an overview of P-bets and $-bets used, see Table 1). The order of these three questions was randomised within each condition. We recorded a preference reversal if a respondent chose the P-bet over the $-bet in the direct choice, but at the same time valued the $-bet strictly higher in the valuation question. This commonly observed reversal pattern is usually referred to as a 'predicted preference reversal', as it is predicted by scale compatibility (Tversky et al., 1990). Preferring the $-bet while assigning a strictly larger value to the P-bet is defined as an 'unpredicted preference reversal'. We will interpret subjects indicating to prefer one bet in direct choice while assigning it a higher or equal value in valuation as having consistent preferences.

Operationalisation of outcome domains (health vs financial)

In both domains, respondents hypothetically advised a person on a decision between two risky prospects. In the financial scenario, respondents advised clients on how to invest their money in different portfolios. The health scenario involved recommending treatment options for a terminally ill patient, where patient health status was described by using the dimensions of the EQ-5D instrument (see Appendix A for exact instructions). Whereas in the original set-up by Slovic and Lichtenstein (1971), which was extended to health outcomes by Oliver (2006, 2013), risky prospects were two-outcome mixed gambles (consisting of a gain and a loss), Table 1 shows that the P-bets and $-bets in this study used three outcomes. The third outcome was included to increase realism[5], as both investment and medical decisions typically have at least three outcomes: a gain (high return on investment or medical treatment is successful), 'the status quo' (moderate return on investment or medical treatment is unsuccessful), and a loss (portfolio value decreases

5 To check the realism of our P-bets ($-bets) and the instructions used for medical decision-making, we consulted a physician. Some minor changes were made to the framing (e.g. we increased the age of the patient whom students are to imagine they would be advising).

or side-effects of medical treatments). In each question, graphical elements like those in Figure 1 were used to emphasise (changes to) the outcome domain and valuation procedure being used.

Table 1. P-bets and $-bets used for health and financial outcomes in all four conditions

Health Open-ended

P-bet	$-bet
80% of 5 years	55% of 9 years
15 % of 0 years	20% of 0 years
5 % of -1 years	25% of -1 years

Health Choice list

P-bet	$-bet
90% of 7 years	50% of 14 years
5 % of 0 years	35% of 0 years
5 % of -2 years	15% of -2 years

Financial Open-ended

P-bet	$-bet
85% of 1600€	35% of 5500€
10% of 1000€	15% of 2700€
5% of -550€	50% of -1800€

Financial Choice list

P-bet	$-bet
95% of 2000€	33% of 7000€
4% of 500€	33% of 1350€
1% of -1500€	34% of -2500€

Operationalisation of valuation procedure (open-ended vs choice list)

For health outcomes, open-ended valuation was operationalised as follows: students were instructed to compare the P-bet ($-bet) to a treatment yielding some amount of life years in perfect health for certain, where students were asked to provide the minimum amount of life years that would lead them to recommend patients to take this certain treatment over the P-bet ($-bet). For financial outcomes, the open-ended valuation was operationalised as follows: students were asked to compare the P-bet ($-bet) to a government bond yielding a sure gain and asked to indicate how large this gain should be for the bond to be equally good to the P-bet ($-bet). In both outcome domains, students were required to provide this certain amount of life years or money in an open answer field, i.e., students reported a certainty equivalent. Choice list valuation was operationalised by offering respondents a list of increasing amounts of money (in increments of 1,000$, followed by a choice list in 100$ increments) or life years (in yearly increments) to choose from. Figure 2 shows an example of such a choice list valuation procedure for valuation of a P-bet, where at some point students switch from preferring the P-bet to a certain outcome. As is usual in choice list methodology (Holt & Laury, 2002), the certainty equivalent is obtained by taking the average of the certain outcome above and below the switching point (see

Figure 2 for examples). This procedure was guided as the choice lists were programmed to prohibit multiple switching points and choices that violated dominance.

Financial example *$-bet* 33% of 7000$ 33% of 1350$ 34% of -2500$				**Health example** *P-bet* 90% of 7 years 5 % of 0 years 5 % of -2 years			
	A	**B**			**A**	**B**	
Government bond yielding $0	■	□	$-bet	P-bet	■	□	Living healthily for 0 additional years
Government bond yielding $1000	■	□	$-bet	P-bet	■	□	Living healthily for 1 additional year
Government bond yielding $2000	■	□	$-bet	P-bet	■	□	Living healthily for 2 additional years
Government bond yielding $3000	■	□	$-bet	P-bet	■	□	Living healthily for 3 additional years
Government bond yielding $4000	■	□	$-bet	P-bet	□	■	Living healthily for 4 additional years
Government bond yielding $5000	□	■	$-bet	P-bet	□	■	Living healthily for 5 additional years
Government bond yielding $6000	□	■	$-bet	P-bet	□	■	Living healthily for 6 additional years
Government bond yielding $7000	□	■	$-bet	P-bet	□	■	Living healthily for 7 additional years

Figure 2. Hypothetical response to choice list valuation of a $-bet (financial) and P-bet (health), yielding certainty equivalents of 4,500$ and 3.5 years, respectively.

RESULTS

Descriptive statistics

Sample characteristics for these two groups of students can be found in Table 2. Comparisons between the two groups yielded some significant differences, showing that economics students (relative to medical students) were more likely to be male, and reported being in a higher study year and more competent in statistics.

Preference reversals for each scenario were first analysed descriptively by creating a dummy variable, which indicated if a preference reversal occurred or not. Table 3 shows the overall results of this online experiment, which indicate that predicted preference reversals were the most occurring combination of preferences in all conditions. Furthermore, only very few unpredicted preference reversals occurred, representing just

over 1% of all combinations of preferences. Hence, we will study both reversals combined, and for brevity refer to these as '*the rate of preference reversal*'.

Table 2. Sample characteristics by study discipline

	Econ. (n=119)		Med. (n=129)		Total (n=248)		Econ vs. Medical
	Mean	SD	Mean	SD	Mean	SD	
Age	21.60	1.94	21.43	2.24	21.51	2.10	
Stat. comp.[6]	2.94	1.02	2.51	0.82	2.72	0.94	$p < 0.02$
Study year	3.81	1.32	3.58	1.69	3.69	1.53	$p < 0.02$
Gender	Female 58	Male 61	Female 104	Male 25	Female 162	Male 86	$p < 0.002$

Table 3. Overall frequency distribution for combinations of preferences per condition, observations and (%)

Pattern	Health		Financial		Interpretation
	Open-ended	Choice list	Open-ended	Choice list	
P$	147 (59.3%)	120 (48.4%)	137 (55.2%)	94 (37.9%)	Predicted reversal
$P	0 (0.0%)	3 (1.2%)	1 (0.4%)	3 (1.2%)	Unpredicted reversal
PP	77 (31.0%)	89 (35.9%)	82 (33.1%)	85 (34.3%)	Consistent
$$	24 (9.7%)	36 (14.5%)	28 (11.3%)	66 (26.6%)	Consistent

Note: The pattern P$ indicates that the P-bet was chosen in the choice task, but that the $-bet was valued strictly higher in the valuation task, while $P indicates the reverse pattern. PP and $$ indicate a choice for a bet that was valued at least as good or higher (i.e. no inconsistency).

Comparisons by students' discipline, outcome domain, and valuation procedure

We compared preference reversals by study discipline, outcome domain and valuation procedure using chi-squared tests. When we sum preference reversals (i.e. predicted and unpredicted), we find that combined for all conditions, fewer reversals occurred in financial domain than in health, economics students show fewer reversals than medical students and fewer reversals occur when choice lists are used compared to open valuation (see Table 4).

6 1 indicating "I had no statistical training", 2 "I feel somewhat competent with statistics", 3 "I know my way around statistics, but I'm not an expert", 4 "I feel competent in statistics", 5 "My specialization is statistics".

Table 4. Reversals rates by domain, training and procedure

Domain	Health	Financial	Chi^2
Rate of reversal	54.4%	47.6%	$p < 0.05$

Training	Medicine	Economics	Chi^2
Rate of reversal	56.6%	45.1%	$p < 0.001$

Procedure	Open Val.	Choice list	Chi^2
Rate of reversal	57.5%	44.4%	$p < 0.001$

When comparing rates of preference reversals between-subjects (see Table 5), we note that for open valuation, an effect of domain-relevant training appeared to occur. Economics students had a significant 14.6 pp difference between financial and health outcomes using open valuation (9.8 pp using choice lists) and were, as expected, more consistent in the financial domain (their area of expertise).

Table 5. Reversal rates between subjects

Economics students				**Medical students**			
Rate of reversal	**Open Valuation**	**Choice List**	**Chi^2 (method)**	**Rate of reversal**	**Open Valuation**	**Choice List**	**Chi^2 (method)**
Health domain	59.3%	43.1%	$p < 0.05$	**Health domain**	59.7%	55.0%	$p = 0.450$
Financial domain	44.7%	33.3%	$p < 0.10$	**Financial domain**	65.9%	45.7%	$p < 0.05$
Chi^2 (domain)	$p < 0.05$	$p < 0.05$		**Chi^2 (domain)**	$p = 0.303$	$p = 0.135$	

By using choice list valuation, both economics and medicine students were more consistent compared to open valuation (i.e., showing lower rates of preference reversal). The most substantial reductions in the rate of preference reversals through choice lists could be observed outside of the respondent's area of expertise. The rate of preference reversals of economics students using choice lists was 16.2 pp lower in the medical domain as opposed to an 11.4 pp reduction in the financial domain. Medical students showed a non-significant 4.7 pp reduction in the rate of preference reversals in the health domain and a significant 20.2 pp reduction in the financial domain when preferences were elicited with choice lists.

Regressions

To substantiate our descriptive findings further, we ran a logistic mixed-effects regression, which allowed us to determine to what extent the chance of observing a preference reversal was affected by our experimental conditions. Table 6 shows the results for a logistic regression model with random subject effects and fixed effects for: a) domain (financial vs health), b) discipline (economics vs medical students), c) procedure (choice list vs open-ended valuation, d) domain-relevant training (domain x discipline interaction) and e) interaction term for procedure and discipline. This analyses showed that preference reversals are more likely to occur a) in the health domain, b) for decisions by medicine students, and c) for open valuations (as opposed to choice list elicitation). Furthermore, we observed a marginally significant interaction between discipline and domain (i.e., the effect of domain-relevant training): medical students were less likely to show preference reversals in their 'own domain'. Importantly, when exploring the robustness of our findings, we found that our main findings were mostly unaffected by controlling for demographics and order effects. The results of these analyses can be found in Appendix C.

Table 6. Results of logistic mixed-effects regression predicting the preference reversal by our experimental conditions

	Estimate	SE	Z	p
Constant	-0.84	0.19	-4.56	**<0.001**
Main effects				
Discipline (medical)	0.79	0.25	3.36	**0.001**
Domain (health)	0.59	0.20	2.99	**0.003**
Procedure (open ended)	0.63	0.20	3.18	**0.001**
Interaction effects				
Domain-relevant training (medical x health)	-0.52	0.27	-1.91	*0.06*
Discipline (medical) x Procedure (open)	-0.10	0.27	-0.38	0.71

Note: Bold-faced p-values are significant at α=1%, italicized p-values are significant at α=10%.

DISCUSSION

This study investigated whether domain-relevant training, gathered through selecting into and exposure to education to become a physician or economist, and choice list elicitation procedures reduced the rate of preference reversal in decision making for others for both health and money. Given that we studied preference reversals for both health and fiancial outcomes, the results of this study can be compared to the extant literature in these two domains. Overall, we find preference reversals to occur frequently with strictly reversed preferences occurring in 32 to 66% of the sample, depending on

the condition. These high rates of (predicted) preference reversals are in accordance with earlier studies for financial outcomes (Grether & Plott, 1979; Lichtenstein & Slovic, 1971) and health (Oliver, 2006, 2013; Oliver & Sunstein, 2019; Stalmeier et al., 1997). Some studies, often with designs that deviate more from the original set-up used by Lichtenstein and Slovic (1971), find somewhat lower rate rates of preference reversals – especially for health (e.g. Bleichrodt & Pinto Prades, 2009; Pinto-Prades et al., 2018). Oliver and Sunstein (2019) compared preference reversals for health and money (and other domains) using different samples for each domain and found higher overall rates of preference reversal for health, which we confirmed in our study with direct within-subjects comparisons. Furthermore, for 3 out of 4 between-subjects comparisons, preference reversals occurred more frequently for health.

In addition, our design allowed comparing open-ended valuations and computer-assisted choice lists. The latter has only recently been introduced in preference elicitation in health economics (e.g. Arrieta et al., 2017; Attema & Lipman, 2018; Galizzi et al., 2016; Irvine et al., 2019; Pinto-Prades et al., 2018). In line with our first hypothesis we found that choice-based valuations, using guided choice list elicitation, reduced the rate of preference reversals for both health and money. Hence, our findings confirm earlier work for health (Attema & Brouwer, 2013) and money (Bateman et al., 2007; Bostic et al., 1990). Moreover, it appears that choice lists yield a lower rate of preference reversals, when they are used in a domain that is unfamiliar to the respondent. This would make choice lists elicitation especially attractive for preference elicitation in general population samples where no experience with the outcome domain can be expected.

Furthermore, we find a higher rate of preference reversal for medical students overall, and a trend suggesting that the increase in rates of preference reversals from money to health is smaller for medical students (as shown by the regression results in Table 6). For example, when medical students completed the open-ended valuation, we found fewer preference reversals for health than for financial outcomes, but not when using choice lists. This effect was stronger for economics students, who had a lower rate of preference reversal in the financial than in the health domain in both methods. Therefore, we find some support for our second hypothesis, that subjects with domain-relevant training show fewer preference reversals in their respective area of expertise.

Overall, we found a more substantial effect of valuation procedures as opposed to domain-relevant training. This may suggest that in our study scale compatibility (Tversky et al., 1990) plays a larger role in generating preference reversals than imprecise preferences (Butler & Loomes, 2007). The fact that controlling for the years of education of respondents did not affect our findings is in line with this (see Appendix C). However, this experiment was unable to provide conclusive evidence regarding this issue, as we used a between-subjects design to test for domain-relevant training (as opposed to studying one individual accumulating experience). This distinction may be important, because even though

economics and medicine students may differ in the content of their experience, they may also differ in terms of experience with participating in preference-based experiments. Hence, the higher overall rates of preference reversal we observed for medical students may also be a reflection of imprecise preferences due to the unfamiliarity or a lack of domain-relevant training in participating in experiments, providing support for the conjecture of Butler and Loomes (2007). Furthermore, while this study allowed us to test if the consistency in choices is affected by the elicitation procedure and the familiarity with the outcome domain, we have no way of determining what the 'true preferences' of participants would be. Moreover, we cannot assert that observing fewer preference reversals implies that elicited preferences are more aligned with such 'true preferences'.

Regardless of our attempts to reduce them, preference reversals remained prevalent. Earlier work provides several explanations for these findings. First, as has been shown by Pinto-Prades et al. (2018), choice list elicitation is a transparent and straightforward way to elicit preferences. This explicit transparency may have allowed subjects to deduce that the goal of this task was to observe an indifference between two outcomes. If respondents are aware of the goal of the task, this could lead to strategic choices or influences from previous choices (a consistency that does not necessarily imply more precise estimates of preferences). Other methods, e.g. the hidden choice-based procedure developed by Fischer and colleagues (1999), reduce these influences by spreading elicitations over multiple items that occur in random order, and they have been shown to reduce the rate of preference reversals (Fischer et al., 1999; Pinto-Prades et al., 2018).

Second, we opted to study preference reversals in decisions for others, as this is relevant in real life and in the context of economics and medicine students' training. Oliver (2013) found that preference reversals occur more frequently in the context of social decision making. In our experiment respondents advise others on decisions and, hence, one might object to referring to these choices on behalf of others as 'preferences' (and inconsistencies as 'preference reversals'). However, similar to Oliver (2013), we decided to also use the established term 'preference reversal' in a context of decision making for others, since the phenomenon is well established under this term in the literature, although it needs noting that in doing so, we use the term preference in a broad sense.

Third, this experiment was completed using online survey software. Although several studies found little differences between lab and online studies (Birnbaum, 2000; Dandurand et al., 2008; Germine et al., 2012; Riva et al., 2003), other studies found that completing research in online environments may lead to higher variances or more noise (e.g. von Gaudecker et al., 2008). In our study, more noise would have been reflected in higher rates of preference reversals, both predicted and unpredicted. Given that the number of unpredicted preference reversals was negligible (less than 1.5%), our results give little indication to expect a large effect of noise related to the online nature of the experiment.

Fourth, the recruitment procedures for the two groups of students differed between medical and economics students, but both groups were unaware of the nature of the experiment until they started it. Therefore, we expect the effect of this difference to be small. Self-selection into the experiment may hamper the generalizability of our findings, as this may involve a biased sample of students.

Finally, related to the issue of generalizability, our (relatively limited) sample comprised of 248 students of economics and medicine, which also raises the question whether our findings generalise to i) the general public, ii) other trained professionals and their respective domains, and iii) actual medical professionals or economists. Given the main dimensions on which our sample differed from the general public (e.g., age, education level and wealth), which are related to risk attitudes (Halek & Eisenhauer, 2001; Hartog et al., 2002), investigating the effects of choice-based elicitation in a general public sample would be an interesting venue for future research. Larger sample sizes would then also be more feasible to obtain. Furthermore, although recruitment may be time-consuming, to further study the effect of domain-relevant training on preference reversal, future work could recruit respondents working as trained experts in these fields, such as investment bankers (as in Abdellaoui et al., 2013) or physicians (as in Brosig-Koch et al., 2016). Although these studies give no indication to expect qualitatively different decision-making, such future work could explore if the positive trend related to domain-relevant training is amplified when more decision experience is accumulated.

CONCLUSION

If observed preferences indeed depend on the way they are elicited, as we showed in this study, this is problematic. As long as revealed and stated preferences remain a cornerstone of research in health economics, such preference reversals offer a challenge to both empirical and theoretical work. Whereas preference reversals appear to be robust, occur frequently and are especially prevalent in unfamiliar domains, we believe this study may still offer some guidance for preference elicitation in research and practice in the future. First, guided choice-based valuation, such as choice list elicitation, may be a promising tool to obtain more consistent preferences. Whether this also implies more accurate measurement of preferences remains to be seen. Second, although preference reversals were more common for decisions about health as opposed to money, we found that medicine students show fewer reversals in their own domain. This effect could have several explanations, but a positive interpretation would be that domain-relevant training improves consistency.

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3

CHAPTER 3

Domain-specific reference points and life satisfaction

BASED ON

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ABSTRACT

In the evaluation of well-being, it is not only important what people have in absolute terms, but also how this compares to reference points in relative terms. We explore the relevance of relative comparisons by testing the effect of people's self-rated position on potential reference points for income and health on their subjective well-being. We used Multiple Discrepancies Theory as a framework to identify seven potentially relevant reference points for income and health. A representative sample (N=550) of the Netherlands assessed their income and health relative to these reference points. In addition, we elicited monthly household income, health status (EQ-5D-5L), and subjective well-being (SWLS). In line with the literature, we found a negative convex relationship between subjective well-being and age and a positive relationship with being employed, income, and health. For income, subjective well-being was also associated with how current income compared to respondents' needs and progression over time, and for health especially with how current health compared to what they felt they deserved. Our findings suggest that income and health are important for subjective well-being both in absolute and relative terms. We found negative effects on life satisfaction if some of the domain specific reference points were not met.

INTRODUCTION

There is increasing attention for subjective well-being (SWB) in research (Diener et al., 1999; Dolan et al., 2008) and policy (Diener et al., 2010; Kahneman et al., 2004; OECD, 2017). SWB is a part of overall well-being and is used as an umbrella term for how people think and feel about their life in general. More formally, *"SWB is defined as a person's cognitive and affective evaluations of his or her life"* (Diener et al., 2012). Previous research into the determinants of SWB suggested that income and health are two of the essential factors associated with SWB (Diener et al., 1999; Dolan et al., 2008). Nonetheless, how health and income attainments exactly translate into SWB is less obvious. Prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) proposes that individuals use reference points when evaluating outcomes such as their health or wealth. Outcomes are processed as deviations from this reference point, often the status quo, and subsequently evaluated as a gain or a loss (Wakker, 2010). Several empirical studies showed that relative comparisons of income affect well-being, for example, when it is compared to the income of others (Carlsson et al., 2007; Luttmer, 2005), or own past and prospective incomes (Easterlin, 2001). Although this suggests reference points are indeed relevant, it leaves open the question which reference points are used.

For most domains, it is unknown which -or indeed how many- reference points people use. To avoid focusing on only one potential reference point, hence potentially missing relevant others, we apply Multiple Discrepancies Theory (MDT), developed by Michalos (1985). MDT suggests that multiple reference points could be used when evaluating one's situation, even simultaneously. A person's satisfaction with the situation is assumed to depend on perceived differences between what one has and seven points of comparison. These are what individuals think they need to survive (self-needs), what individuals think they are entitled to (self-deserve), what they would like to have (self-wants), what people in their immediate environment have (self-others), what individuals ever had before (self-past), what they had expected to have now three years ago (self-progress), and what they expect to have five years from now (self-future).

The importance of income for SWB has been shown before (e.g. Lucas and Schimmack, 2009). Affluent individuals usually report a higher SWB than impoverished people. However, a more recent study by Jebb et al. (2018), building on the research of Kahneman and Deaton (2010), suggested that additional income only increases SWB up to a saturation point.

Based on US data, Easterlin (1980) observed that wealthier people reported a higher SWB, but that increases in the absolute income of a country did not raise overall SWB. This finding has been labelled the Easterlin paradox. When the study was repeated, including several industrialised and developing economies, Easterlin et al. (2010) found that short-term happiness and income move in the same direction (e.g. downwards in a financial

crisis). Nonetheless, in the long run (i.e., about ten years), SWB does not increase together with the absolute income over time. One possible explanation for this paradoxical finding is that individuals compare their income to that of others and themselves in the past, which Clark et al. (2008) call internal and external reference points.

Previous studies found that not only absolute levels of income impact SWB (Diener et al., 1993) but also relative comparisons (Easterlin, 1980; Easterlin et al., 2010). For instance, Luttmer (2005) found that an increase in the neighbours' earnings negatively affects the well-being of an individual. In related research, Kuhn et al. (2011) found that neighbours of lottery winners are more likely to (also) buy new cars, and Agarwal et al. (2018) showed that the magnitude of lottery prizes increased the number of subsequent bankruptcy filings of nonwinning peers in the neighbourhood. This suggests that relative comparisons can increase the consumption of peers, which is colloquially referred to as "keeping up with the Joneses" (Cambridge Dictionary, 2019).

The second domain considered to be one of the major determinants of SWB concerns health (Diener and Chan, 2011; Okun et al., 1984). The impact of health on SWB is substantial (Dolan et al., 2008), and the literature suggests the association between health and well-being relies, at least in part, on relative comparisons (Diener et al., 1999). For example, results from the German Socio-Economic Panel suggest that becoming sicker than the reference group worsens health satisfaction (Thiel, 2014). To a certain degree, there is interdependence between SWB and health and also income, where well-being affects health and income. For example, Diener and Chan (2011) showed that SWB serves as a predictor of health and longevity, while for income, Oswald et al. (2008) find that people with higher well-being are more productive.

The absolute health status of an individual tends to depreciate over time due to ageing. In theory, this would lead to an increasingly negative effect on SWB because of the deprecation of absolute health. This effect is offset by the process of adaptation, which mitigates the effect of declining health on SWB over time (Cubí-Mollá et al., 2017; Etil et al., 2017; Powdthavee, 2009). An early example of adaptation concerns the case of extreme events, where a study by Brickman et al. (1978) compared the relative happiness of lottery winners and accident victims to a control group. They found that lottery winners were, in general, not happier than people in the control group because they gained less pleasure from ordinary events after experiencing an extremely positive event. In contrast, para- and quadriplegic accident victims reported their happiness at 2.96 on a five-point scale within twelve months after their accident, compared to 1.28 shortly after the accident. In a study using the same dataset as the current study, Wouters et al. (2016) concluded that absolute improvements in health might improve SWB. However, perceived improvements relative to relevant reference points may have the same effect.

Overall, reference points and theories of reference dependence remain a theoretical and practical challenge in economics. On the theoretical side, Wakker (2010) argues that we still lack a comprehensive theory of how reference points are formed. Hence, both how and which reference points are formed is not easily theoretically predicted. Empirical studies may therefore provide information on which reference points are relevant in this context. The practical implications of existing multiple and domain-specific reference points are relevant for policymakers who aim to maximise well-being. To explain and understand how people react to policies or changes, we need to investigate which reference points are relevant for people's assessment of wellbeing. The reference points people use in such evaluations may be absolute (e.g. size of a payment) or relative (e.g. size of a payment relative to the one of others), and multiple, domain specific reference points may exist simultaneously. This may not only inform policies attempting to improve (relative) attainment, but also those trying to influence people's reference points themselves. Kahneman and Tversky (1981) for instance suggest that the framing of outcomes can shift a reference point and well-being evaluations therefore may vary if an outcome is perceived as a gain or a loss. A better understanding of which reference points for income and health are associated with well-being may therefore provide policymakers with valuable information on designing and framing their policies to maximise well-being.

Hence, the objective of this paper is to explore the relevance of a broad range of potential reference points for income and health in the context of subjective well-being.

METHODS

Subjects

The subject pool for the current study consisted of 550 respondents representative of the general public in the Netherlands between 18-75 years regarding age, gender, and education. A professional sampling company was hired to program the experiment and obtain the data through an Internet survey. Panel members received an invitation to participate in a web-based questionnaire. By accepting the invitation to participate in this survey, respondents provided consent to use their responses for the purpose of this study. The data reported in this paper was collected in 2013 as part of a larger study. Here we only used a part of the relevant data for MDT and potential reference points; other elements were used for other purposes (Attema et al., 2018; Wouters et al., 2016). The relevant parts of the questionnaire can be found in the appendix.

Design

The respondents first received questions regarding their sociodemographic characteristics. To account for respondents' personal characteristics, we selected age, gender, education level, marital status, having at least one child, and being unemployed from the sociodemographic section. For gender, we created a dummy variable taking the value 1 for males (49.3%) and 0 for females. We did the same for unemployment where the dummy took

the value 1 if the respondent stated to be unemployed (11.8%) and 0 if they were working, retired, pensioners, doing housework, or were in training. A different dummy variable took the value 1 if respondents were married or living with a partner (59%) and the value 0 if they were single, divorced, widowers or in another type of relationship. Lastly, a dummy variable took the value of 1 if respondents had a least one child (57.5%) and 0 otherwise. Education was grouped into the categories low (28.6%), middle (41.6%) and high (29.8%).

In the second part of the survey, we asked subjects to complete the Satisfaction with Life Scale (SWLS), where they had to indicate to what extent they agreed with five propositions about their life (Diener et al., 1985). Each proposition consisted of seven response possibilities, varying from "completely disagree" to "completely agree". The point values of the answers to the five propositions were then summarised into a composite well-being index ranging from 7 (lowest possible well-being) to 35 (highest possible well-being). The third part of the survey was about income. Subjects were first asked to tick one of 13 income bands (see Appendix C for income bands used) in which their current monthly net household income fell. We used the midpoints of the chosen income band in the analyses; in case a subject picked the lowest [highest] band "below €999" ["€8,000 or more"], they were asked to state their income in an open text field.

To elicit relative income positions, the net monthly household income stated before was displayed. We asked for (1) the income that would be sufficient for the respondents household to get by (*subsistence income;* see Appendix C), and (2) the income that their household would need to be able to live a comfortable life without any worries (*luxury income;* see Appendix C). These latter questions were specifically drawn up for this study, but resemble and build on previous work (van Praag and Frijters, 1999). Individuals were asked to evaluate their income through a verbal qualifier such as sufficient or very good (here labelled as subsistence and luxury). As an alternative, externally determined measure of relative income, we used two reference budgets for households in the Netherlands (in 2014) that specified values for a "basic needs budget" and a "not-much-but-adequate budget", respectively (Hoff et al., 2016). These were coded as dummy variables taking the value of 1 if household income was below the household-specific "basic needs budget" (24.7% of households in the sample) or "not-much-but-adequate budget" (25.8% of households). We selected the "basic needs budget" as an externally determined measure of relative income in the regressions since this was conceptually closest to the subsistence income. Since the reference budgets for households in the Netherlands are based on the number of household members, we calculated separate budgets lines for each respondent based on their household composition.

Health state was elicited by using the EQ5D-5L (Herdman et al., 2011) that captures the respondents' health states using five dimensions; i.e. mobility, self-care, usual activities, pain/discomfort and anxiety/depression, each with 5 levels ranging from "1-no problems" to "5-extreme problems". We added a sixth dimension to the questionnaire to better

account for neuropsychiatric health problems. This question captured cognitive health or functioning, e.g. memory, concentration, coherence, and IQ. A more detailed discussion of why this is a relevant addition to the EQ5D-5L can be found elsewhere (Wouters et al., 2016). Based on these absolute health assessments, we generated a health problem index by summarising the scores of the EQ5D-5L and the cognitive dimension, which therefore ranges from 6 (best health) to 30 (worst health).

Reference points for income and health

Finally, the MDT dimensions cover a broader range of relative comparisons. To cover these, we asked respondents to compare their current income to a set of seven reference points derived from MDT. These are what individuals think they need to survive (self-needs), what individuals think they are entitled to (self-deserve), what they would like to have (self-wants), what people in their immediate environment have (self-others), what individuals ever had before (self-past), what they had expected to have now three years ago (self-progress), and what they expect to have five years from now (self-future).

Each comparison could be rated on a nine-point Likert scale ranging from "not good at all" (1) over "neutral" (5) to "very good" (9). The set of questions can be found in Appendix A and B. Based on MDT, life satisfaction may depend on comparisons between the current conditions (here in terms of income and health) and the standards described in MDT. A discrepancy resulting from an upward comparison (i.e. the standard is higher than the current situation) is expected to have a negative impact on satisfaction, whereas a downward comparison (current situation is better than the standard) is expected to have a positive impact (Michalos, 1985; Diener et al., 1999). We expect a more substantial impact on well-being from downward comparisons since prospect theory predicts that losses loom larger than gains of the same magnitude (Kahneman & Tversky, 1979a). Therefore, we generated dummy variables for each MDT item that takes the value of 1 for an upward comparison, i.e. if the rating is anywhere between "not good at all" and "not good" (1-4 on the 9 point Likert scale) and 0 for neutral to very good (5-9). With this approach, we take neutral (5) as the status quo and anything below neutral as a loss compared to the offered reference point, e.g. what individuals think they need to survive (self-needs). Consequently, we expect a negative association with the SWLS score for all MDT reference point dummy variables.

Data Analysis

Descriptive statistics of the sample and the MDT domains were first derived. Next, we employed independent-samples t-tests to compare well-being of those being below neutral to those above neutral in each of the MDT domains. Furthermore, we looked at the distribution of the sample across the relative income categories and the corresponding well-being ratings. Since one might argue that the MDT domains elicit quite similar aspects (e.g. self-future and self-progress) regarding income and health, we inspected the correlation between the MDT domains. To that end, we used Spearman's rank

correlation coefficients to assess the relationships between the MDT reference points in both domains. We proceeded by using the Variance Inflation Factor (VIF) to measure the degree of multicollinearity. A VIF is commonly seen as unproblematic if it is below 10 (Chatterjee et al., 2000; Neter et al., 1990).

Finally, we employed a stepwise ordinary least squares regression approach to investigate the relationship between SWB and the reference points for income and health. We estimated a total of 8 models, each testing variables of interest or alternative specifications, e.g. for different measures of relative income in model II and model III. More specifically, model I was the basic model, including only sociodemographic characteristics, absolute income and health, the latter measured by the health problem index. We included the dummy variables signalling unemployment, being married or living together and having at least one child. Furthermore, we added age squared and the health problem index squared to test for a non-linear relationship between these variables and SWB.

Model II added the relative income variables displayed in Table 4 to Model I, as a dummy variable that is equal to 1 for respondents with an income higher than their subsistence level, or at least as high as their luxury income level (i.e., C, D and E in Table 4), and 0 otherwise. Having an income below or at the subsistence level served as a base. Model III tested the alternative specification of relative income, being below the "basic needs budget", as an alternative to the subsistence and luxury income levels. Model IV added the MDT reference points for the income domain to Model I. Model V tested the self-stated relative incomes levels combined with the MDT income reference points. In Model VI, we tested the MDT reference points for health in the basic specification and added relative income (subsistence and luxury level income) in Model VII. Model VIII ultimately included all potential reference points for income and health. This stepwise approach aimed to provide tractable insights into the influence of specific factors, such as relative income and showed the robustness of estimates.

RESULTS

Table 1 presents the sample characteristics, while Table 2 presents descriptive statistics of the MDT reference points for income and health. Mean net household income was € 2,152.27 (median: 1,750, SD: 1,310.29, IQR=1,500), mean subsistence income was € 2,080 (median: 1,750, SD: 1,204.67, IQR=1,000) and median luxury income was € 2,750, with the mean € 185,518 (SD: 4,263,867, IQR=1,500) being skewed due to a few outliers in the data.

The distribution of the respondents in terms of the relative income categories and the mean SWLS scores associated with them are presented in Table 4. Some participants seemed to have struggled with the relative income questions, as indicated by category E. Characteristic for these 34 participants, who reported the same value for subsistence

and luxury income, was that they spent significantly less time with the questionnaire than all other participants (others gave the same score for all MDT questions). As a robustness check, the analysis was repeated, excluding 48 participants that showed the similarities described above (category E in Table 4 and MDT in patterns), but this did not change the results.

Given the descriptive statistics, we inspected the correlation between the MDT domains for income and health. The answer patterns are reported in Figure 1 and 2. Furthermore, Spearman's rank correlation coefficients matrices are reported in Table 6 and 7 in Appendix D to assess the relationships between the MDT reference points in both domains. The results suggest a positive correlation between MDT reference points in both the health and income domain. The MDT domains' VIF ranged from 1.54 to 2.67, which suggests an unproblematic degree of collinearity in the regressions (Chatterjee et al., 2000; Neter et al., 1990).

The results from the independent-samples t-test in Table 3 established a statistically significant difference in SWB values for being below or above the reference point (neutral) across the MDT reference points for health and income. We furthermore observed differences in SWLS scores in the relative income categories A-D. This may suggest that living below what oneself considers her or his subsistence level income was associated with lower SWB. On the other end of the spectrum, having an income at or above what respondents considered their luxury level income was associated with higher SWB, which intuitively makes sense.

Table 5 reports the results of the eight regression models. Across models, SWB was decreasing up to age 40-45 and then increasing. Furthermore, in line with expectations, well-being was positively associated with income and negatively with unemployment. The association of SWB with the health problems index was also convex, indicating that more health problems were associated with lower SWB, but at a decreasing rate. Both living together and having children were positively associated with SWLS scores, but only at the 10% level and not consistently throughout models.

The relative income expressed by having an income above the stated subsistence and luxury income introduced in model II (also part of model V and VII-VIII) was associated with a significantly higher SWB compared to people at or below the subsistence level. The alternative (external) specification of relative income, having an income below the "basic needs budget", was not significant. Once the subsistence and luxury income dummies were added, absolute income was no longer significant, suggesting relative income may be more strongly associated with SWLS scores than absolute income.

When applying the MDT reference points for income in model IV-V and model VIII, we identified that two MDT reference points, namely self-need and self-progress, were

significantly associated with SWB. As expected, the signs were negative, meaning that having an income in the loss domain (worse than neutral) compared to the income one would need to survive and what respondents had expected to have at that point in time was associated with a negative impact on SWB.

We investigated the effect of the MDT reference points for health in model VI without relative income and in model VII, including it. In the health domain, self-deserve was highly significant with a negative sign throughout models VI-VIII, implying that having a health status that is considered worse than what respondents believed they are entitled to was associated with a lower SWLS score. We identified two more potential reference points in the health domain, but not consistently throughout models and only at the 10% level. Self-progress, rating own health worse than the health the respondent expected to have, was only significant in models where we included reference points for health (model VI & VII), but not when combined with the MDT reference points for income. When these were added (Model VIII), self-others was significant. This suggests that when comparing the own health to that of others in the immediate environment, a health state seen as worse than neutral was associated with a lower SWB.

Overall, our results indicate that in the income domain, SWB was primarily associated with people's comparison to their needs and their progression over time compared to expectations about this in the past. In the health domain, what people think they deserve was significantly associated with SWB, whereas the association with other reference points was less clear. Furthermore, as compared to health, relative income variables appeared comparatively more relevant than absolute income variables for SWB. For health, the addition of the MDT reference points was relevant in explaining differences in SWB. Still, it did not affect the relevance of absolute health, expressed by the health problem index.

DISCUSSION

There is a growing interest in how people evaluate outcomes relative to reference points. Here, we investigated the relationship between subjective well-being and multiple potential reference points for income and health derived from multiple discrepancies theory (Michalos, 1985). This provided insights into which reference points respondents may use when evaluating their subjective well-being. To our knowledge, this is the first application of MDT to identify which potential reference points people apply in the income and health domains, which are seen as two of the most important contributors to subjective well-being (van Praag et al., 2003). Our results allowed us to identify to which reference points individuals compared their income and health in assessing SWB. This may help to further understand SWB assessments and future research in identifying how exactly reference points are formed and why.

Our results suggest that in our sample, multiple reference points were associated with life satisfaction. We found significant negative effects on life satisfaction measured by the SWLS when there were discrepancies between the current income and the perceived self-need or self-progress. An upward comparison, meaning that the current income was rated worse than what respondents think they need or expected to have, was associated with lower satisfaction. This finding is intuitive and in line with the theory (Diener et al., 1999; Michalos, 1985). Falling short of an expectation or reference level would be expected to have a negative impact on SWB. Indeed, Stutzer (2004) also highlights the importance of relative income and suggests that subjective well-being depends on gaps between the actual income and aspirations rather than on absolute income levels.

Similarly, we found that relative income (i.e. actual income compared to self-stated subsistence and luxury incomes) was significantly associated with SWB throughout all models. In contrast, the comparison to the basic budget line, which could be seen as an external relative income category, was not significantly associated with SWB. Furthermore, the basic budget line values, relevant in Dutch policy, were substantially below what respondents believed to be a subsistence income. For example, median subsistence household income for couples with no children was € 2,250 as indicated by themselves, while, in contrast, the basic budget for this household would be € 1,330 (Hoff et al., 2016). This suggests that (self-perceived) relative income may be more relevant for SWB than absolute income and that own assessments of minimum levels of income may be more important than 'objective' figures. Other studies (Gabillard and Duesenberry, 1953; Luttmer, 2005) suggested that relative income in the form of social comparisons is important for subjective well-being, which we could not confirm in our study. Differences in income inequality between countries, which are lower in the Netherlands than, for instance, in the United States or the United Kingdom (OECD, 2019; van Doorslaer and Koolman, 2004), may partly explain this.

In the health domain, being in a health state that was perceived as worse than what respondents thought they deserved was highly significantly and negatively associated with life satisfaction measured by the SWLS, similar to findings by Wouters et al. (2016). In agreement with Graham et al. (2011), we found that comparing own health to that of people in one's direct environment (self-others) was significantly associated with life satisfaction. Graham and colleagues (2011) found a positive impact of reference group health in a Latin American context. In contrast, we found that if the own health state was considered worse than that of the reference group's health, this was negatively associated with SWB in our sample from the Netherlands. However, this association was only marginally significant and was not consistently observed throughout different models, e.g. not when only the MDT reference points for health were included (regression models VI-VII). One further reference point for health, self-progress, also was sometimes found to be potentially relevant. Our findings in this sense partly resemble those of Michalos (2004, 1991), who found that gaps in self-wants and self-others had the most considerable impact on health

satisfaction in a large cross-country student sample. Our findings suggest that reference points are associated with SWB scores in both the income and health domain, but different reference points may be relevant in these domains and further research may explore these reference points further.

Some limitations of this study need noting. First, we emphasise that we use the term 'reference points' somewhat loosely compared to its definition in prospect theory. Indeed, we did not precisely quantify the income or health levels below which an individual would consider him- or herself in the loss domain, nor did we directly observe inflexion points below and above these points. We instead investigated which types of reference points within the set provided by MDT were significantly associated with SWB, which is merely suggestive of functioning as reference points.

Second, the dataset used for this research was obtained in a representative sample of the Dutch population. Therefore, the generalisability of our results to other settings (e.g. countries with lower levels of income and health or more inequality) is limited. Repeating this study in larger samples would be of value as well. This might also allow a closer investigation of SWB changes on the Likert scale.

Third, this study only identified associations between reference points in the respective domains and subjective well-being, limiting its contribution. Future research could use more formal tests to investigate whether the here identified potential reference points actually serve as formal reference points, for instance using an experimental design (e.g. Lipman et al., 2020). Causal relationships could also be investigated using panel data by investigating the effect of changes in variables serving as reference points.

Fourth, we used an unweighted composite index of the five propositions in the Satisfaction with Life Scale in this study. The advantage of such a multi-item scale is that it has higher reliability and is less prone to differences in scale interpretation across individuals than single-item scales (OECD, 2013). On the other hand, Cheung and Lucas (2014) showed that single-item scales can perform as good as the multi-item SWLS when eliciting life satisfaction. Since there is no established standard to measure life satisfaction (OECD, 2013), we summarised the result in one index. Using a single-item scale or a composite index out of both (Himmler et al., 2020) would also have been options. Some authors argue that the last two items of the SWLS should be omitted (Lamu and Olsen, 2018) since these two items are age-sensitive (Zou et al., 2013). We tested this approach as a sensitivity analysis, but it did not change our results.

Furthermore, there were some incoherent answers by respondents, such as answering in patterns or stating illogical relative incomes such as a luxury income below the subsistence income. This may be due to the length of the overall questionnaire or a problem with the relative income categories. We conducted a sensitivity analysis to address this potential

issue, excluding all participants that showed incoherent answers (n=182). The results of the sensitivity analysis were similar to model VIII. The directions of the coefficients did not change, but the self-others reference point for health was no longer statistically significant.

Fifth, we only focused on income and health as two essential domains in determining overall well-being using self-reported values. Future research into identifying reference points in other domains and the quantification of these and those highlighted in this paper is encouraged.

Overall, our results suggest that people may use multiple and domain-specific reference points when evaluating SWB. This would imply that people focus on multiple and domain-dependent comparisons when evaluating their achievements in specific domains to determine subjective well-being. Furthermore, our results imply that money matters, but primarily in relative terms. SWB appears to be substantially negatively affected when current income is below what people think they need to 'survive' (self-need), although we only observed associations. One could claim that Dutch social security legislation already incorporates this critical aspect, given that unemployment benefits are relative to the last earned income (European Commission, 2018).

In addition, policymakers could use framing to influence people to adopt specific reference points (Tversky & Kahneman, 1981). For example, government payments to mitigate the effect of an economic crisis could be framed to enable recipients to meet their self-needs. If respondents took this reference point instead of a self-past one, this could improve both SWB and support for the policy.

In conclusion, people appear to have multiple and domain-specific reference points to compare their current achievements when assessing SWB. The smaller the discrepancy between what they have and what they think they need or deserve, the higher the well-being they experience. Reference points can relate to absolute levels of endowment, but also to relative ones, and the degree to which these matter also appears to be domain-specific.

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TABLES AND FIGURES

Table 1. Descriptive summary statistics of demographic and health characteristics of the sample.

Variable	Level	Sample statistic
Age (S.E., range)		45.6 (0.64, 18-75)
Gender (% male)		49.3
Education	Low	28.6
	Medium	41.6
	High	29.8
Employment status	Employed	48.1
	Unemployed	11.8
	Other	40.1
Household income	Low (<1500 €)	33.8
	Middle (1500 € - 3999 €)	59.5
	High (>3999 €)	6.7
Marital status	Married or living together	59.1
	Other	40.9
Children	Yes	57.5
	No	42.5
Health	EQVAS (S.E., range)	76.8 (0.76, 9-100)
	Mobility problems	28.0
	Self-care problems	7.5
	Usual activities problems	30.0
	Pain/discomfort problems	56.9
	Anxiety/depression problems	27.6
	Cognitive functioning problems	22.4

Table 2. Descriptive statistics of the MDT domains

Reference points	Mean	S.E. and Range	Mean	S.E. and Range
	Income Domain		Health Domain	
Self-needs	5.9	(0.09, 1-9)	6.6	(0.07, 1-9)
Self-deserves	5.6	(0.09, 1-9)	6.4	(0.07, 1-9)
Self-wants	5.4	(0.09, 1-9)	6.7	(0.08, 1-9)
Self-others	5.5	(0.08, 1-9)	6.4	(0.07, 1-9)
Self-past	5.7	(0.09, 1-9)	6.5	(0.09, 1-9)
Self-progress	5.4	(0.09, 1-9)	6.3	(0.08, 1-9)
Self-future	5.5	(0.09, 1-9)	6.5	(0.08, 1-9)

Table 3. Distribution of MDT reference points for income and health and corresponding subjective well-being (SWLS) values using independent sample t-tests

MDT Domain	level	SWLS compact for income				SWLS compact for health			
		Obs.	Mean	sd	p-value	Obs.	Mean	sd	p-value
Self-need	neutral or above	436	25,47	5,75	0,0000	509	25,42	6,33	0,0000
	below neutral	114	17,62	7,36	0,0000	41	15,44	7,95	0,0000
Self-deserve	neutral or above	414	25,33	5,98	0,0000	494	24,82	6,17	0,0000
	below neutral	136	19,32	7,50	0,0000	56	15,20	6,89	0,0000
Self-want	neutral or above	384	25,59	5,93	0,0000	477	24,70	6,35	0,0000
	below neutral	166	19,79	7,27	0,0000	73	18,21	7,65	0,0000
Self-others	neutral or above	450	19,9	7,60	0,0000	498	24,44	6,52	0,0000
	below neutral	100	24,72	6,41	0,0000	52	18,12	7,72	0,0000
Self-past	neutral or above	419	25,26	6,23	0,0000	467	24,78	6,34	0,0000
	below neutral	131	19,29	6,94	0,0000	83	18,53	7,49	0,0000
Self-progress	neutral or above	406	25,56	5,98	0,0000	476	24,80	6,34	0,0000
	below neutral	144	19,00	7,00	0,0000	74	17,69	7,17	0,0000
Self-future	neutral or above	421	25,23	6,07	0,0000	486	24,83	6,34	0,0000
	below neutral	129	19,31	7,47	0,0000	64	16,33	6,27	0,0000

Table 4. Distribution of relative income categories and corresponding subjective well-being (SWLS) values

Variable		SWLS Compact			
	Obsv.	Mean	sd	Min	Max
A: Has income below their own subsistence level	214	20,97	7,33	5	35
B: Has income at subsistence level (below luxury level)	108	24,26	5,67	8	35
C: Has income in-between subsistence and luxury level	112	26,14	5,53	9	35
D: Has income at luxury level (above subsistence level)	82	27,51	5,42	10	35
E: Has income at both subsistence and luxury level (all 3 values are the same)	34	24,15	7,64	5	35
Sum	**550**	**23,84**	**6,89**	**5**	**35**

Table 5. OLS regression of SWLS on respondent characteristics, health, and MDT for monetary and health questions

SWLS	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
Age	-0.27**	-0.25**	-0.26**	-0.19*	-0.18*	-0.30***	-0.29***	-0.23**
Age^2	0.0031***	0.0029**	0.0031***	0.0023**	0.0022**	0.0034***	0.0032***	0.0026**
Male (base: female)	-0.80	-1.06**	-0.76	-0.91*	-1.06**	-0.22	-0.51	-0.66
Education level (base: low)								
middle	0.78	0.54	0.82	1.12*	0.96*	0.60	0.39	0.74
high	0.85	0.54	0.79	1.37**	1.14*	0.72	0.44	0.90
Unemployed (base: working/training/ retired)	-3.10****	-3.13****	-3.15****	-1.68**	-1.78**	-2.97****	-2.99****	-1.93**
Married or living together (base: single, divorced, widow, other)	1.09*	1.13*	1.04	0.79	0.82	0.97*	1.01*	0.79
Has at least one child (base: no children)	0.64	0.92	0.61	0.75	0.93	0.76	1.01*	1.03*
Income (base: low <1500)								
Middle income (1500-4000)	1.09*	0.11	1.23	0.049	-0.47	1.08*	0.20	-0.30
High income (> 4000)	3.69****	1.53	3.85***	2.17**	0.83	3.08***	1.19	0.75
Relative income (base: income below or at subs. Level)								
Income between subs. & luxury level		2.20****			1.19**		2.02****	1.26**
Income at or above luxury level		3.38****			2.32***		3.00****	2.26***
Income < basic needs budget			0.20					
Health problem index	**-1.85******	**-1.73******	**-1.89******	**-1.47******	**-1.43******	**-1.40******	**-1.30******	**-1.21******
Health problem index^2	**0.039****	**0.035****	**0.040****	**0.030****	**0.029***	**0.034*****	**0.030****	**0.027****

Table 5. OLS regression of SWLS on respondent characteristics, health, and MDT for monetary and health questions (continued)

SWLS	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
MDT Reference points for income (base: better than neutral)								
Self-need				-2.95****	-2.80***			-2.31***
Self-deserve				-0.91	-0.82			-0.46
Self-want				-0.79	-0.69			-0.68
Self-others				0.24	0.27			0.11
Self-past				-0.82	-0.91			-0.74
Self-progress				-2.29***	-2.23***			-1.97**
Self-future				0.51	0.66			0.79
MDT Reference points for health (base: better than neutral)								
Self-need						-2.20	-2.11	-1.77
Self-deserve						-3.62****	-3.43****	-2.27**
Self-want						1.29	0.99	1.60
Self-others						-1.42	-1.50	-1.51*
Self-past						-0.71	-0.41	-0.36
Self-progress						-1.87*	-1.69*	-1.22
Self-future						-1.44	-1.58	-1.39
R-squared	0.334	0.361	0.335	0.439	0.450	0.412	0.434	0.486

**** p<0.001, *** p<0.01, ** p<0.05, * p<0.10

Table 6. Robust standard errors for all models in parentheses

SWLS	SE MI	SE M II	SE M III	SE M IV	SE M V	SE M VI	SE M VII	SE M VIII
Age	(0.11)	(0.11)	(0.11)	(0.099)	(0.098)	(0.10)	(0.100)	(0.096)
Age²	(0.0012)	(0.0011)	(0.0012)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0010)
Male (base: female)	(0.50)	(0.50)	(0.51)	(0.47)	(0.46)	(0.49)	(0.48)	(0.46)
Education level (base: low)								
middle	(0.64)	(0.63)	(0.64)	(0.58)	(0.58)	(0.59)	(0.59)	(0.56)
high	(0.68)	(0.68)	(0.69)	(0.63)	(0.64)	(0.66)	(0.65)	(0.62)
Unemployed (base: working/training/retired)	(0.88)	(0.87)	(0.91)	(0.77)	(0.77)	(0.84)	(0.84)	(0.79)
Married or living together (base: single, divorced, widow, other)	(0.64)	(0.63)	(0.66)	(0.62)	(0.62)	(0.58)	(0.58)	(0.58)
Has at least one child	(0.65)	(0.63)	(0.66)	(0.60)	(0.59)	(0.61)	(0.60)	(0.58)
Income (base: low <1500)								
Middle income (1500-4000)	(0.62)	(0.63)	(0.98)	(0.60)	(0.60)	(0.58)	(0.59)	(0.59)
High income (> 4000)	(1.08)	(1.13)	(1.37)	(1.01)	(1.05)	(1.01)	(1.04)	(1.00)
Relative income (base: income below or at subs. Level)								
Income between subs. & luxury level		(0.59)			(0.57)		(0.57)	(0.57)
Income at or above luxury level		(0.72)			(0.71)		(0.68)	(0.68)
Income < basic needs budget			(1.01)					
Health problem index	(0.39)	(0.39)	(0.39)	(0.36)	(0.37)	(0.33)	(0.33)	(0.33)
Health problem index^2	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)	(0.013)	(0.013)	(0.013)
MDT Reference points for income (base: better than neutral)								
Self-need				(0.88)	(0.87)			(0.89)

Table 6. Robust standard errors for all models in parentheses (continued)

SWLS	SE M I	SE M II	SE M III	SE M IV	SE M V	SE M VI	SE M VII	SE M VIII
Self-deserve				(0.87)	(0.86)			(0.84)
Self-want				(0.72)	(0.72)			(0.72)
Self-others				(0.81)	(0.81)			(0.78)
Self-past				(0.72)	(0.70)			(0.69)
Self-progress				(0.80)	(0.79)			(0.80)
Self-future				(0.79)	(0.78)			(0.81)
MDT Reference points for health (base: better than neutral)								
Self-need						(1.35)	(1.30)	(1.22)
Self-deserve						(0.98)	(0.95)	(0.93)
Self-want						(1.04)	(1.03)	(1.03)
Self-others						(0.96)	(0.95)	(0.90)
Self-past						(1.05)	(1.05)	(1.04)
Self-progress						(1.04)	(1.01)	(1.00)
Self-future						(1.06)	(1.02)	(0.98)

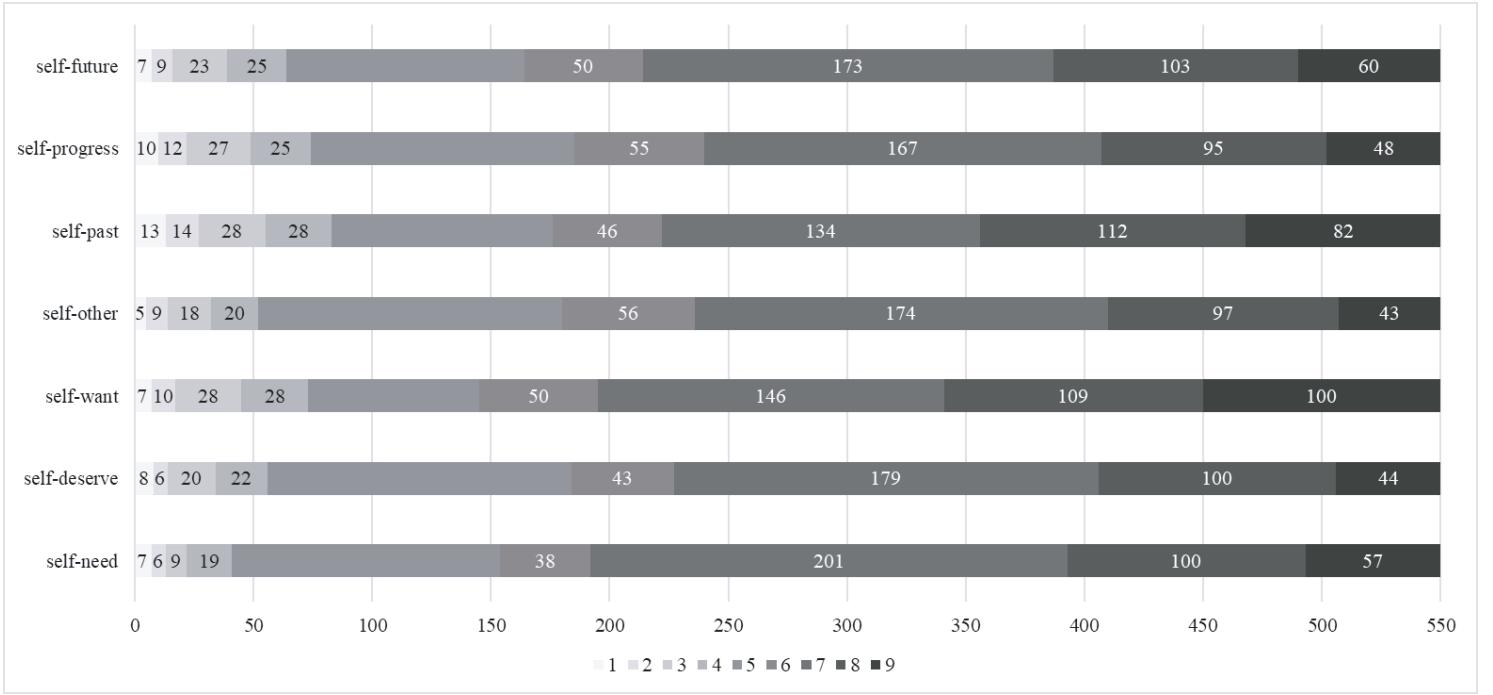

Figure 1. Distribution of responses in the MDT Domains for income

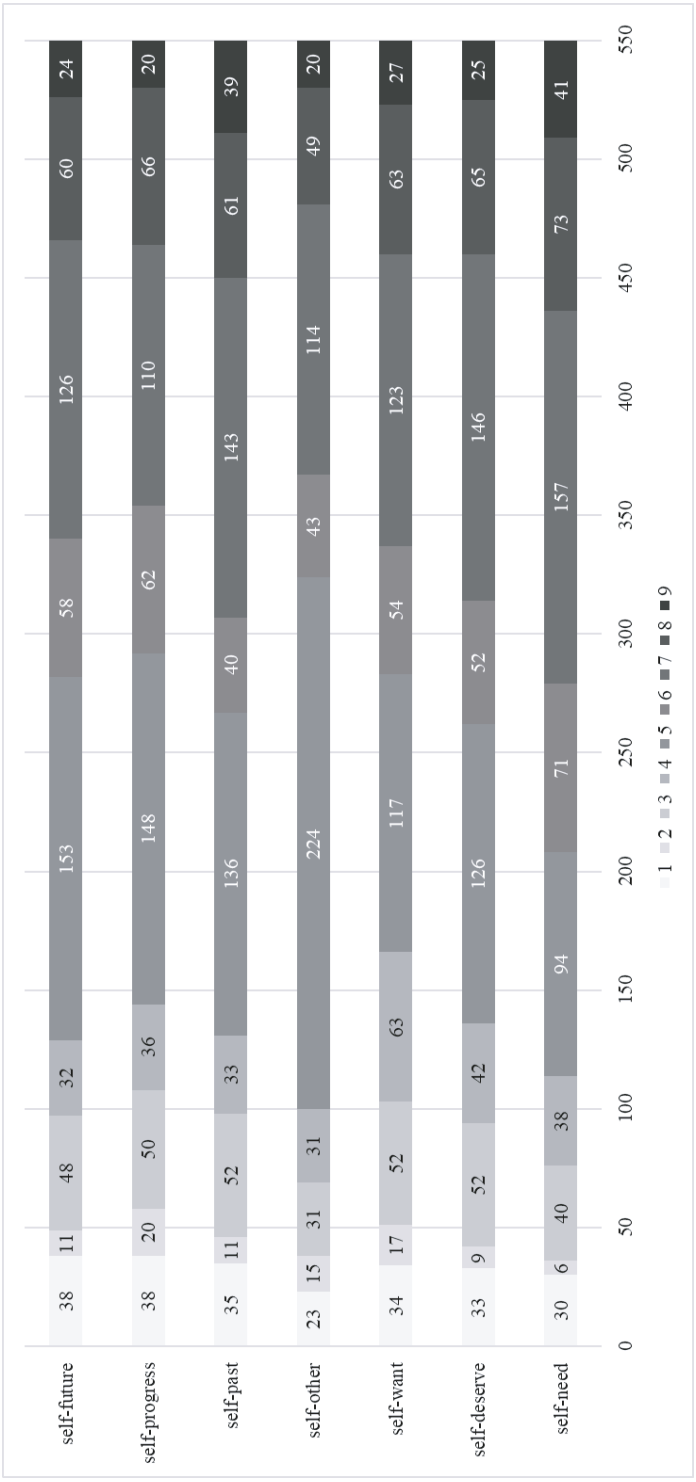

Figure 2. Distribution of responses in the MDT Domains for health

PART II

Analysing decision making in the context of the COVID-19 pandemic.

4

CHAPTER 4

United but divided: Policy responses and people's perceptions in the EU during the COVID-19 outbreak

BASED ON

Sabat, I., Neumann-Böhme, S., Varghese, N. E., Barros, P. P., Brouwer, W., van Exel, J. Schreyögg, J., & Stargardt, T. (2020). United but divided: Policy responses and people's perceptions in the EU during the COVID-19 outbreak. Health Policy, 124(9), 909–918. https://doi.org/10.1016/j.healthpol.2020.06.009

ABSTRACT

To understand the public sentiment toward the measures used by policymakers for COVID-19 containment, a survey among representative samples of the population in seven European countries was carried out in the first two weeks of April 2020. The study addressed people's support for containment policies, worries about COVID-19 consequences, and trust in sources of information. Citizens were overall satisfied with their government's response to the pandemic; however, the extent of approval differed across countries and policy measures. A north-south divide in public opinion was noticeable across the European states. It was particularly pronounced for intrusive policy measures, such as mobile data use for movement tracking, economic concerns, and trust in the information from the national government. Considerable differences in people's attitudes were noticed within countries, especially across individual regions and age groups. The findings suggest that the epidemic acts as a stressor, causing health and economic anxieties even in households that were not directly affected by the virus. At the same time, the burden of stress was unequally distributed across regions and age groups. Based on the data collected, we draw lessons from the containment stage and identify several insights that can facilitate the design of lockdown exit strategies and future containment policies so that a high level of compliance can be expected.

INTRODUCTION

The outbreak of COVID-19 triggered a wide range of responses from governments in the European Union. Given that the disease was new and effective medical countermeasures did not exist in early 2020, governments had to adopt non-medical measures aiming at the containment and mitigation of COVID-19. With the aim of "flattening the curve," these policies included bans on public gatherings, closures of academic institutions and public places, national and international mobility restrictions, confinement, and several others (IMF, 2020).

Italy was the first country in Europe to apply intervention measures from the beginning of March 2020 in response to the severity of the COVID-19 outbreak. Other EU countries followed soon afterwards, using similar countermeasures around mid-March 2020 (Flaxman et al., 2020). The adoption of these policies varied in their scale, stringency, and pace across countries. While most European states implemented confinement measures, the extent of limitations of people's freedoms differed across individual countries. Lockdowns were usually strictest where the pandemic was deadliest (Italy, Spain, and France), imposing severe limitations on population movements. Some governments chose less stringent versions of confinement or no lockdown at all, for instance, "an intelligent lockdown" in the Netherlands or "freedom under responsibility" in Sweden (The Economist, 2020).

Forced to react swiftly to the unfolding epidemic situation, policymakers in every country tried to balance the implementation of containment policies against numerous important factors with the priority mostly given to the protection of the population's health. Consequently, there has been a lot of debate in every society about whether measures taken by the government were appropriate or not. Some parts of the population have been voicing support for more severe containment policies to minimize the spread of the virus. Such attitudes were likely fueled by people's worries about their health and the potential of their national healthcare system to withstand the epidemic. Meanwhile, others expressed their concerns about the social and economic consequences of such policies, thereby advocating for less severe containment measures (Financial Times, 2020).

As the pandemic began to abate, governments started designing the lockdown exit strategies and restarting their economies. However, the risk that the new wave of the epidemic may happen did not disappear, especially given that the vaccine development takes a long time, and herd immunity was not achieved (Graeden et al., 2020). In this light, the issue of lifting lockdowns has become a new subject of public debate across and within European countries raising discussions about the appropriateness of timing, risks, and potential consequences of ending the confinement (The New York Times, 2020b). Lifting lockdown restrictions creates acute dilemmas to the policymakers since the economic and human costs of any exit strategy seem to be closely linked together. Taking a utilitarian

approach in this situation could backfire if the society's understanding is not preliminarily secured or expectations are not fulfilled.

Policymakers and public health experts have to persuade their citizens to make behavior changes and respect future containment interventions while facing the difficulty of enforcing such regulations. Therefore, it becomes crucial to understand people's worries about the pandemic and their perceptions of the effects of containment policies, so that the design of further policies and contingency measures is well-informed, and a high level of compliance can be expected from the population. Moreover, trust in the government and social institutions may become central to achieving a successful implementation of future measures, whereas lack of it may turn detrimental to the fight against the pandemic. Hence it is of paramount importance to understand who people trust most so that public health messages can be amplified using correct means of communication.

We provide a timely description of the current situation and draw lessons from the containment stage to inform the design and implementation of the lockdown exit policies.

MATERIALS AND METHODS

In order to understand the public sentiment towards the COVID-19 containment measures and to inform future policy development, we collected information on people's support for these policies, their worries in relation to the unfolding epidemic, and their trust in different sources of information. We surveyed over 7,000 people representative of the adult population in seven European countries: Denmark, France, Germany, Italy, Portugal, the Netherlands, and the UK. The fieldwork was conducted online during April 2-15, 2020, using multi-sourced online panels provided by the market research company Dynata. To ensure that the sampling frame was representative given the online nature of the study, the company applied diverse recruiting procedures to reach the general population (through open recruitment, loyalty programs, affiliate networks, mobile apps). It then used quotas to match the national census shares in each country.

The questionnaire was designed by the authors of the study except for the worry items that were adopted from the World Health Organization (WHO) COVID-19 Snapshot Monitoring project (Betsch et al., 2020). The questionnaire was carefully translated into six other languages by native speakers and then implemented using the Qualtrics platform first as a pilot (10% of the sample in every country) and next as a large-scale survey. The data from the pilot study were included in the total sample.

In each country, we collected data from a sample of 1,000 respondents representative of the national population in terms of region, age, gender, and education. Given that the Italian region Lombardy was the most severely hit by the COVID-19 outbreak, we collected 500 additional responses in this region representative in terms of age and gender. Learning

about perceptions and attitudes of people who reside there could provide essential insights to researchers and policymakers. The extra data collected from Lombardy were not included in the representative sample of Italy. Thus, no weighting was used as the additional Lombardy sample was analysed separately and denoted as Lombardy in the results section.

RESULTS

Policy support

We assessed people's approval of policy measures that were taken (or were likely to be taken) by their national government in response to the COVID-19 outbreak. In particular, we covered such issues as school closures, bans on public gatherings, border closures, bans imposed on the export of medical equipment, fines for quarantine violations, random temperature checks, curfews, public transport suspensions and utilization of mobile phone data for tracking COVID-19 cases and their contacts.

On average, 68% of people in the seven European countries approved of the policies taken in their country in response to the pandemic, implying considerable public support. Nevertheless, the extent of approval differed by country and by policy measure.

The most approved measures were fining 14-day quarantine violations, ban of public gatherings, and border closures (each supported by 83% of respondents). By the time of the survey's fieldwork, restrictions on public gatherings had been adopted in all countries covered by the study, whereas international travel controls had been imposed to a certain extent everywhere, except the UK (Hale et al., 2020, 2021).

Prior to complete border closures in mid-March 2020, some countries (for example, Italy, France, Germany, Denmark) had been requiring screening and 14-day quarantine for arrivals from high-risk regions already since February. In contrast, other countries, such as Portugal and the Netherlands, started later and turned directly to strict measures, such as banning arrivals from high-risk areas and imposing partial border closures. The latter typically implied either limitation on entries of nonresidents or closure of only certain types of borders (land, sea, air), while ensuring "green lanes" for freight vehicles transporting goods. However, complete border closures occurred haphazardly and led to disrupted commerce and stranding citizens. Among countries covered in our study, Denmark was the first to close all borders in mid-March, whereas the UK did so only in the second half of May 2020. Moreover, at the time of fieldwork, the UK did not have routine screenings at its airports or quarantine requirement for travelers (European Commission, 2016; Hale et al., 2020). Thus, the results for the UK showed the extent of public support that these measures would have received, had they been implemented earlier.

Meanwhile, the most opposed containment policies were public transport suspension (37% of respondents against it), ban of medical export, use of mobile phone data for tracking, and the imposition of a curfew (each disapproved by approximately 23% of respondents).

These trends might reflect within-country regional and age structure of the population. For example, older individuals and those living in remote areas tended to be the most strongly opposed to public transport suspension. In fact, among countries covered by the survey, public transport suspension was implemented only in Italy, whereas its volume was reduced in all other states except for Germany (Hale et al., 2020). The stay-at-home orders were most significantly opposed by the youngest respondents aged below 25. This measure was enforced in all countries covered by the survey except for Denmark, where it was introduced as a recommendation (Hale et al., 2020).

Overall, a north-south gradient could often be noticed in the EU regarding policy support: people living in the southern states (Portugal, Italy, and France) tended to approve of the containment policies more than residents in the northern countries (Denmark, Germany and the Netherlands). Noteworthy, the largest share of supporters for every containment measure was noticed among the residents of Italy and particularly in Lombardy. Here, on average, 79% of the population approved of the government's response to the pandemic.

Fig.1 illustrates the average degree of approval of several selected countermeasures across seven European countries (measured on a Likert scale from 1-strongly disapprove to 5-strongly approve), which highlights how diverse Europe is in the perceptions of COVID-19 policy responses. Higher intensity of the color reflects a higher level of approval of a specific policy by the population in each country.

Interestingly, the most significant share of the population who explicitly opposed each of the containment policies taken by their government was identified in Denmark. Here, for example, 22% of respondents disapproved of school closures and 48% disapproved of the imposition of a curfew. In comparison, the average disapproval of these measures in other countries was around 8% for schools and 20% for curfews.

The most polarizing opinions were observed concerning the use of mobile data for tracking COVID-19 cases and their contacts. The most significant share of people explicitly opposing such policy was identified in Denmark (34%), the Netherlands (31%), and Germany (25%). It was particularly disfavored by the youngest age group (33% of respondents aged below 25 against it).

This policy received significant media attention as some countries and the European Commission started the collaboration with telecom providers to access individual geolocation data for prediction and surveillance of COVID-19 spread (HSRM, 2020; OECD, 2020). As of March 2020, Deutsche Telekom provided German authorities with the

anonymized data on the movement of its users. In Italy, Vodafone, WindTre and Telecom Italia offered aggregated user data provision to the government for the same purpose. Authorities in the Lombardy region used mobile phone data to check compliance with the lockdown restrictions (HSRM, 2020; OECD, 2020; Reuters, 2020). Other countries either initiated the development of their own mobile phone tracking apps or cooperated on the creation of common software, such as the Pan-European Privacy-Preserving Proximity Tracing (PEPP-PT) project led by Germany. However, the launch of the PEPP-PT was delayed at the end of April due to the data protection concerns voiced by experts and even some of the project participants (Deutsche Welle, 2020).

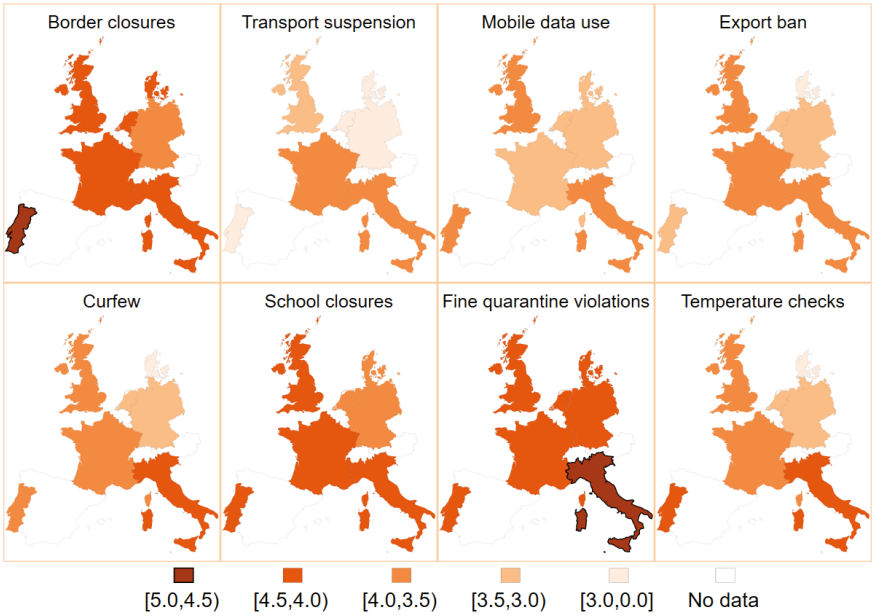

Fig.1. Mean support of government policies

While proponents of the contact-tracing measures claim that using mobile data is of paramount importance in response to the COVID-19 pandemic, many people worry about the government's use of technology due to possible privacy violations, thereby raising debates about the appropriateness of such social control measures (Deutsche Welle, 2020; Ienca & Vayena, 2020; OECD, 2020). According to our data, people in some European countries expressed considerable reluctance about supporting such policy, which therefore makes future compliance questionable. Moreover, such privacy disputes, as in the case of the PEPP-PT project launch, might trigger higher reluctance among the potential users to use any contact-tracing app in the future, which could be detrimental for the implementation of a viable tracing technology (Deutsche Welle, 2020).

To better understand public opinion on certain policies, it is essential to look at the big picture and place obtained results into the national contexts. People's attitudes were likely based on their perceptions of the general state of affairs in their country, particularly in terms of the epidemic situation and restrictions they were subject to at that moment.

In view of that, Table 1 summarizes the scale of the pandemic and the stringency of government's response in seven European countries at four points of time spaced around April 12 (when the survey's fieldwork was 99% complete in every country). The public health situation in each state is described using total confirmed cases of COVID-19 and total deaths attributed to COVID-19, both measured per 1 million people and reported by the European Centre for Disease Prevention and Control (Our World in Data, 2020). The stringency of government's response is measured with the COVID-19 Government Response Stringency Index, a composite measure of containment policies ranging from 1 to 100, where a higher value denotes a stricter response (Hale et al., 2020).

At the time of the survey's fieldwork, the epidemic situation was worst, and the stringency index was highest in Italy and France (Hale et al., 2020; Our World in Data, 2020). Clearly, there was a north-south gradient in the stringency of government response: Italy, France and Portugal imposed more demanding policies than Denmark, Germany, the Netherlands and the UK. Nevertheless, although people in southern countries were exposed to more severe containment measures, they approved of them more than people residing in northern states, who experienced less stringent restrictions.

Table 1. Total confirmed COVID-19 cases and deaths (per 1 million people) and government response stringency index

Country		Date			
		March 12, 2020	**April 12, 2020**	**May 12, 2020**	**June 12, 2020***
Denmark	Cases	89	1 035	1 815	2 078
	Deaths	0	45	91	102
	Stringency index	37.96	72.22	65.74	62.96
France	Cases	35	1 437	2 138	2 383
	Deaths	0.74	212	408	450
	Stringency index	28.7	90.74	76.85	60.19
Germany	Cases	19	1 438	2 035	2 216
	Deaths	0.04	32	90	105
	Stringency index	32.87	73.15	64.35	50

Italy	Cases	206	2 519	3 636	3 906
	Deaths	14	322	508	565
	Stringency index	85.19	93.52	62.96	48.15
Netherlands	Cases	29	1 425	2 497	2 816
	Deaths	0.29	154	318	353
	Stringency index	41.67	79.63	68.52	62.96
Portugal	Cases	6	1 568	2 715	3 522
	Deaths	0	46	112	148
	Stringency index	32.41	87.96	75	71.3
United Kingdom	Cases	7	1 164	3 286	4 293
	Deaths	0.1	171	472	608
	Stringency index	11.11	75.93	75.93	70.37

*or closest available date

Turning now to within-country variations, we observed considerable heterogeneity of attitudes towards many policy responses within individual countries with particularly marked differences between regions and age groups in Italy, France, and the Netherlands.

Hereinafter, we grouped regions based on the severity of the COVID-19 outbreak distinguishing between the most and the least affected areas. Noteworthy, Lombardy denotes the extra sample collected in Italy and was analyzed separately from the representative Italian sample. Overall, we did not find significant differences in policy support between Lombardy and the rest of Italy.

To illustrate within-country differences, Fig.2. reflects regional and age-related heterogeneity of public opinions in France and Italy toward banning the export of medical equipment, such as masks. In fact, this measure was briefly undertaken by Germany and France at the onset of the pandemic in early March 2020, leading to political tensions between the EU member states. Germany declared that the reason was to avoid shortages of masks, gloves and safety glasses within the country, whereas France argued that the ban was needed for the assessment of inventory and storage capacity (The New York Times, 2020a). Following the call for solidarity, both countries lifted the within-EU export ban on equipment in mid-March (Thierry Breton, 2020).

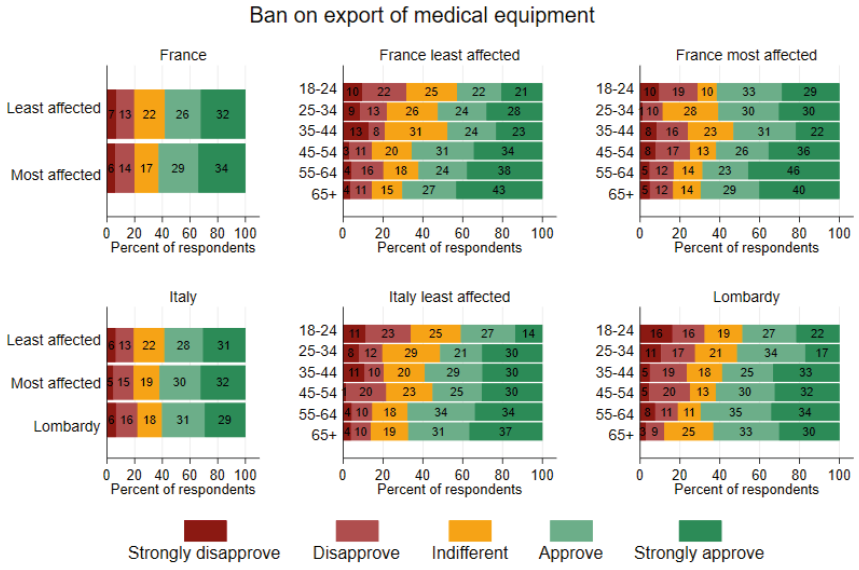

Fig.2. Heterogeneity of public attitudes within countries by region and age category in France and Italy

While support for this policy tended to be similar in the most and the least severely affected parts of Italy and France, the approval of the export ban conspicuously differed across age groups. Older individuals approved more of this policy than younger people, which, besides other factors, may be related to the levels of worry people in these age categories have about the risks that COVID-19 poses to their health. We found that 51% of French and 46% of Italian respondents aged above 65 perceived risks to their health from COVID-19 as high or very high, while the corresponding share among people aged below 25 equaled 30% in France and 17% in Italy.

Worries about health and the economy

To address the mental health implications of the COVID-19 outbreak and subsequent containment measures, we assessed levels of worry prevailing in European societies over several domains (health, economic, emotional, work, and future). More specifically, we addressed concerns about losing a close person, becoming unemployed, health system getting overloaded, school closures, small companies running out of business, recession, restricted access to food supplies, blackouts, and society getting more egoistic. These items were adopted from the WHO COVID-19 Snapshot Monitoring project, which will allow future comparisons with similar data collected for other countries and at different points in time (Betsch et al., 2020).

We found that the mean trend was similar in all countries: people worried most of all about the health system getting overloaded so that the capacities could become insufficient to cope with the surge in COVID-19 cases. We observed that even in case of households that had not been directly hit by the novel coronavirus (above 75% of respondents in the total sample), the pandemic might have acted as a stressor causing health and economic anxieties.

Fig.3 presents people's worry about selected issues across seven EU countries (measured on a Likert scale from 1-not worry at all to 5-worry a lot), where the higher intensity of color reflects a larger share of the population who worry "quite a bit" or "a lot". Cross-country differences look substantial, and a north-south divide in the worry caused by the COVID-19 outbreak is conspicuous.

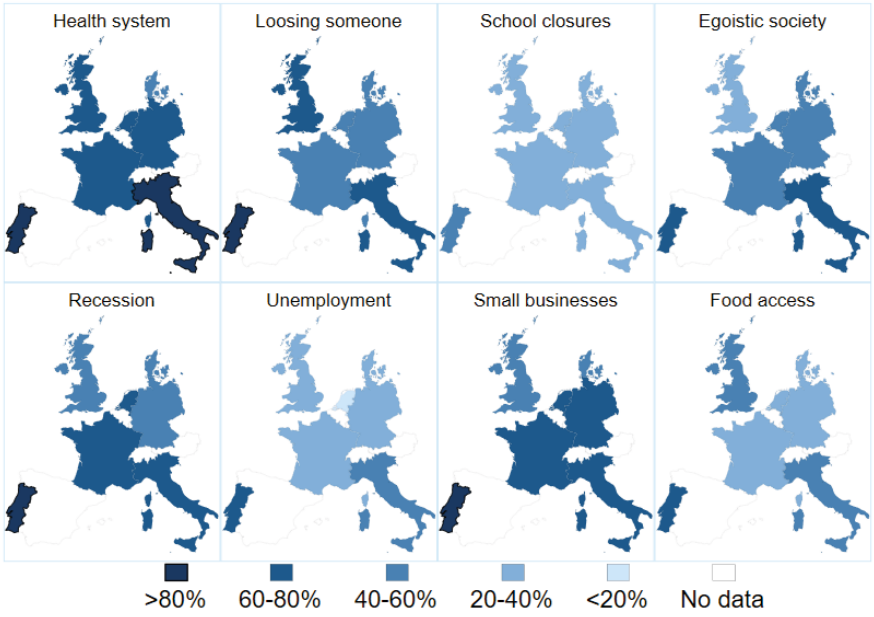

Fig.3. The proportion of respondents who worry "quite a bit" or "a lot"

For instance, 84% of respondents in Portugal and 81% in Italy mentioned that they worried "quite a bit" or "a lot" about the national health system becoming overloaded, while the corresponding shares in Denmark and Germany were 54% and 62%, respectively. These health concerns might have reflected the development of the pandemic. As showed in Table 1, the progress of the epidemic had a north-south pattern with more COVID-19 cases and deaths per million of the population in southern states than in northern. The exception was the UK, where the epidemic was third deadliest after Italy and France, but government

response was less strict than in countries with a better epidemiological situation (Hale et al., 2020; Our World in Data, 2020).

Similarly, more people in Portugal and Italy were concerned with the economic consequences of the pandemic than in other European countries. For example, 68% of Portuguese and 56% of Italians were worried about losing their jobs, while respective shares in the Netherlands and Denmark were 27% and 16%, correspondingly.

These cross-country differences in economic anxieties may be related to people's perceptions of the economic and financial countermeasures taken by their national government and the EU. During the pandemic, European countries implemented several fiscal and monetary measures to mitigate the economic impact of the COVID-19 outbreak. These policies typically included support of wages under the reduced-hour scheme, postponement of tax payments for companies, direct financial supports and grants to small enterprises and self-employed, the extension of unemployment benefits, provision of capital buffers to banks, etc.(IMF, 2020). Nevertheless, there were substantial variations in the timing and specific content of these countermeasures across the states.

To briefly overview the scale of economic support provided by the government in each of the seven countries, Table 2 summarizes values of the economic support index, a composite measure reflecting income support and debt/contract relief provided by the national government to households (Hale et al., 2020). It is measured on a 0 to 100 scale, where a higher value refers to a more substantial economic assistance.

Table 2. Economic support index

Country	Date			
	March 12, 2020	April 12, 2020	May 12, 2020	June 12, 2020*
Denmark	37.5	37.5	87.5	87.5
France	0	100	100	75
Germany	0	37.5	87.5	62.5
Italy	0	50	50	75
Netherlands	0	62.5	62.5	62.5
Portugal	25	75	75	50
United Kingdom	0	100	100	100

*or closest available date

At the time of the survey's fieldwork, all countries provided some type of economic relief to their residents. Nevertheless, the extent of such support was conspicuously different: France and the UK ranked highest, while Denmark, Germany, and Italy ranked lowest (Hale

et al., 2020). Hence, it may be possible that higher levels of economic concerns in some countries indicated people's beliefs in the insufficiency of the government's response, which will be subject to the analysis in the next waves of the survey.

Moreover, the composition of employment varies across the EU, especially in terms of informal and temporary employment. Temporary contracts provide lower levels of social protection and job security to employees, but their prevalence has increased over the last years, particularly in the Netherlands, Italy, and France. As of 2019, the share of temporary employees in the total number of employed was highest in southern European countries: Portugal (17.4%), France (13.3%), and Italy (13.1%). In contrast, it was significantly lower in northern states: the UK (3.8%), Denmark (8.3%), and Germany (9.3%). The only exception was the Netherlands, where temporary workers constituted 13.6% of all employees (Eurostat, 2020). Thus, such differences in the employment composition may be in part responsible for the cross-country dissimilarities in economic concerns.

We also observed differences in the levels of concern within individual countries. Fig.4 shows the extent of worry about the health system and a recession in Italy. We grouped regions based on the severity of the COVID-19 outbreak and distinguished the levels of anxiety across age categories. Higher intensity of the color reflects a greater extent of worry.

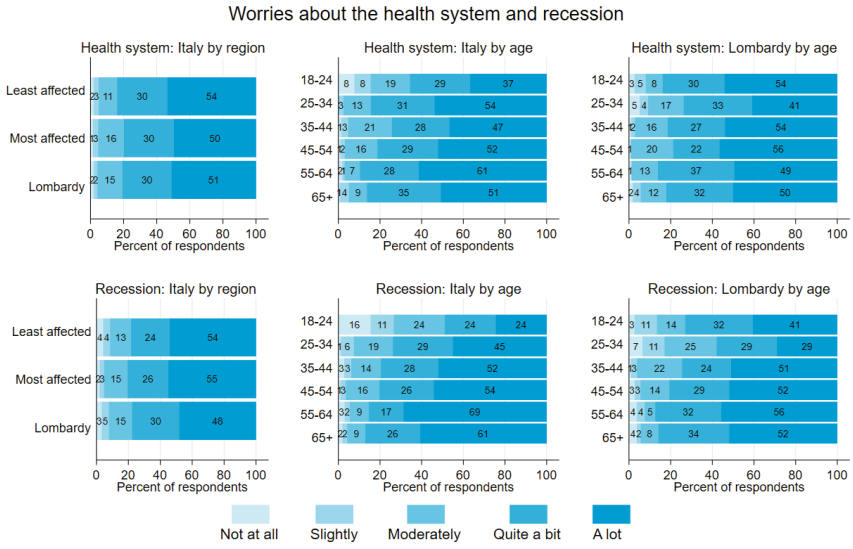

Fig.4. Heterogeneity of people's worries in Italy by region and age category

Overall, the level of worry in the highly affected regions of the country was not higher than elsewhere in Italy, except for the youngest age group. However, economic concerns tended to be unequally distributed across the age groups. For instance, worries about the recession and small companies running out of business were higher among older individuals than younger age cohort. This pattern was similar in all countries covered by the survey.

Trust in sources of information

We asked people about the main sources of information from where they received news about COVID-19. The data show that overall 94% of respondents closely followed the news on the situation with COVID-19, implying a high level of public awareness. Regarding the sources of information, 86% of respondents mentioned receiving updates from the TV and 50% additionally searched for information on the Internet. Presumably, reliable information presented through the television emerged as the best channel to reach the population at large.

Next, we assessed the extent of people's trust in the information received from various sources in the context of the COVID-19 situation. The trust in the following information sources was addressed: national government, the EU, the WHO, hospitals and GPs, national news channels and newspapers, social media, relatives and friends.

Fig.5 shows mean values of trust in information from six selected sources across seven European states (measured on a Likert scale from 1-no trust at all to 5-trust very much). Higher intensity of the color reflects a higher level of trust in the information from a specific source.

The data show that overall people had the highest levels of trust in information from hospitals, family doctors, and the WHO, followed by information from the national government and main national news channels. This ranking of sources by trust was similar in all countries covered by the survey, except for France, where citizens had a high level of confidence only in healthcare providers and placed relatively little trust in all other sources.

Moreover, a north-south divide could be noticed in the level of trust in information from the national government. Trust was highest in Denmark and the Netherlands (more than 70% of respondents trusted "much" or "very much"), whereas it was lowest in France (27% of respondents had a high level of trust).

Furthermore, a similar north-south gradient was observed concerning the trust in the EU: trust was highest in Denmark (45%), Germany (40%), the Netherlands (39%) and the UK (35%), whereas it was lowest in Italy (24%) and France (21%). Portugal was an exception to this case since the corresponding value here constituted 46%.

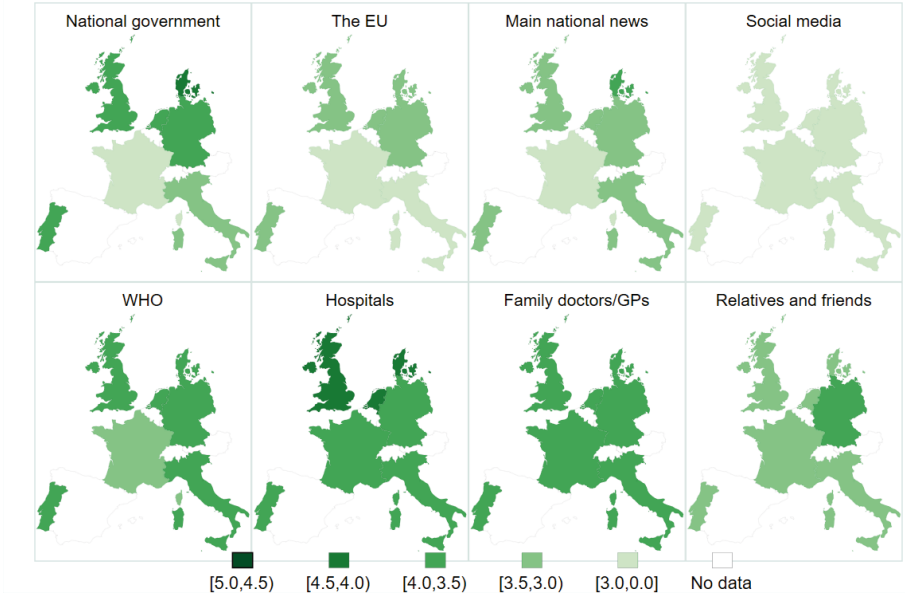

Fig.5. Mean trust in information sources in the context of COVID-19 situation

Finally, we also observed considerable regional heterogeneities in levels of trust within countries with particularly noticeable differences across individual regions in Italy, France, and Germany. Fig.6 shows people's trust in information from the national government in the context of COVID-19 in Germany and France as an example, where the higher intensity of the color indicates a greater extent of trust. While trust did not differ significantly between regions grouped with respect to the COVID-19 severity, it was heterogenous across the age groups.

Although the survey asked about the level of trust in information from different sources in the context of the COVID-19 situation and not about the overall trust in institutions, these two are likely to be related. Generally, trust reflects people's perceptions of whether institutions are doing what is right. Thus, trust in the information they provide can be considered an indicator of the confidence that citizens have in these institutions (OECD., 2013).

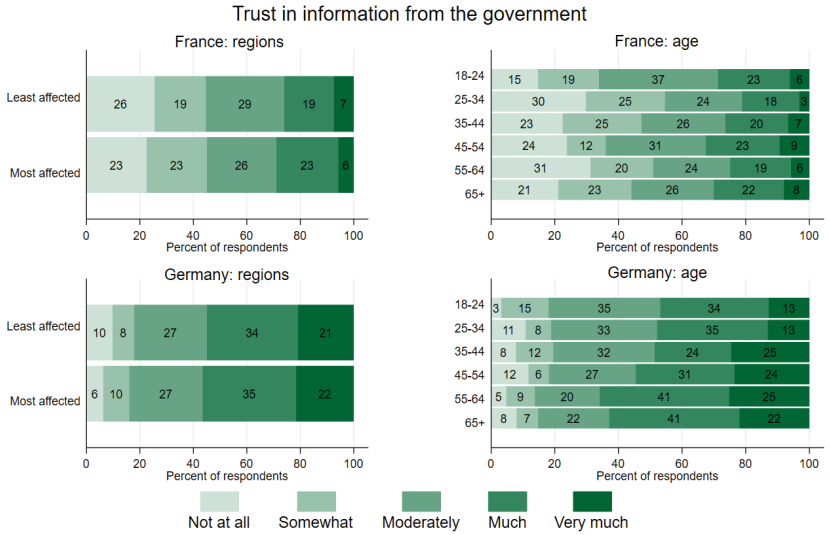

Fig.6. Heterogeneity of levels of trust in information from the national government

POLICY IMPLICATIONS

The COVID-19 pandemic raised new challenges for policymakers across the EU. The imminent threat to public health at the onset of the pandemic led most governments to impose a lockdown on society. However, as the peak of the pandemic abated, the focus of attention turned to the social and economic consequences of the containment measures. Given that without acquired herd immunity the risk of a new wave of the epidemic remains high, and the production and distribution of vaccines may take 12 to 18 months (Nature Nanotechnology, 2020), governments must try to strike the right balance between effects on public health, social life and the economy when considering possible exit-strategies from the current lockdown situation.

In the absence of medical intervention, policymakers and public health officials must resort to non-medical behavioral interventions. Lifting the lockdown requires that citizens support and adhere to the policy measures that aim to contain the spread of the virus as social and economic activity gradually restarts. Given the difficulty of enforcing such regulations, future measures need to be both well-designed and well-communicated to the public. The more people are willing to comply voluntarily with the new measures, the less enforcement and supervision will be needed to achieve high compliance. For this, people's perceptions and attitudes need to be factored in at the policy-design and implementation stages.

Our survey sought to capture the public sentiment toward measures previously taken by policymakers to contain COVID-19 and addressed people's support for policies, worries about the consequences of COVID-19, and trust in different sources of information. The first insights obtained from the data showed that containment and mitigating policies undertaken by national governments in response to the initial stages of the COVID-19 pandemic were generally well-received by the population in all countries covered by the survey. Nevertheless, the extent of approval varied across states and specific policy measures.

Several lessons can be drawn for the design and implementation of policies for the prolongation or gradual removal of lockdown restrictions.

First, we observed a north-south divide in people's perceptions, worries and trust across the European countries. This finding suggests that further containment measures and lockdown exit strategies need to be balanced against the factors that worry people in each specific country. One noteworthy example is the level of importance that people in European countries attribute to the concepts of individual freedom and privacy. Using mobile data for tracking COVID-19 cases and their contacts may be a controversial decision to take even though it is believed by many experts to be a useful tool to manage the COVID-19 outbreak. The effectiveness of this policy critically depends on a sufficient level of adoption of the technology by the population (Hale et al., 2020). Our data suggest that this may not be achieved easily in some European countries.

A clear takeaway is that an open dialogue with society on this matter is needed. Explaining the need for and the advantages of such intrusive policies through trusted means of communication, while addressing people's concerns explicitly and being open about the risks of using such policy measures may help raise the support and compliance in society to a sufficient degree.

Another critical issue is the balance between saving lives and saving livelihoods. According to the survey, people in southern European countries are substantially more concerned about the economic aspects of the COVID-19 outbreak than people in northern European countries. Economic anxieties, if left unaddressed, may have adverse effects on the mental health and wellbeing of the population, as well as cause downward adjustments in consumption behavior, thereby exacerbating the economic situation in a country if the recession indeed happens.

Second, we found considerable heterogeneities in people's approval of policies within individual countries. This tendency was particularly noticeable in France and Italy. One possible determinant of regional differences in public support could be the extent of the devolution of decision-making in the country. On the one hand, devolution could enable regional or local authorities to make better decisions due to their better awareness of

region-specific circumstances. On the other hand, it could harm the coordination of policy responses between the central and regional authorities within individual countries. Thus, it is crucial to understand the determinants of such differences and address them to secure public support of future policies and ensure high compliance with government measures.

Furthermore, our results showed that the burden of stress tended to be unequally distributed across and within countries. Even in case of households that were not directly hit by COVID-19, the pandemic may have acted as a stressor causing health and economic anxieties. Such worries may be detrimental to individual mental health and wellbeing, and they may become further exacerbated by the imposition of self-isolation policies. Thus, it may be reasonable to consider an asymmetric approach to the design of exit strategies taking region-specific levels of support and worry into account. This includes the identification of vulnerable categories of the population not only in terms of health risks but also with respect to social and economic activities, and addressing their concerns satisfactorily.

Third, during a pandemic, public trust in the government and the information it provides is of paramount importance. To expect high compliance over extended periods of time, policymakers need to adopt effective strategies and means of communication whereby securing a sufficient level of trust and confidence from the society. As our results suggest, some countries were more successful in this respect than others.

Society needs to be well-informed about the dilemmas faced by policymakers, and for this, the communication between the government and the citizens must be clear and transparent. The data showed that 94% of respondents closely followed the news on the situation with COVID-19 mainly using television to keep themselves updated. Thus, television emerged as the best channel to reach the population at large, suggesting that presenting reliable information through this means is an effective strategy to follow.

Nevertheless, given that the data show regional and age-related heterogeneities in trust and policy support, it may be worth tailoring messages and means of communication to specific groups of the society. For example, cooperation with public figures and well-known experts can be used to deliver government and public health messages in a simple language, or local voices could be used to amplify such messages in individual regions of the country.

Overall, information provision, public education and effective communication strategies should be among the key guidelines for policymakers when implementing exit strategies and designing future containment measures so that these policies have public support and high compliance.

Additional waves of the survey are scheduled in June and August 2020. This will allow us to investigate in more detail how the population copes with the health, social and economic consequences of the COVID-19 pandemic as the situation evolves.

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5

CHAPTER 5

Altruism and the link to pro-social pandemic behaviour

BASED ON

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ABSTRACT

In the Corona pandemic, especially in the phase before vaccines were available, people's risk of infection with COVID-19 was dependent on the adherence to pandemic behaviours (e.g. wearing masks) of others around them. To explore whether altruistic individuals are more likely to engage in pro-social behaviours to protect others during the pandemic, we use data from the European Covid Survey (ECOS). The data was collected in September 2020 and consisted of a representative sample from seven European countries (N=7025). Altruism was measured as a deviation from purely self-interested behaviour by asking respondents how much they would be willing to donate from an unexpected gain to the equivalent of 1000€. Respondents who were willing to donate more than 0 Euros (68.7%) were treated as altruistic; on average, respondents were willing to donate 11.7% (SD 17.9) of the gain. Controlling for country, sociodemographics, general risk aversion and COVID-specific risk aversion, we find that individuals classified as altruistic were more likely to behave pro-socially. More specifically, we find that altruistic respondents were more likely to wait at home for test results and wear a mask where it is recommended. They would also stay about one day longer under quarantine without symptoms after visiting a high-risk country and were less likely to go to a supermarket with COVID symptoms. We find no significant effect for wearing a mask in places where it is mandatory and for inviting more than six people into the house. Furthermore, we find that the subjective risk assessment of COVID-19 also plays a role in these behaviours. Our results support evidence from the literature that suggests that adherence to pro-social pandemic behaviours may be increased if public health officials emphasise the altruistic nature of these behaviours.

INTRODUCTION

The COVID-19 pandemic has increased the impact the behaviours of others have on someone's health. For example, wearing a face mask or a face filtering piece (FFP) has been shown to significantly reduce the risk of infection with COVID-19 in communities (Coclite et al., 2021). Masks work best if everyone wears them, which is a minor nuisance to the individual but benefits everyone in a given space.

Pandemic behaviours, such as mask-wearing and social distancing, can be seen as contributing to a public good. A public good is non-excludable: individual A cannot be excluded from the protection generated by individual B wearing a mask (Samuelson, 1954). Public goods are also non-rivalrous: the fact that individual A's risk of infection is reduced by social distancing does not diminish this effect for individual B. Therefore, during the pandemic, certain pro-social behaviours (e.g. the correct and consequent use of masks) contribute to a public good, namely a low-risk environment that reduces the risk of a COVID-19 infection. Most of the behaviours that contribute to the low (infection) risk environment have in common that they require some sacrifice or discomfort for the individual to contribute to the low-risk environment. This can mean standing in line outside to follow social distancing rules or carrying around and wearing face masks. Some of these behaviours will benefit others and the individual making a sacrifice, while many will mainly benefit others. A (selfless) concern for the well-being of others, as opposed to selfishness, as a principle of action, is defined as *altruism* by the Oxford English Dictionary (Oxford University Press, 2022). In (classical) economics (e.g. Nagel, 1970; Rushton, 1984), altruism is defined as a behaviour that benefits others at one's own expense (Galizzi et al., 2015) and a deviation from what rational beings ought to do, maximising their own wealth. Another explanation in the context of altruism and rationality is provided by Andreoni (1990), who discusses that a donation to charity can also provide a warm glow in the form of social recognition to the donor, which would be seen as *impure altruism*.

Altruism has been shown to explain pro-social behaviour, for example, in the health (Burnett, 1981) and the environmental context (He et al., 2020). Applied to the question at hand, Cato et al. (2020) showed that people with higher altruistic concerns and sensitivity to shaming were more likely to follow social distancing measures during the COVID-19 pandemic. Meanwhile, Webster et al. (2020) reviewed existing evidence to improve adherence to quarantine measures. The authors argued that adherence could be improved if public health officials provide a timely and clear rationale for quarantine and emphasise social norms to encourage altruistic (pandemic) behaviours. Nikolov et al. (2020) performed a longitudinal study in the U.S. during the COVID-19 pandemic. They found that demographic characteristics exert the largest influence on social distancing measures and mask-wearing and that individual risk perception and cognitive biases exert a critical role in influencing the decision to adopt social distancing measures.

Alfaro et al. (2021) posited that social preferences facilitate the internalisation of health externalities by, for example, reducing mobility during a pandemic. They found that mitigation policies matter less in regions that are more altruistic, patient, or exhibit less negative reciprocity. In those regions, mobility fell ahead of lockdowns and remained low after the lifting thereof.

On the effect of pro-social behaviour, Campos-Mercade et al. (2021) showed that a large majority of people are very reluctant to put others at risk for their personal benefit. They also find that prosociality predicts health behaviours during the pandemic and suggested that the impact of policies on a population may depend on the degree of prosociality. Applied to the German context at the end of 2020, Fang et al. (2021) investigated the role of prosociality in reducing the spread of COVID-19 in a nationally representative survey. They reported that higher prosociality is positively related to compliance with recommended public health behaviours. Their results confirmed that voluntary behavioural change due to pro-social motivations could play an important role in the pandemic.

Müller and Rau (2021) analysed whether economic preferences and pre-crisis social responsibility predict social compliance with policy regulations. Their results show that economic preferences are closely related to compliance with policies fighting a crisis. Risk tolerance negatively affected citizens' avoidance of crowds, whereas patience helped them to do so and to stay home. Pre-crisis socially responsible behaviour related to fare evasion, turnout and support of vaccination was also positively related to social compliance.

Van Hulsen et al. (2021) examined the role of intertemporal and social preferences in explaining cooperation in the social dilemma caused by the intelligent lockdown in The Netherlands. Through an online survey, they measured people's considerations of future consequences and of others and found that both were associated with increased compliance with the precautionary measures. In order to investigate the relationship between altruism and pro-social pandemic behaviours, we aim to investigate the following hypothesis:

I. More altruistic people are more likely to follow pandemic behaviours that benefit others (at their own cost).

We expect that factors such as overall risk aversion and COVID-19-specific risk assessments will play a role in the pandemic behaviours investigated in this study. Nonetheless, similar to the observations that Rabin (1998) makes, we believe that people may be willing to contribute more to a public good than can be explained by self-interest. In other words, we expect that people who show a general disposition to altruistic behaviour are also more likely to show pandemic behaviour that benefits others at their own disadvantage.

METHODS

The data collected for this article was part of a more extensive data collection. The European COVID Survey (ECOS) started in April 2020 and collected representative samples of the population in seven (eight from June 2021) European countries bi-monthly. More details on the ECOS project and its methodology can be found elsewhere (Neumann-Böhme et al., 2020; Sabat et al., 2020). It was part of the third ECOS data collection running in September 2020 (08-18.09.2020). As part of the data collection, certain quality assurance measures were applied. Respondents who did not complete the survey (incompletes) answered the survey multiple times (doubles), and those who answered the survey faster than 1/3 of the median length of interview in their respective country (speeders) were excluded from the sample. These cases consisted of about 50 responses in total. The total sample of the data collection consisted of 7,025 respondents. Income was elicited as a relative position ("Thinking of your household's total monthly income, would you say that your household is able to make ends meet …") of household income in relation to the monthly costs.

As a measure of altruism, we asked respondents how much they would donate if they unexpectedly received 1,000 Euros (or the currency and purchasing power adjusted equivalent)(Fehr et al., 2018). Everyone willing to donate more than 0 Euros was considered altruistic (to some degree) since this signals a deviation from purely self-interested behaviour. Therefore, we generated a binary variable taking the value of 1 if more than 0 Euros were donated and 0 otherwise to indicate Altruism. We considered and tested (see section 3.4) the percentage of the respondents who donated as a continuous measure based on the share of the equivalent of 1000 Euros donated. Furthermore, we tested a measure of altruism based on the country specific quartiles for the share donated, to generate levels of altruism (no altruism, low, medium and high level). While these measures use more information than the binary relationship, they do not fit with the definition of altruism as a deviation from purely self-interested behaviour (donating zero).

When the data for this article was collected in September 2020, no vaccines against COVID-19 were available in the ECOS countries. The European Commission only approved the first vaccine (Comirnaty by BioNTech) in December 2020 (European Commission, 2020). Therefore, the primary way to reduce the risk of infection with COVID-19 at the time was social distancing, testing, and wearing masks.

Based on this, we elicited pandemic behaviours on a 1-4 Likert scale ranging from very unlikely (1) to very likely (4) and "do not know" as an opt-out option. We asked respondents to indicate:

- "You got a COVID-19 test due to symptoms; you are waiting for the results. It can take up to 4 days. Would you stay at home (under quarantine)?"

- "Suppose you show some COVID-19 related symptoms (coughing/fever/feeling tired/sneezing), but it could also be a cold. Would you still go to a supermarket?" How likely would you be to:
  a. "Invite more than 6 people to your house for an indoor gathering."
  b. "Wear face masks where it is *recommended* (e.g. large outside gatherings)."
  c. "Wear face masks where it is *mandatory* (e.g. public transport, supermarket)."

Similar to Aschwanden et al. (2021), we proceeded to recode these preventative behaviours into binary variables taking the value of 1 to indicate that respondents stated they were likely or very likely to engage in this behaviour and 0 otherwise, while "do not know" was recoded to missing.

We analysed these five behaviours individually, employing a logit regression and reporting the odds ratio of being more or less likely to engage in a given behaviour. September 2020 was also when many Europeans returned from summer vacations; therefore, we asked respondents how many days they would voluntarily spend in quarantine after visiting a high-risk country if no COVID-19 test was available.

"Consider you have to have to travel to a country that has been designated as a risk area because of the number of COVID infections. You have no symptoms and do not take a test at the airport. For how many days would you stay in quarantine if no test was available?"

Respondents were able to indicate if they would spend 0-14 days under quarantine on a slider. This allowed us to investigate if altruistic people would spend more days in quarantine using an OLS regression with the same set of controls as the other five pandemic behaviours.

We then proceeded to create an index of pro-social behaviour (iPSB) by adding together the answers on the Likert scale for each behaviour1F[7]. We rescaled the days in quarantine after travel to on a 1-4 scale to fit other items on the iPSB. With six items the scale ranges from 6-24, where 6 indicates a low score of pro-social behaviour and 24 a very high score. Cronbach's alpha $\alpha = 0.71$ with all six items and $\alpha = 0.72$ when only the five items with the Likert scale would be included (i.e. without rescaling), suggesting that the internal consistency of the iPSB is at least acceptable. The interitem correlation is below 0.50 for all items, except for the two mask items (mandatory and voluntary mask wearing) where it is 0.71, which is to be expected since both test a similar construct. Due to the high degree of correlation between the two mask related items of the iPSB we conducted a principal component analysis (pca) as a sensitivity check for the iPSB. Using pca, we generated a score that combines the six protective behaviors into one scalar by multiplying each

7 Behavior 2. "Go to the supermarket with symptoms" and 3. "Invite more than 6 people to your house" were recoded to match the others so that 3-4 is pro-social and 1-2 is not.

response with the respective factor loading and adding them up to one index. We achieved a Kaiser-Meyer-Olkin measure of sampling adequacy of 0.68, suggesting that the data is suitable for pca (Dziuban and Shirkey, 1974).

Next to our variable of interest (altruism), we used a vector of control variables: age, gender, country, education, and relative household income. We also included the risk preferences based on income by Barsky et al. (1997), offering respondents lotteries that can increase/decrease income as a general measure of risk aversion. In a more COVID-specific subjective measure, respondents were asked how they "think and feel about the risks related to the COVID-19 outbreak". They could indicate their subjective assessment of how they rate the risk of being infected with COVID-19, and the risk COVID-19 poses to their health, their families' health, and the risk to the health of people in their community. The perceived risk could be indicated on a slider ranging from 1 (no risk at all) to 5 (very high risk). For the regression analysis, we recoded these to 0 (no/low/moderate) and 1 (high/very high) risk. To account for the incidence rate of COVID-19, we used the country-specific 7-day average of confirmed COVID-19 cases per million (cpm) on the day each respondent filled out the survey (Ritchie et al., 2020). We used a stepwise regression approach, using OLS and adjusting for heteroscedasticity, with three models to investigate the effect of altruism on the iPSB. Model I uses the sociodemographic controls and the cpm, Model II proceeds to add the general risk preferences, and Model III adds the covid-related subjective risk factors.

RESULTS

We report the respondents' sociodemographic characteristics by country and in total in Table 1. The data presented here are largely representative of the population in terms of age category, gender, and regional distribution of the respondents in the respective countries. As shown in Table 1, there are deviations from the representativeness regarding the education level in some countries. This reflects a difference between the education level reported to the panel agency Dynata and the education level elicited in ECOS. This constitutes a (known) limitation of online survey methods together with problems of ensuring the representativeness of older individuals in online panels, which in the case of ECOS has been problematic in Portugal.

Table 7. Participants' sociodemographics compared to national census2F[8]

	DE		UK		DK		NL		FR		PT		IT		Total
N	**1,005**		**1,005**		**1,000**		**1,004**		**1,001**		**1,001**		**1,009**		**7,025**
Gender	cen.	ECOS	cen.	ECOS	cen.	ECOS	cen.	ECOS	cen.	ECOS	cen.	ECOS	cen.	ECOS	
Male	48.3	48.3	48.6	49.6	49.1	45.8	49.0	48.3	47.6	46.2	47.8	48.0	47.9	47.4	47.6
Female	51.7	51.7	51.4	50.5	50.9	54.2	51.0	51.7	52.4	53.9	52.2	52.1	52.1	52.6	52.4
Age category															
18-24	9.7	7.3	12.0	10.5	11.2	8.1	10.8	10.0	11.4	9.2	9.7	10.7	8.6	7.9	9.1
25-34	14.3	13.5	17.1	16.5	14.9	12.6	15.2	15.4	16.2	15.3	18.2	21.0	14.9	14.9	15.6
35-44	17.0	17.7	17.9	18.5	17.8	16.4	18.8	18.0	18.1	18.9	18.5	21.1	19.3	20.3	18.7
45-54	18.0	18.8	17.7	18.3	18.0	19.0	18.7	18.3	17.5	18.1	17.1	18.4	17.7	18.2	18.5
55-64	16.2	16.9	15.1	15.8	16.1	19.3	16.3	17.2	15.5	16.4	14.6	14.6	15.0	14.8	16.4
65+	24.8	25.8	20.2	20.4	22.0	24.6	20.1	21.0	21.4	22.2	21.9	14.3	24.4	23.9	21.7
Education															
Low	17.0	11.5	37.0	14.5	19.3	11.7	34.3	28.7	34.0	21.4	59.0	21.9	44.4	26.1	19.4
Middle	60.0	64.6	36.0	41.0	54.0	55.2	42.1	43.4	41.0	44.6	22.0	34.4	41.3	50.8	47.7
High	23.0	23.9	27.0	44.6	26.7	33.1	23.6	27.9	25.0	34.0	19.0	43.8	14.3	23.1	33.0

8 Compared to the national Census data: Spain, 2011, Instituto Nacional de Estadistica (INE); UK, 2011, Office of National Statistics (ONS); Netherlands, 2018, Centraal Bureau voor de Statistiek (CBS); Germany, 2011, Federal Statistical Office; France, 2011, National Institute of Statistics and Economic Studies (INSEE); Italy, 2018, Italian National Institute of Statistics; Denmark 2017, Statistics Denmark; Portugal, 2011, Instituto Nacional De Estatistica (INE) / Statistics Portugal

Table 7. Participants' sociodemographics compared to national census2F[8](continued)

	DE	UK	DK	NL	FR	PT	IT	Total
N	**1,005**	**1,005**	**1,000**	**1,004**	**1,001**	**1,001**	**1,009**	**7,025**
Income (make ends meet)								
Great difficulty	7.0	5.6	7.8	7.7	13.0	6.3	11.0	8.3
Some difficulty	35.8	28.9	31.4	37.7	44.0	26.0	47.2	35.8
Fairly easily	41.8	43.8	41.4	37.4	34.9	57.0	34.6	41.5
Easily	15.4	21.8	19.4	17.3	8.2	10.7	7.2	14.3

3.1 ALTRUISM AS A DEVIATION FROM SELF-INTERESTED BEHAVIOUR

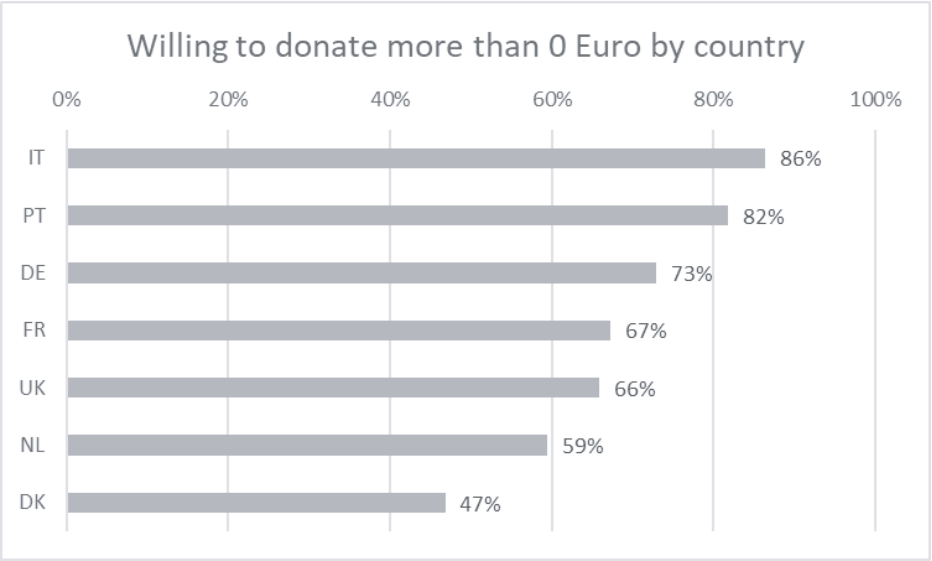

Figure 4. Share of respondents by country, who were willing to donate more than 0 Euro of an unexpected monetary gain of the equivalent of 1,000 Euros

Overall, 68.65% of respondents were willing to donate more than 0 Euros, with clear differences between countries as visualised in Figure 1. We find that the largest share of respondents willing to donate a share of an unexpected monetary gain was observed in Italy (86%) and the lowest share in Denmark (47%). We find that the willingness to donate is highest among respondents aged 18-24 (75.9%), then decreases gradually to 65.6% among those between the age of 55-64, with those above the age of 65 having the second-highest share (71.8%). As expected, the share of respondents willing to donate is slightly higher (71.8%) among those who report that they get by with their income fairly easy than among those who state to get by with some difficulty (67.5%).

On average, people were willing to donate 11.7% (SD 17.9) of the gain, with a median of 5%. We also tested variations of our altruism variable, such as treating altruism as a continuous measure by using the percentage donated and the country specific quartiles of the share donated.

As outlined above, we generated a measure of altruism or level based on the country specific quartiles of the share donated. We observe a relatively even distribution across levels, with a donation level in the 1st quartile (36%) i.e. no altruism a bit overrepresented and a low level of altruism (2nd quartile, 20%), medium level (3rd quartile, 23%) and high level

(4th quartile 21%) more even distributed. We proceeded to test the continuous and ordinal measure as alternative specifications in the regression model.

3.2 PREVENTATIVE BEHAVIOURS

Table 8. Restriction level by country

CN	Gatherings of people limited to	Lockdown	Restriction to movement	Masks
DE	10 or less	no measure	no measure	Required in some specified shared/ public spaces
DK	up to 100	recommended not to leave house	no measure	Required in some specified shared/ public spaces
FR	10 or less	no measure	recommend not to travel between regions/cities	Required outside the home at all times
UK	10 or less	recommended not to leave house	internal movement restrictions in place	Required in all shared/public spaces
IT	up to 1000	required not leaving house with exceptions for daily exercise, grocery shopping, and essential' trips	internal movement restrictions in place	Required outside the home at all times
NL	10 or less	recommended not to leave house	no measure	Required in some specified shared/ public spaces
PT	10 or less	no measure	no measure	Required in some specified shared/ public spaces

3.3 MEASURES OF RISK AVERSION

When analysing the general (income-based) risk aversion (Barsky et al., 1997), by asking respondents two consecutive questions if they would take a gamble to increase or reduce their income3F[9], we find that a majority of the sample is very risk-averse (52%) and that there are differences between the countries in the survey, as shown in Table 3. We find a

9 Lottery A: 50/50 chance to double income or to reduce it by 1/3
Lottery B: 50/50 chance to double income or to reduce it by 1/2 (if respondent is willing to take lottery A)
Lottery C: 50/50 chance to double income or to reduce it by 1/5 (if respondent is not willing to take lottery A)

significant difference in the level of risk aversion among respondents who are altruistic (M = 2.76, SD = 1.30) and those who are not altruistic (M = 3.21, SD = 1.14), t(7023)=14.08, p = 0.000, indicating a higher level of risk aversion among respondents who are not altruistic.

Table 9. General risk aversion

Group	DE	UK	DK	NL	FR	PT	IT	Total
IV (least risk averse)	23%	25%	15%	17%	25%	36%	30%	24%
III	13%	11%	12%	12%	11%	14%	16%	13%
II	11%	12%	11%	12%	11%	5%	13%	11%
I (most risk averse)	52%	51%	62%	58%	53%	45%	41%	52%

There is a clear difference in risk preferences between the two southern European countries, which are less risk-averse than their northern neighbours, with France in the middle. A similar distinction between the northern and southern European countries was identified by Sabat et al. (2020) when analysing the economic worries of respondents in the first wave of the ECOS in April 2020.

Table 10. Subjective assessments of risk COVID-19 poses to respondents by country

Country	Risk of Infection		Risk to own health		Risk to Family		Risk to Community	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
DE	2.89	0.99	2.99	1.15	3.04	1.15	2.95	1.02
UK	2.97	0.91	3.1	1.07	3.27	1.12	3.22	0.98
DK	2.85	0.85	2.94	1.12	3.17	1.15	2.98	0.97
NL	2.91	0.94	2.93	1.12	3.07	1.12	2.95	1.04
FR	3.11	0.91	3.23	1.09	3.45	1.07	3.33	1.05
PT	2.99	0.89	3.05	1.12	3.51	1.08	3.31	0.97
IT	2.97	0.93	2.99	1.04	3.29	1.05	3.29	0.98
Total	2.96	0.92	3.03	1.11	3.26	1.12	3.15	1.02

As indicated in Table 4, we also observe variation in the Covid-related risk factors between countries. Focusing on the different domains of subjective risk perceptions (all countries taken together, row total Table 4), we find a significant difference in means between the perceived risk of infection (M=2.96, sd=0.92) and the risk to the own health (M=3.03, sd=1.11); t(7024) = [-6.85], p<0.000, using a paired-samples t-test. This could be interpreted as respondents being less worried about the risk of infection than the risks to their health if they would get the disease. Using the same test, we also find a significant difference

in means between the perceived risk to the family (M=3.26, sd=1.12) and the risk to the community (M=3.15, sd=1.02); t(7024) = [10.59], p<0.000.

3.4 REGRESSION ANALYSIS

We proceed by presenting the regression results of the determinants and characteristics associated, first with the iPSB and afterwards with the pandemic behaviours individually.

Index of pro-social behaviour (iPSB)

Using the index of pro-social behaviour (iPSB) that combines the six protective or pro-social behaviours, we find that respondents' average score on the index was 19.5 (SD 3.4, median 20). When looking at the determinants, we find that age (p<0.001) and being female (p<0.001), as well as a medium (p<0.001) or high level of formal education (p<0.01) are significantly associated with a higher iPSB score throughout models. A higher incidence of COVID-19 cases (p<0.05 in Model I, p<0.01 in Model II/III) were positively associated with a higher score, similarly higher levels of income (p<0.05) had a positive association, but it was not consistently significant throughout models, as shown in Table 5. A higher general risk aversion (p<0.001) had a significant positive association with the iPSB.

We find a significant positive relationship between being altruistic and a higher score of pro-social behaviour in the base model (p<0.01) as well as when we control for risk aversion in Model II (p<0.001) and for Covid-related risk assessments in Model III (p<0.001).

Table 11. Regression results Index of pro-social behaviour (iPSB)

iPSB	Model I	se	Model II	se	Model III	se
Altruistic	0.33***	(0.10)	0.52****	(0.10)	0.43****	(0.10)
Age	0.05****	(0.00)	0.04****	(0.00)	0.03****	(0.00)
Female	0.75****	(0.09)	0.64****	(0.09)	0.58****	(0.08)
Country						
DE (base)						
UK	1.22****	(0.21)	1.17****	(0.21)	1.05****	(0.21)
DK	0.60***	(0.22)	0.44**	(0.22)	0.38*	(0.22)
NL	-0.48	(0.32)	-0.70**	(0.31)	-0.72**	(0.31)
FR	-1.25**	(0.58)	-1.57***	(0.57)	-1.77***	(0.57)
PT	1.37****	(0.24)	1.37****	(0.23)	1.16****	(0.23)

Table 11. Regression results Index of pro-social behaviour (iPSB)(continued)

iPSB	Model I	se	Model II	se	Model III	se
IT	-1.18****	(0.17)	-1.11****	(0.17)	-1.18****	(0.16)
Education						
Low (base)						
Medium	0.45****	(0.12)	0.41****	(0.12)	0.40****	(0.12)
High	0.39***	(0.13)	0.36***	(0.13)	0.34***	(0.13)
Income (make end meet)						
With great difficulty (base)						
With some difficulty	0.19	(0.18)	0.12	(0.18)	0.21	(0.18)
Fairly easily	0.39**	(0.18)	0.28	(0.18)	0.45***	(0.18)
Easily	0.43**	(0.20)	0.27	(0.20)	0.50**	(0.20)
Confirmed cases (cpm)	0.01**	(0.01)	0.02***	(0.01)	0.01***	(0.01)
General risk aversion			0.50****	(0.04)	0.50****	(0.04)
Covid related risk factors						
Risk of Infection					-0.21**	(0.11)
Risk to own health					0.58****	(0.10)
Risk family health					0.77****	(0.10)
Risk community health					0.30***	(0.09)
Intercept	15.39****	(0.31)	14.41****	(0.31)	14.00****	(0.31)
Observations	5,812		5,812		5,812	
R-squared	0.12		0.15		0.18	

Robust standard errors in parentheses
**** p<0.001, *** p<0.01, ** p<0.05, * p<0.10

We proceeded to Test Model III with the alternative specifications for altruism (Table 6 in the appendix). We found a marginally significant effect when altruism is defined as a continuous measure (p<0.10), as in the percentage share donated. When we test the ordinal measure, we find a significant positive association between higher altruism/donation levels and a higher iPSB score. In Table 13 in the appendix we furthermore tested Model III with the iPSB by country and find significant positive associations between altruism and the iPSB in the Netherlands (p<0.001), Germany (p<0.05), Italy (p<0.05) and Portugal (p<0.10) for the binary measure. As a further sensitivity check for the iPSB we compare the results of Model 3 using the iPSB and a score derived by employing pca in Table 14 and find no differences in results.

Days of quarantine after visiting a high-risk area

On average, respondents were willing to spend 9.6 (sd=4.7) days in quarantine without symptoms (range 0-14) after visiting a high-risk area and taking no test. The duration of a voluntary stay under quarantine was found to be longer among the altruistic as compared to non-altruistic respondents. When analysing the factors that influence the number of days, we observe a significant effect of altruism (Table 7 in the appendix). Controlling for sociodemographics and risk assessments, we find that the duration of a voluntary stay under quarantine was longer among the altruistic than non-altruistic respondents ($p<0.000$). Other characteristics that were significantly associated with staying at home longer were age ($p<0.000$), being female ($p<0.000$), having a middle education ($p<0.01$) as compared to low (base), and having a very high relative household income ($p<0.01$). Compared to Germany (base), respondents in five countries were willing to spend more time in quarantine ($p<0.000$), except in France, where respondents were willing to stay home fewer days ($p<0.01$). Furthermore, the higher the risk perception of COVID concerning their health ($p<0.000$), their families' health ($p<0.000$), their communities' health ($p<0.000$), and the higher the perceived risk of infection for themselves ($p<0.01$), the more days respondents would stay at home.

Likelihood of staying at home (with symptoms) to wait for test result

On average, 89.4% (sd=0.3%) of respondents (N=6,732 4F) stated they would be likely or very likely to stay at home for up to four days under quarantine to wait for the results of a (PCR) test because of symptoms. Again, controlling for sociodemographics and risk assessments, we find that altruistic respondents would be more likely ($p<0.01$ Model III) to wait for a test result (Table 9) for all three models.

Going to a supermarket with COVID-related symptoms

On average, 35% (sd=0.48) of respondents (N=6,502) stated they would be likely or very likely to go to a supermarket when showing COVID-19 or cold-related symptoms (coughing/ fever/feeling tired/ sneezing). Controlling for sociodemographics and risk assessments, we find that altruistic respondents would be less likely to go to a supermarket with symptoms (Table 10, $p<0.001$).

Wearing a face mask where it is recommended

On average, 90.3% (sd=0.30) of respondents (N=6,645) stated they would be likely or very likely to wear a facemask where it is recommended (e.g. at large outside gatherings). We find, consistently throughout Model I-III, that being altruistic is significantly associated with being more likely to wear a face mask voluntarily (Table 10, $p<0.001$).

Wearing a face mask where it is mandatory

On average, 93.4% (sd=0.25) of respondents (N=6,631) stated they would be likely or very likely to wear a facemask where it is mandatory (e.g. public transport, supermarket). For this behaviour, we find no significant effect of being altruistic on the likelihood of wearing

a mask when it is mandatory (Table 11). A larger general risk aversion (p<0.000), perceived risk for the health of the family (p<0.01) and community (p<0.01) were associated with a higher likelihood of wearing a face mask where it is mandatory.

Inviting more than six persons to one's own house for an indoor gathering

On average, 28.7% (sd=0.45) of respondents (N=6,688) stated they would be likely or very likely to invite more than six people to an indoor gathering. We again find no significant effect of being altruistic on the likelihood of engaging in this behaviour (Table 12). As shown in Table 3, there is a variation across the ECOS countries. For example, in September 2020, indoor meetings were not forbidden but highly discouraged in Germany (DW, 2020). Meanwhile, Italy was (in September 2020) in a phase in-between lockdowns, where meetings with more than six people in their own home were allowed and only forbidden in October 2020 (ANSA, 2020), which was after the data collection for this article. In Italy, 39.3% of respondents stated that they would be likely to invite more than six people to their house compared to 29.9% in Germany. Differences in the regulation or situation may be a factor in this difference.

A larger general risk aversion (p<0.000), as well as a higher perceived risk of COVID to the own health (p<0.000) and the families' health (p<0.000), was associated with a lower likelihood of hosting such a gathering. Counterintuitively, a perceived higher risk of infection was associated with an increased likelihood of hosting such a gathering (p<0.05). The latter may express people expecting a mild course of the disease if they get infected.

Quantitative magnitude coefficients

The effect size between the altruistic and non-altruistic group of respondents for six individual behaviours and the iPSB was found to be below Cohen's (1988) convention for a small effect size (d>=0.20). Only the days of quarantine after visiting a high-risk country (d=-0.27) exceeded the convention for a small effect size. The effect size for gender for the iPSB (d=-0.13) as well as for all individual behaviours was also below the threshold. We find a similar picture when looking at the iPSB and education, where neither a high (d=-0.08), middle (d=0.00), nor low level (d=0.11) would pass the threshold. When looking at the age categories, we find small effects for the iPSB as well as for inviting more than six people to their own house. Respondents between the age of 18-24 stated to be significantly more likely to invite more than six people to their home (M=2.58, sd=1.42) compared to other age groups (M=2.08, sd=1.33); t(7023) = [-9.21], p<0.000, using a paired-samples t-test, while satisfying the criteria for a small effect size (d=-0.38). We find a similar picture for respondents between the age of 25-34 (d=-0.25). On the other side of the age spectrum, we find that respondents age 65 and above would be less likely to invite more than six people to their house (M=1.88, sd=1.21) compared to other age groups (M=2.19, sd=1.37); t(7023) = [8.03], p<0.000 using the same test, also resulting in a small effect size (d=0.23) when using cohens test. Similarly, we find a small effect (d=0.31) for the iPSB score when comparing 18-24 year-old respondents (M=18.56, sd=3.42) to all other age groups

(M=19.64, sd=3.46); t(5996) = [6.92], p<0.000 similar to 25-34 (d=0.28) year-old respondents. Respondents age 55-64 (d=-0.22) and above 65 (d=-0.25) had a slightly higher iPSB score (M=20.21, sd=3.13) compared to other age groups (M=19.35, sd=3.53); t(5996) = [-7.96].

4. DISCUSSION

Using data from the ECOS study, we investigated if there is a relationship between an overall altruistic disposition (i.e. a concern for others as opposed to self-interest) and behaviours in the COVID-19 pandemic that mainly benefits others. We indeed find such a relationship and can conclude that people who show at least a degree of altruistic behaviour will also be more likely to act in a pro-social manner, as expressed in a higher score on our index of pro-social behaviours. The level of significance is higher once we control for risk aversion. This may have to do with the fact that altruistic people are less risk averse in our sample, and risk aversion has been shown to be correlated to positive reciprocity by (Falk et al., 2018), which in turn is positively related to altruism.

We find a similar result when analysing the relationship between altruism and individual behaviours. For example, we find that being altruistic is associated with a higher likelihood of not going to a supermarket with COVID-19 symptoms. This is inconvenient or associated with extra cost for the individual (e.g. food delivery services) but contributes to a low infection risk environment for others. This result is intuitive, in line with previous findings (e.g. Burnett, 1981; He et al., 2020) and confirms earlier observations during the pandemic (Alfaro et al., 2021; Campos-Mercade et al., 2021; Fang et al., 2021). For two of the behaviours, namely wearing a mask where it is mandatory and inviting more than six people to their own house, we find no significant effect of being altruistic. Different reasons may be the cause for this; more altruistic people could also be more sociable and therefore inclined to invite people. Maybe altruism plays a role in voluntary activities that protect others but not in observing regulations like mandatory mask-wearing. For these regulations, peer pressure and sanctions may play a more important role (Ostrom, 2014; Cato et al., 2020), or it may be driven by individual risk perception and cognitive biases (Nikolov et al., 2020).

We further find that general risk aversion plays a role in the pandemic behaviours and the subjective assessment of what risk COVID-19 poses to the individual or the people around her/him. For example, perceiving COVID-19 as a higher risk for one own health or the health of the family was associated with a higher likelihood of wearing a face mask where it is recommended. This is consistent with other recent findings (Bruine de Bruin and Bennett, 2020; Dryhurst et al., 2020; Bundorf et al., 2021; Tagini et al., 2021) that conclude a higher perceived risk of COVID-19 increases the adoption of preventative measures.

When studying the altruism coefficients in the iPSB model country-by-country (Table 13), we found relatively large differences. Although there is a lot of noise in this comparison

due to the much smaller sample sizes, it is worth speculating about these differences. For example, the coefficients are especially low for the Netherlands, where the government relied a lot on moral appeals with respect to preventive measures at the start of the pandemic. Altruistic Dutch citizens may have reacted stronger to this appeal than non-altruistic Dutch citizens. Governments of other countries have relied less on such moral appeals, and implemented more strict measures, leaving less room for heterogeneity in pro-social behaviour among different types of altruists. Future research is encouraged to study the effects of different Covid-related policy measures on the mediating role of altruism on pro-social behaviour in more detail.

Some limitations apply; first, our elicitation of altruism comes from economic theory and contrasts it with self-interest. When we tested other definitions of altruism, such as an ordinal measure, we found a significant association between higher donations and pro-social behaviour, suggesting that there may be a positive relationship between the amount donated and pro-social behaviours. On the other hand the results of the ordered measure suggest a non-monotonic relationship, which could in turn mean a that the amount does not matter in a hypothetical donation. Of course, altruism, like many behaviours, is better identified by observing behaviour (e.g. in experiments) than by eliciting it hypothetically. Furthermore, there are validated questionnaires in psychological research that aim to identify more altruistic people, e.g., by using the simplified SRA scale to assess altruism (Manzur and Olavarrieta, 2021). Future research could compare the results of our measure and other ways of identifying altruistic individuals in stated choice contexts as well as other measures associated with pro-social behaviour, such as time preferences, we were not able to control for.

Second, we use stated choice for pandemic behaviours. This always involves the risk of respondents giving socially acceptable or desirable answers. While this is a limitation, we are confident that the anonymity of our questionnaire minimised the risk of socially desirable answers.

Third, related to this, we find only a small change in the size of the donations between the altruistic and non-altruistic group. This could be related to the hypothetical nature of the questions and the donation measure since this is not a behavioural experiment, but a study based on stated choices.

Our results indicate that altruism or regard for the well-being of others positively contributes to pandemic behaviours, which in turn contributes to a low infection risk environment. Furthermore, we find that the subjective risk assessment of COVID-19 also plays a role in these behaviours. Especially for risks for which individuals have limited reference points, such as COVID-19 or previous new viruses like H1N1 (swine flu), subjective risk perceptions may play an important role in engaging in protective or avoidance behaviours (Rudisill, 2013). In order to update these reference points and correct the

subjective risk assessments, Bish and Michie (2010) suggest using tailored interventions and communication strategies that focus on particular demographic groups to update their perceived threat of the pandemic and the effectiveness of certain protective behaviours.

Policymakers could draw from these lessons for the current and possibly future pandemics to improve adherence to and acceptability of measures. In line with earlier findings (Cato et al., 2020; Webster et al., 2020b), our results suggest that emphasising how a particular behaviour (e.g. wearing a mask) will protect vulnerable people around us may increase the adherence to the behaviour. Furthermore, providing accurate and straightforward information about the infection risks that behaviours may cause (e.g. going to the supermarket with symptoms), could further improve adherence to pro-social behaviours.

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6

CHAPTER 6

Willingness to be vaccinated against COVID-19 in seven European countries

BASED ON

Neumann-Böhme, S., Varghese, N. E., Sabat, I., Barros, P. P., Brouwer, W., van Exel, J., Schreyögg, J., & Stargardt, T. (2020). Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. *European Journal of Health Economics*. https://doi.org/10.1007/s10198-020-01208-6

INTRODUCTION

While the focus of attention currently is on developing a vaccine against the Coronavirus SARS-CoV-2 to protect against the disease COVID-19, policymakers should prepare for the next challenge: uptake of the vaccine among the public. Having a vaccine does not automatically imply it will be used. Compliance with the anti-H1N1 vaccine during the 2009 influenza pandemic for instance was low (Blasi et al., 2012), and in the decade since, vaccination rates have remained an issue of concern (Kata, 2012) while vaccination hesitancy has become more prevalent, leading to increases in disease outbreaks in multiple countries (Larson et al., 2018). It is therefore important to understand whether or not people are willing to be vaccinated against COVID-19, as this can have large consequences for the success a a vaccination program – with potentially large health and economic consequences. In this editorial we provide some first insights into this willingness to be vaccinated, based on a multi-country European study (*Countering COVID-19: A European survey on acceptability and commitment to preventive measures*, 2020), which hopefully result in more attention for this important issue.

A VACCINE AGAINST COVID-19

On April 26, the WHO counted seven COVID-19 candidate vaccines in the clinical evaluation phase and 82 more in the preclinical evaluation phase (World Health Organization, 2020). This underlines the unprecedented current efforts worldwide to find an effective vaccine against the Coronavirus SARS-CoV-2. Some expect that first vaccines may become available under emergency use protocols as soon as early 2021, given the speed and scale of research and development efforts globally, while others argue it will take longer (Callaway, 2020; Tundzhay, 2020; Welcome trust, 2020). In both cases, the development phase should be followed by large scale vaccination programs to attain herd immunity (Fine et al., 2011). That way, we can protect the lives of the most vulnerable people and reduce the social and economic burden of the current crisis.

Vaccination programs can lead to herd immunity without requiring a large proportion of the population to be infected. The latter is mostly seen as an undesirable option, given the potentially high numbers of deaths as a result of infection. Especially so if the health systems are overwhelmed by a large number of patients with severe COVID-19 symptoms (Gypsyamber & Dowdy, 2020). Herd immunity through vaccination, however, requires a sufficient proportion of the population to be vaccinated. While vaccination is widely recognised as an effective way to reduce or eliminate the burden of infectious diseases by health authorities and the medical community (Andre et al., 2008), its effectiveness also depends on the individual willingness to be vaccinated. This willingness could be negatively affected by doubts and worries that exist in the population about the safety and appropriateness of vaccines. This is sometimes labelled vaccine hesitancy (Siciliani et al., 2020). If too many individuals hesitate about being vaccinated, herd immunity may not be

reached. Besides objective trade-offs of costs and benefits of a vaccine, risk-attitude, pro-social considerations, and misinformation or misperceptions about a vaccine may play a role in this (Betsch et al., 2013; Kata, 2012; Korn et al., 2018).

At present, it is unclear whether a sufficient proportion of the population would decide to get vaccinated when a vaccine becomes available. In the EU, vaccine delays and refusals are contributing to declining immunisation rates in several countries and lead to increases in disease outbreaks (Larson et al., 2018). Hence, and the question is whether enough Europeans trust the effectiveness and safety of vaccines and the healthcare system that delivers them (VCP, 2015).

WILLINGNESS TO BE VACCINATED

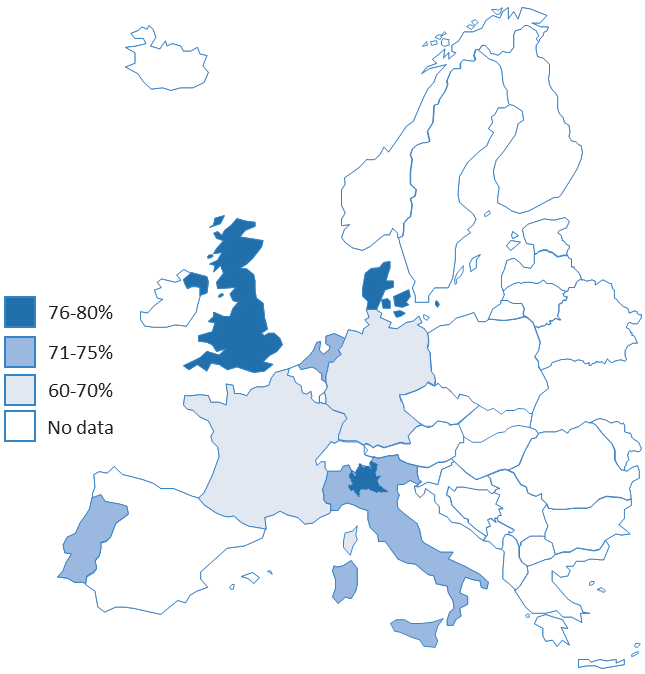

Figure 5. Proportion of respondents who stated they would be willing to be vaccinated against the novel coronavirus per country

In order to shed more light on the issue of willingness to be vaccinated, we investigated people attitudes about vaccination against COVID-19 in an online survey among representative samples of the population (in terms of region, gender, age-group and education) in seven European countries (N=7.662). The sample consisted of about 1.000 respondents per country, and an additional 500 from the highly affected region Lombardy, since we expected that results might differ from the rest of Italy. In this first wave of the data collection, respondents were inquired about worries and beliefs about COVID-19, as well as attitudes about vaccination and their willingness to be vaccinated between 2 and 15 April 2020 (*Countering COVID-19: A European survey on acceptability and commitment to preventive measures*, 2020). In this editorial, we provide some first insights into the findings, in order to stimulate further research and policy in this area.

In total, 73.9 % of the 7,664 participants from Denmark, France, Germany, Italy, Portugal, the Netherlands, and the UK stated that they would be willing to get vaccinated against COVID-19 if a vaccine would be available. A further 18.9% of respondents stated that they were not sure, and 7.2% stated that they don't want to get vaccinated. As shown in Figures 1 and 2, the willingness ranged from 62% in France to approx. 80% in Denmark and the UK. The largest proportions of the population opposed to a COVID-19 vaccination were observed in Germany (10%) and France (10%), while France also has the largest group of people who were unsure about getting vaccinated (28%).

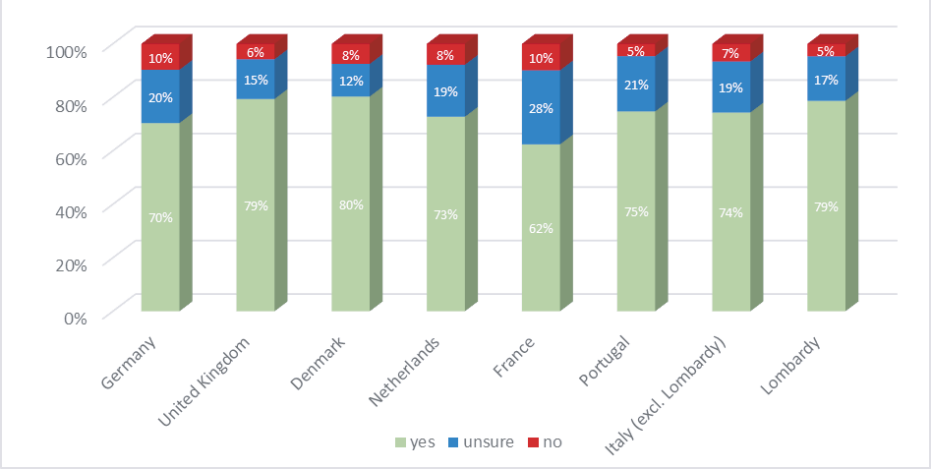

Figure 6. Willingness to be vaccinated against the coronavirus by country

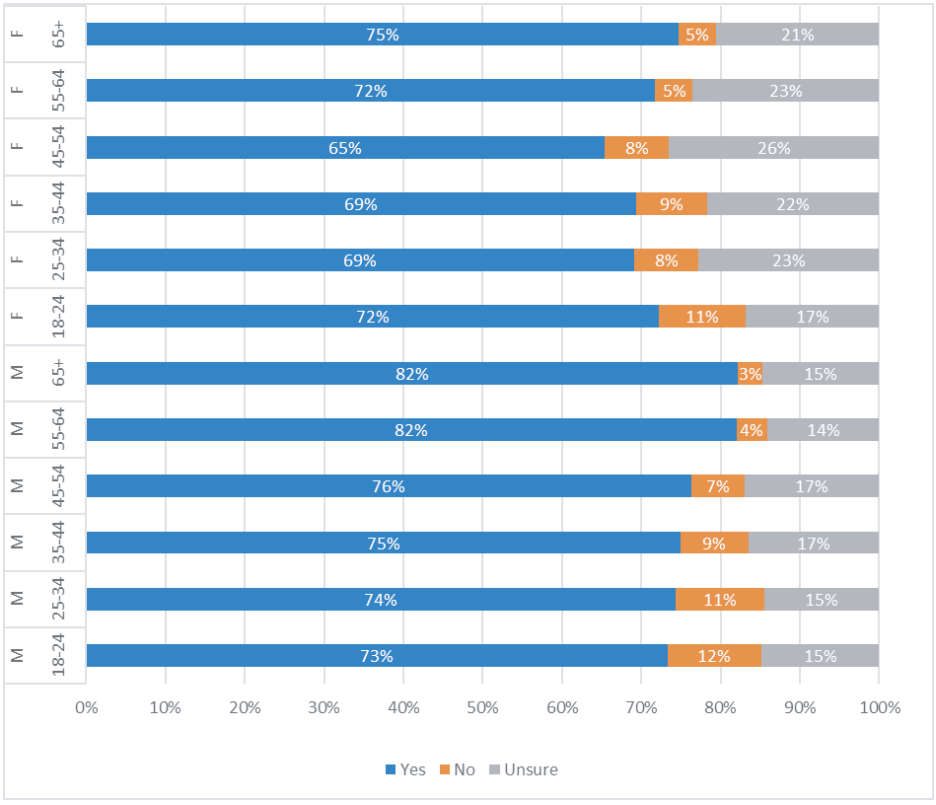

Figure 7. Willingness to be vaccinated against COVID-19 by age group and gender

Looking closer, we found considerable differences in willingness to get vaccinated across genders and age groups (figure 3). A significantly higher proportion of men were willing to get vaccinated (77.94%, Chi-squared, $p < 0.001$) than women (70.15%). The willingness to be vaccinated is largest among men above the age of 55, while uncertainty ranged between 14-17% across all age groups. Males who were unwilling to get vaccinated tended to be younger with the largest share of 12% among the 18-24-year-olds. Similarly, the trend for women who were unwilling to vaccinate seems also to follow the age categories. The uncertainty among women was higher in all age groups and largest for women between the ages of 45 to 54 (26%).

One might argue that the group who is currently unsure about getting a vaccine may be the most relevant. These are the people who potentially can be persuaded more easily to get vaccinated to achieve herd immunity. Based on our results, these efforts could best be aimed at persons below the age of 55 and at females in general, where the willingness is lower.

We asked respondents who were unsure about being vaccinated about their main reasons (Figure 4). More than half (55%) said they were concerned about potential side effects of a vaccine, although this concern was more frequent among women (36%) than men (19%). Around 15% of respondents stated that a vaccine might not be safe, with no notable differences between genders. These findings are in the literature on frequent reasons for vaccine hesitancy (VCP, 2015). Looking at the open text explanations given to the category "other", we saw that a common concern seems to be that a COVID-19 vaccine might be experimental, without any studies on side-effects, and that the vaccine may not be safe for specific groups, such as for pregnant woman, people with pre-existing conditions like MS, allergic persons etc.

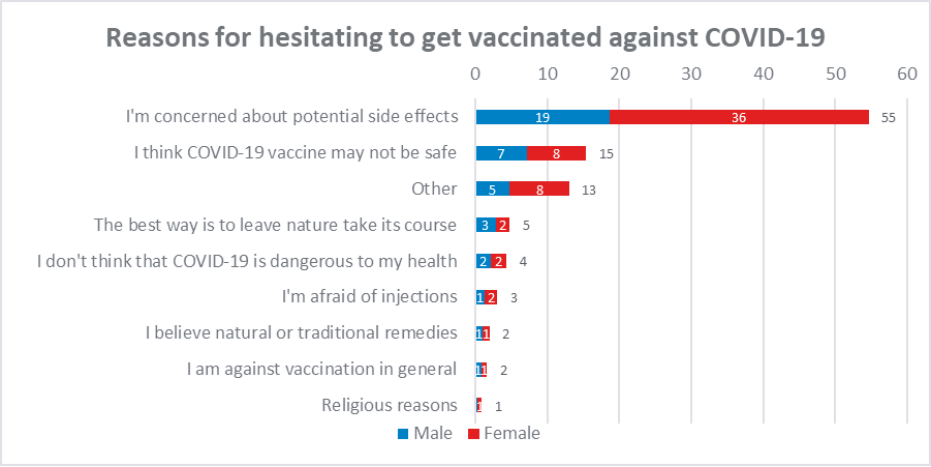

Figure 4. Reasons given by people who were unsure if they would like to be vaccinated against COVID-19 in %, N=1451

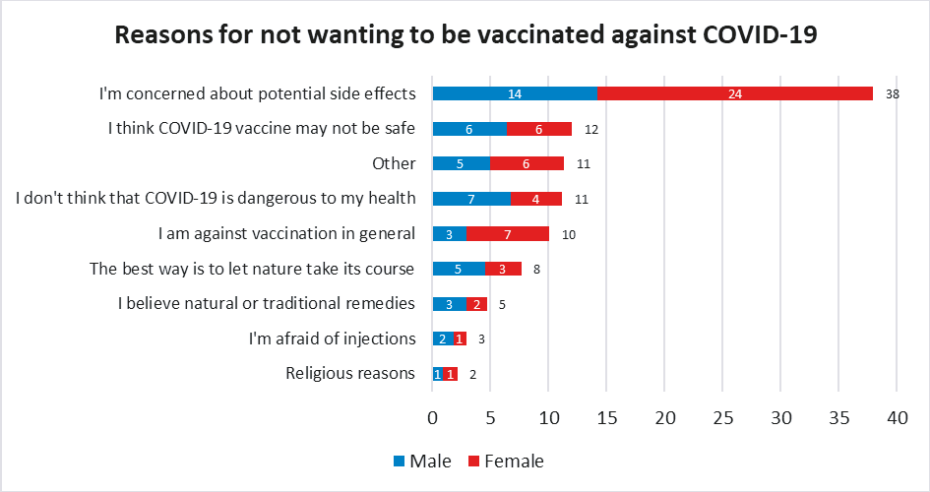

Figure 5. Reasons for not getting vaccinated against COVID-19 in %, N=548

This finding highlights that while the current focus seems to be on developing a vaccine about ten times faster than usual (Welcome trust, 2020), the public should also be reassured that any vaccine that becomes available that quickly is safe and effective. Otherwise, there is a risk to lose the public trust in the particular vaccine, and coronavirus vaccination altogether (Jiang, 2020), potentially compromising herd immunity.

We find a similar trend regarding the most frequently mentioned reasons and the gender differences for the concerns about side effects among those who were not willing to get vaccinated. Notable gender differences could also be observed among those respondents who stated that they think COVID-19 is not dangerous to their health (11%), comprised of almost twice as many men (7%) than women (4%). Furthermore, we see that an overall rejection of vaccination was more than twice as common among women (7%) than among men (3%). When looking at the open text answers of respondents who choose other reasons (11%), we found concerns about safety but also comments about conspiracy theories and a general rejection of vaccines.

INCREASING WILLINGNESS TO BE VACCINATED

The literature suggests multiple steps that could be taken by policymakers to decrease vaccine hesitancy and convince doubters to get vaccinated after all. One approach for vaccine advocacy suggests "vaccine adoption = access + acceptance" (Thomson & Watson, 2012). Looking at access, it is essential to translate the willingness to be vaccinated into actual vaccination decisions. Our study measured the intention to vaccinate; this rate might differ from actual vaccination uptake (vaccination decision) depending on potential constraints, such as the price of the vaccine and the ease of access of vaccination sites.

Vaccines should thus be available in a timely manner and an easily accessible way to have as little attrition as possible (Siciliani et al., 2020). In the case of the coronavirus vaccine, access will prove quite challenging since, at the early stages of availability, the demand for this vaccine worldwide will be much greater than the (short term) production capacities. Currently, about 5 billion doses of vaccine are produced yearly worldwide, of which 30% are seasonal flu vaccines („Can the world find a good covid-19 vaccine quickly enough ?", 2020). So even when a vaccine becomes available, access to it will probably be limited in the short-run. Therefore, policymakers need to prepare how access can be organised equitably and effectively.

Our results on acceptability suggest that substantial gains could be made among the sizeable proportion of the population (i.e. 18.9%) that is unsure whether they want to get vaccinated. If this group needs to be convinced to be vaccinated to get to herd immunity, clear communication about safety, and potential side-effects of the vaccine is especially important. This could help stimulate the hesitant part of European citizens to get vaccinated after all.

This is especially important since it is unclear whether the group of people who are willing to be vaccinated in itself is large enough to achieve herd immunity. The basic reproduction number R_0 shows the transmission potential of diseases (Rothman et al., 2008), i.e., to how many people the infection is expected to be passed on by one infected individual in a fully susceptible population, on average. The herd immunity threshold describes the proportion of the population that needs to be immune, so that the infectious diseases is stable (R=1) and is calculated as (Nishiura & Chowell, 2009):

$$Herd\ immunity\ threshold = 1 - \frac{1}{R_0}$$

This means that the higher the basic reproductive number R_0 is, the higher the herd immunity threshold becomes. A recent study estimated a COVID-19 R_0 of around 3.87 for Europe (Flaxman et al., 2020), implying a herd immunity threshold for Europe of 74%. For the US, it was estimated at around 3.45, implying a herd immunity threshold of 71% (Pitzer et al., 2020), while a recent study argues these values may be lower if there is heterogeneity in the individual susceptibility to the virus (Gomes et al., 2020). Of course, these estimates are uncertain, but comparing this 71-74% threshold range with our results indicates that the current willingness levels in France, Germany and the Netherlands, in particular, may prove insufficient to reach this threshold.

Our survey highlighted important differences between citizens from European countries in terms of willingness to be vaccinated against COVID-19. The levels don't follow trends that we see in other vaccination rates, e.g. against measles, which are generally higher, but in most countries below the recommended 95% threshold (WHO, 2019).

Understanding which groups in the population are not willing to be vaccinated and why remains vital for the design of policy responses to vaccination hesitancy. One of the avenues to explore could be to emphasise the social benefits of vaccination more strongly so that they weigh the public health dimension more heavily in their decision whether to vaccinate (Betsch et al., 2013). A recent study, for example, found that people are more willing to get vaccinated when they were informed that this would protect others who have are willing but unable to get vaccinated themselves (Böhm et al., 2019). Consequently, one of the communication strategies could be to emphasise how vaccination against COVID-19 helps to protect vulnerable members of society. Furthermore, the distribution of vaccinated individuals in the population matters, pockets of non-vaccinated groups could be highly problematic even when overall vaccination rates are high. Unvaccinated individuals may be in contact with other unvaccinated individuals relatively often(Barclay et al., 2014). Outbreak in particular communities may then occur, even if overall vaccination rates are high. Examples of measles outbreaks in the Netherlands (Van Den Hof et al., 2001) and the US (Centers for Disease Control and Prevention, 2020), for instance highlight the role of religious communities and travelers in this context.

Alternative strategies range from restrictive measures against those who chose not to be vaccinated to mandatory vaccination schemes for certain target groups or the whole population. Experimental evidence suggests that individuals under specific conditions may be willing to support mandatory vaccination policies, but this support seems very sensitive to adverse events (Meier et al., 2019). Such a policy may be less appropriate in the context of COVID-19.

BEYOND FINDING A VACCINE

Our findings highlight that considerable policy effort may be required to come from having a vaccine to adequate vaccination rates, especially in some countries. Targeting those in the population who are currently hesitant seems most promising and cost-effective, but this requires convincing evidence and clear communication on the safety and effectiveness of the vaccine. This may be at odds with the current push for having a vaccine available as soon as possible. A campaign emphasising the social benefits of vaccination could increase the willingness to be vaccinated among those amenable to such pro-social motives. Finally, a sizeable proportion of the population indicates not to be open to vaccination. This group may remain at risk of spreading the virus and contracting the disease, even after herd immunity has been achieved. Concluding, improving our understanding of vaccination hesitancy in the context of COVID-19, as well as finding and using policies to overcome it, may be as important as discovering a safe and effective vaccine.

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7

Under Embargo

8

CHAPTER 8

General Discussion

Human decisions are not always the result of rational thinking but are sometimes prone to failures of reasoning. This is true in different domains of life, including health choices, as was for instance highlighted during the COVID-19 pandemic. A relatively harmless example of such a failure of reasoning may be panic buying and stockpiling of toilet paper (Loxton et al., 2020). A more severe and harmful example was engaging in conspiracy beliefs which provided false information about the pandemic and the containment measures, which led to lower compliance with containment policies among those who believed in them (Bierwiaczonek et al., 2020), with clear health risks. Another example was not vaccinating against COVID-19 (Neumann-Böhme et al., 2020), despite highly effective vaccines being available, due to misperceptions regarding the disease or the vaccine. This thesis investigated preferences and perceptions of individuals in the context of decision-making in the health domain, with special attention to the COVID-19 pandemic. Gaining a better understanding of what influences such preferences and perceptions, and the subsequent decisions, is valuable in itself, but it also offers opportunities on a practical level. It, for example, allows policymakers to use these insights to increase the acceptability of health measures in the population by using tailored information campaigns. Research in behavioural and experimental economics in turn can improve our knowledge base and inform better economics models and methods (e.g., those used to explain and elicit individuals' preferences for health states).

PART I: DEEPENING THE KNOWLEDGE IN BEHAVIOURAL HEALTH ECONOMICS

Contributing to the efforts to improve preference measurement, chapter two addressed the problem of preference reversals, which violate procedural invariance. Procedural invariance is a central assumption of expected utility theory and is required to compare results from different methods used to measure respondents' preferences. Ideally, preferences should be stable, and various methods should yield identical preference orderings. The first research question in this thesis addressed the issue of whether preferences are more consistent in the own area of expertise than in unfamiliar areas, and if more straightforward elicitation procedures can lead to more consistent outcomes.

The experiment conducted in chapter two found that respondents' preferences differed depending on the technique used to elicit their preferences, leading to a rate of preference reversals of 59% in the health domain and 55% in the financial domain, similar to findings previously reported in the literature. When making decisions on behalf of others, medical and economics students showed fewer reversals in their own area of expertise than in an unfamiliar domain.

Furthermore, a simplified procedure of eliciting preference using guided choice lists led to fewer reversals overall and appeared to be especially promising in unfamiliar domains. Nonetheless, even in the best scenario, a third of the respondents still showed inconsistent

preferences in their area of expertise when using the simplified elicitation procedure. Despite attempts by researchers to simplify procedures and find more consistent methods of measuring preferences (Bostic et al., 1990; Bateman et al., 2007; Attema & Brouwer, 2013; Oliver, 2013), preference reversals remain a problem which implies that it is unclear which method (if any) reveals the 'true' preferences of respondents. Considering the literature and the results of chapter two, inconsistent responses or preference reversals remain a problem across domains and procedures in eliciting preferences. Still, chapter two also showed that reversals were less common in the specialist's domain than in unfamiliar areas. Furthermore, guided choice lists as a simplified valuation procedure may be a promising way to elicit more consistent preferences.

The environment people operate in is likely to influence their preferences and perceptions. Miles' law illustrates this very well: "Where you stand depends on where you sit" (Miles, 1978). In his experience in Government, Miles found that there was no such thing as pure objectivity in policy making and that a person's function and responsibility influenced their judgement. The effect of perceptions and relative comparisons in relation to well-being was illustrated in chapter three. The results of this chapter answer the second research question posed in this thesis that asked which comparisons in the income and health domain affected the subjective well-being of individuals. Chapter three used a representative sample of respondents in the Netherlands to investigate whether and how well-being depends on absolute levels of health and wealth as well as on relative comparisons to a broad set of potential reference points. For income, subjective well-being was associated with two reference points. First, current income relative to respondents' financial needs for survival appeared to have been a reference point. The second reference point was current income relative to (financial) expectations for the stage of the lives of respondents. In the health domain, well-being was mainly associated with one reference point, which compared current health to the health respondents felt they deserved. In both domains, well-being was negatively affected if actual attainment levels fell short of the reference points. The results from Chapter three showed that individuals appear to have multiple reference points for health and income against which they compare their achievements. These reference points appear to be domain-specific, and well-being is negatively affected if achievements fall short of the reference point.

PART II: APPLYING INSIGHTS TO THE COVID-19 PANDEMIC

The COVID-19 pandemic was a challenge for the general population as well as for policymakers. The almost unprecedented scale, the infectiousness of the virus, the associated health consequences, as well as the risk that health systems could be overwhelmed by the number of infected patients forced governments worldwide to issue restrictions to contain the spread of the virus. Like the pandemic, some of the measures were also quite unique in scale and nature. Lockdowns might be seen as one of the strictest measures, and the literature is still unclear about whether they were effective.

Some argue that non-pharmaceutical interventions and lockdowns, in particular, had a large effect on reducing transmissions in Europe (Flaxman et al., 2020). Others argue that specific non-pharmaceutical interventions such as school/university and business closures as well as gathering bans have effectively reduced COVID-19 transmission and argue that stay-at-home orders, in most cases, supplemented other measures with only a small added effect (Brauner et al., 2021).

While stay-at-home orders/lockdowns may avoid infections and thus contribute to public health, lockdowns at the same time may amplify existing inequalities in society (Lewis, 2022). For instance, wealthier people often have more space and access to recreational areas such as parks or gardens, which benefits them in a lockdown, relative to poorer people living in smaller houses and in less spacious and green neighbourhoods. Furthermore, knowledge workers, like academics, were able to continue their work from home, while people working in gastronomy and the recreational sector suffered much more from lockdowns.

Chapter four of this thesis investigated the public sentiment towards the implemented containment policies in Europe in April 2020. It furthermore analysed worries about different aspects of the pandemic (e.g., that the health system would be overwhelmed) as well as trust in information sources in representative samples of the public. On average, 68% of people in the seven European countries included in the study approved of the policies taken in their country in response to the pandemic, implying considerable public support, but also a sizeable minority of people not approving the policies. The extent of approval differed by country and by policy measure. The most approved measures were fining violations of the (14-day) COVID-19 quarantine, a ban on public gatherings, and border closures (each supported by 83% of respondents). Within Europe, a north-south divide was observed in public opinion about the pandemic and its consequences. For instance, 84% of respondents in Portugal and 81% in Italy were worried "quite a bit" or "a lot" that their national health system would be overwhelmed due to the pandemic. The corresponding shares in Denmark and Germany were 54% and 62%, respectively. Such differences may also relate to the experiences in the different countries in the first phases of the pandemic.

Understanding the public support for containment policies proved critical to the adherence to measures and their chance of success. Investigations of the commitment to containment policies have highlighted the importance of trust in the Government and its institutions for compliance with measures (Pak et al., 2021). Chapter five investigated another essential factor contributing to compliance with containment policies. Analysis of the ECOS data revealed that altruistic individuals were more likely to behave pro-socially. Overall, 68.7% of respondents stated they would donate at least some part of an unexpected 1000 Euro gain, which is a deviation from purely self-interested behaviour and was interpreted as altruistic behaviour. Such altruistic respondents were found to be more likely to wear a mask where it is recommended, less likely to go to a supermarket

with COVID symptoms and would, on average, stay under quarantine after visiting a high-risk country one day longer than other respondents. Controlling for several other factors, altruism remained significantly and positively associated with pro-social behaviours. This suggests that explaining measures to the population and highlighting the benefits of adherence for (vulnerable) others, thus tapping into altruistic motives for behaviour, may increase the acceptability and compliance to containment measures. In terms of reasoning failures, reminding people that they wear a mask to protect vulnerable others may improve their knowledge about the full benefits of their behaviour and, as a result, increase compliance with the measure.

The third research question posed in this thesis asked about the public perception of the implemented containment measures and the degree to which individuals followed the introduced measures. The analysis in chapter four showed that Europeans largely supported the policies to contain the spread of the COVID-19 pandemic in April 2020, with differences in support between countries, and that they were worried that the pandemic might overwhelm their national healthcare systems. The results of chapter five, in turn, showed that a large part of the population followed measures that reduced their chance of being infected, but also measures that mainly benefit others, such as not going to a supermarket with symptoms.

Ultimately, vaccines were highly important in mitigating the consequences of the COVID-19 pandemic. In order to have an impact, having vaccines is not enough; they need to be used. Although this may be obvious, this also highlights the importance of the willingness to be vaccinated (WTV) of individuals as a crucial factor in vaccination campaigns. The WTV against COVID-19 was a much-debated and researched topic. Chapter six contributed to this discussion and line of research by, based on ECOS data, reporting on the WTV in April 2020, when vaccines were still eight months away from being approved. At that time, a lot of uncertainty remained regarding the vaccines, their safety and effectiveness. Although the percentages differed considerably between countries, on average, 19% of respondents were unsure, 7% unwilling, and 74% were willing to be vaccinated. Vaccine hesitancy was highest in France, with only 62% being willing to be vaccinated, compared to 80% in Denmark and 79% in the UK. The results from chapter six also showed considerable differences in WTV across subgroups in the population, e.g., based on gender and age. A significantly higher proportion of men (77.94%) than women (70.15%) were willing to be vaccinated, and WTV was highest among men above the age of 55. This early report on the WTV pointed out the need for large information campaigns that address vaccine hesitancy and the population's concerns once the vaccines became available. Interestingly, the average WTV measured in ECOS decreased until November 2020, after which it increased again. This coincided with the time at which the first encouraging Phase III trial results were reported for Comirnaty, the BioNTech/Pfizer vaccine (Polack et al., 2020).

Once the vaccines became available in Europe in early 2021, there was a great demand from those who wanted to be vaccinated, sometimes resulting in long (real or virtual) queues in front of the vaccination centres. The results from chapter seven showed that 73% of ECOS respondents in January/February 2021 would have been willing to pay to skip the waiting lines to gain immediate access to a (hypothetical) 100% effective vaccine. On average, these people were willing to pay 54.36 Euros. Similar to what was found in other studies (e.g. Carpio et al., 2021; Morillon & Poder, 2022), and unsurprisingly, respondents took the vaccine's effectiveness into account when indicating their willingness to pay for immediate access. As chapter seven reports, fewer people (i.e., 68.5%) were willing to pay for immediate access to a vaccine with an effectiveness of 60%, and the average amount they were willing to pay also was lower (i.e., 43.83 Euros). The time respondents expected to wait for an appointment through the public system appeared to have served as a, quite logical, reference point against which respondents evaluated the benefits of immediate access, highlighting the important role of reference points[11] in valuation tasks as well as the need for reference points to be well-informed. Furthermore, the study found evidence of preference reversals between the willingness to be vaccinated and the willingness to pay. In the WTV question, 6% of respondents stated that they were unwilling to be vaccinated, while they did indicate to be willing to pay a positive amount for immediate access to a vaccine. This constitutes a preference reversal between a choice and a valuation task.

The fourth research question asked about the factors that influenced the willingness to be vaccinated against COVID-19 and the willingness to pay for access to a vaccination. For the willingness to be vaccinated reported in chapter six, we found the main concerns of those still hesitant about getting a vaccination revolved around safety and potential side effects of the vaccine. This relates to findings in the literature listing the risk of infection, effectiveness, vaccine safety and a lack of side effects as major determinants for the willingness to be vaccinated (Kreps et al., 2020; Morillon & Poder, 2022). This ties in very well with findings on the willingness to pay for access to a vaccine in chapter seven. The perceived severity of the virus to oneself and others and the effectiveness of the vaccine were relevant determinants for the WTP. As expected, the willingness to be vaccinated also influenced the willingness to pay, while confidence in vaccine safety may have been a mediator.

STRENGTHS AND LIMITATIONS

At the start of this PhD trajectory, it was, of course, not foreseen that the world would be hit by a pandemic. While the COVID-19 pandemic has caused much human suffering, disruption, as well as social and economic impact, it also presented a unique, societally,

11 The term reference point is in this context not necessarily used as it is in prospect theory. We rather refer to the more general definition of a reference point as basis or standard for evaluation, assessment, or comparison (OED, 2018)

and scientifically relevant subject for health economic research. The ECOS dataset offered the possibility to continuously gather data on and study a range of topics relevant to researchers, policymakers, and a broader audience. However, the repeated data collection for ECOS also posed significant challenges to the researchers involved, not only requiring changes of research plans (in a changing environment), but also adherence to stringent timelines for questionnaire design and data collection. In addition, the nature of the pandemic and the associated public health measures meant that the research had to be conducted remotely. Despite these challenges, using an online survey facilitated the efficient collection of a large and diverse sample, aiming to provide valuable insights into the economic and social impacts of the pandemic across Europe.

This thesis used survey and experimental data to answer research questions about a wide range of topics, such as preferences in decision-making for others, policy support, potential reasoning failures, the impact of diverse reference points on well-being, and the demand for vaccines. One of the strengths of using survey data of the kind used here is that it is fit for purpose, meaning that it is collected after carefully designing a survey given the research questions that need to be answered. Chapter two on preference reversal used an online experiment with a specific sample of medical and economics students and a design that allowed observing preference reversals in different settings. This design allowed observing decision-making in familiar and unfamiliar domains. Although it would be worthwhile repeating a study like this in actual decisions and professionals, the study provided valuable insights into preference elicitation and reversals.

The survey data used in part II of the thesis was representative of the population in seven European countries in terms of age, gender, regional distribution and, to a degree, education and, therefore, with the necessary caution also due to the online data collection, better allows generalisability of the findings for these populations.

Some limitations of survey data and their implication for the work included in this thesis need emphasis. First, the work presented in this thesis is based on stated preferences and not revealed preferences, i.e., observations of actual behaviour. This implies that there is, for example, no way of confirming if the vaccination status respondents claim to have was true, or whether, in real life, they would, for instance, actually pay the amounts they indicated to be willing to pay in the survey. This general drawback of survey-based research can be mitigated in incentive-compatible experiments that use incentives/pay-outs to reveal preferences. Alternative approaches such as eliciting preferences from administrative or other data that were not collected for this purpose, come with their own disadvantages like requiring numerous assumptions and sophisticated econometric models to answer research questions.

The second point, which is partly related to the preceding discussion, concerns the limitations inherently associated with conducting survey-based research. As discussed

in chapter two, there may be a slight sample bias in the group of respondents used in this chapter because some economics students may have attended lectures on behavioural economics and preference reversals or had more experience with economic experiments than medical students. This may have influenced results although it is difficult to pinpoint whether this was the case or to what extent. During the data collection process for ECOS, a trade-of needed to be made between two competing goals: the degree of representativeness of the sample and the duration of the fieldwork. Throughout all 11 data collections or survey waves, we encountered difficulties in enrolling elderly participants, especially from Portugal. Hence, a balance between full representativeness and the duration of data collection needed to be found, which resulted in the relaxation of some quotas. This compromise ensured obtaining the required sample size within a reasonable time frame, but at the expensive of not being fully representative.

Third, the data used in this thesis was gathered solely in Western European populations. While some of the conclusions may have broad applicability across different contexts, it is important to note the potential limitation of generalisability. In other countries, with, for instance other cultural or economic contexts, populations may have different views and preferences than the ones presented here. To illustrate, in chapter seven, the construction of a hypothetical scenario where respondents had to pay out of pocket for a COVID-19 vaccine resulted in some participants providing protest answers as the scenario was unrealistic to them, highlighting the relevance of the (financing of the) healthcare system. Moreover, the average willingness to pay will obviously be different in low- and middle-income countries. Another example is chapter three, which identified potential reference points for health and wealth and their impact on well-being, based on a sample from the Netherlands. While the results align with findings in the literature based on data from Latin America (Graham et al., 2011) and Switzerland (Stutzer, 2004), people from other countries may compare their achievements to other potential reference points. We were, for example, unable to confirm findings from the US (Luttmer, 2005), which showed that relative income in the form of social comparisons was important for subjective well-being. This may be due to cultural differences or differences in income inequality between the Netherlands (Gini index 2019: 29.2) and the US (Gini index 2019: 41.5)[12] (World Bank, 2023), but it generally highlights the contextuality of the findings. Revisiting this topic with a larger dataset like ECOS may highlight differences between countries in this area within Europe. For now, caution is advised in generalising these results beyond the context in which they were observed.

12 The Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from an equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality (World Bank, 2023)3,9]]},"issued":{"date-parts":[["2023"]]}}],"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"} .

IMPLICATIONS AND AREAS FOR FUTURE RESEARCH

This thesis hopes to contribute to the literature on behavioural health economics, with an emphasis on preferences and perceptions, in particular in relation to the COVID-19 pandemic. In chapter two, we used two novel ways to investigate and potentially reduce preference reversals which impact the comparability (and reliability) of different methods used in (health) economics. If the same respondent prefers higher efficacy of a vaccine over a lower probability of side effects using one method to elicit these preferences but vice versa when these preferences are measured with another method, it remains unclear which vaccines are optimal to use (ceteris paribus). The fact that preferences orderings are not independent of the elicitation method researchers use therefore remains an important area for future research. An important implication of the work presented in chapter two is that preferences appear to be less stable when people have to make decisions in relatively unfamiliar domains. Therefore, good explanations for respondents about what they are asked to evaluate, i.e., increasing their familiarity with the subject, may help to mitigate this effect. On the other hand, biasing the results due to the framing of provided explanations also poses a risk that needs to be addressed. Simplified elicitation procedures such as guided choice lists appear to offer a more stable method of eliciting preferences. Future research may further test the optimal design of such guided choice lists.

Chapter three applied multiple discrepancy theory to identify reference points in evaluating health and wealth, which could be relevant for well-being. Our analysis showed that individuals can use multiple domain-dependent comparisons when evaluating their achievements. The use of particular reference points might impact well-being by changing the way individuals perceive their relative wealth or health status. Our findings highlight the need for a more nuanced approach in investigating the determinants of subjective well-being, one that considers the role of (different) reference points in evaluating individuals' perceptions of their achievements. By doing so, we may gather a more comprehensive understanding of the factors that contribute to well-being, which can support the development of interventions aimed at improving it. As discussed in the previous section, it is important to note that our findings are limited to the population from which the data was collected and the specific contexts in which the study was conducted. To advance our understanding of the impact of reference points on well-being, it would be beneficial to investigate the generalizability of our findings in diverse cultural and geographic contexts. Specifically, future research could examine whether the identified domain-dependent comparisons are consistent across non-Western cultures and countries. In addition, exploring interventions designed to alter reference points and their impact on well-being could further expand our knowledge of this area. Such research could inform the development of targeted policy measures aimed at improving well-being through influencing reference points. In a general sense, a better understanding of the formation of reference points and the stability of reference points, remains needed.

The COVID-19 pandemic raised many (research) questions, some of which were addressed in part II of this thesis. Chapter four analysed perceptions in the general public regarding non-pharmaceutical containment policies, while chapter five analysed the link between altruism and the adherence to protective behaviours. The findings in these chapters and the literature suggest that consistent communication (Fitzpatrick et al., 2021) and targeted messaging (Blais et al., 2021) may be helpful in improving the support of containment measures and adherence to them. Furthermore, appealing to pro-social motivations by highlighting the benefit of preventative behaviours to vulnerable others may be helpful in increasing adherence to measures such as mask-wearing or vaccinations. Gaining a better understanding of the factors and characteristics that influence adherence to containment policies and preventative measures allows for more targeted communication policies and tests of their effectiveness.

Chapters six and seven focussed on vaccinations against COVID-19, reporting the willingness to be vaccinated against COVID-19 in April 2020 in chapter six and the willingness to pay for faster access to a vaccine in January 2021 in chapter seven. As pointed out in chapter six, it was not sufficient to have a vaccine, but policymakers were also required to address concerns regarding the safety and side effects of these new vaccines to convince the population to get vaccinated. While concepts like the 5C psychological antecedents of vaccination (Betsch et al., 2018) offer some insights into the causes of vaccination hesitancy, it is still not fully clear what drove the variation in the willingness to be vaccinated in Europe throughout the pandemic. Concepts such as health literacy (Berkman et al., 2011) or the Threatening Medical Situations Inventory (van Zuuren et al., 1996) may help to identify ways of understanding and convincing those who still are unvaccinated. Other evidence shows that addressing people with specific personality traits differently (Hughes & Machan, 2021) may be helpful in convincing some of those who are hesitant or unwilling to be vaccinated. On a methodological level, more gradual scales than the three-point answer used in chapter six, for example, a scale from 0-100 asking about the likelihood of getting vaccinated, could be informative for researchers and policymakers. This would allow for a more nuanced view than clear-cut yes/not sure/no categories.

Chapter seven investigated the willingness to pay for faster access to COVID-19 vaccines in January 2021. Our results imply that the prices European countries paid to pharmaceutical companies were below the willingness to pay elicited from our sample (Dyer, 2021). This implies, on the one hand, that the price negotiations were in line with the preferences of the population. The results furthermore suggest that respondents who had already been infected with COVID-19 were willing to pay more for access to a vaccination, which may seem counterintuitive since they already had some degree of protection through their previous infection. This finding may suggest that a health information shock could influence the WTP estimates, highlighting a relevant area for future research. If health information shocks influence WTP results, timing of the WTP question relative to the

health information shock may influence results. In a general sense, more research into the reliability, sensitivity, and stability of WTP estimates and better methods to derive WTP, remains relevant and required. The relation between stated and revealed WTP is also important here.

Asking the public what they would be willing to pay for faster access to particular health services may be informative for policymakers. It allows them to identify areas of high need or value, such as access to psychotherapy or paediatricians, which may inform decisions to allocate public resources to particular services. When informing policy, WTP estimates need to be accurate and reliable, but also distributional aspects deserve attention (as WTP typically increases with income).

CONCLUDING REMARKS

Humans tend to behave in ways that surprise others, researchers and maybe even themselves later on. The psychologist Dan Ariely states in his blog, *"Even the most analytical thinkers are predictably irrational; the really smart ones acknowledge and address their irrationalities."* (Ariely, 2009). He goes on to explain that sophisticated decision-makers understand their flaws in judgement or reasoning failures and build mechanisms to cope with them. This thesis provides an analysis of preferences and perceptions, also in the context of reasoning failures. Through the examination of various research chapters, it illustrates the influence of behavioural factors on decision-making and perceptions. The research findings presented in this thesis recommend specific communication strategies for policymakers to address reasoning failures and to establish mechanisms that enable individuals to overcome them. Despite the progress made in the past five years, there is still much to do and many important research questions to address.

I will conclude with a few personal words. Since I was a student there, I have always liked the London School of Economics motto, *"Rerum cognoscere causas"* – to understand the causes of things. The full quotation from the poet Virgil reads, *"Felix qui potuit rerum cognoscere causas"* (Donnelly, 2017) – fortunate is who was able to understand the causes of things. I was very fortunate that my position as a PhD student gave me the time and the freedom to investigate the causes of things I was interested in, allowing me to come closer to understanding them.

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APPENDICES

Summary

Nederlandse Samenvatting

Deutsche Zusammenfassung

PhD portfolio

List of publications

Acknowledgements

About the author

SUMMARY

The discipline of health economics is broadly concerned with the efficient and equitable allocation of resources in the health(care) system. It investigates how the (health) benefits from the given resources can be maximised and how a fair distribution of the benefits can be ensured. The specialisation of behavioural health economics complements the field by combining insights from economics and psychology, applied to the field of healthcare. This thesis consists of studies in behavioural health economics which examine the effects of preferences and perceptions on decision-making. It argues that humans are prone to reasoning failures, which can lead to non-optimal outcomes in health-related decisions.

Rising healthcare costs require decision-makers to allocate funds according to the preferences of the population that funds the healthcare system. Especially new and often expensive treatment options require policymakers to make decisions on what to cover, given that maintaining the affordability of healthcare systems is also an important goal. Health economic evaluations are used to inform such funding decisions. However, some of the elements in economic evaluations depend on the assumption that individuals are rational decision-makers that maximise their utility. These assumptions are problematic as they probably do not hold when eliciting health state preferences in a general population sample. **Part I** of this thesis is concerned with this issue and aims to contribute to **deepening the knowledge in Behavioural Health Economics** by reporting on improvements to measure preferences and investigating the effect of reference points on well-being.

To elicit the preferences of people, researchers use a variety of methods, which in theory should all yield the same order of preferences, e.g., preferring one health state over the other, all else being equal. The phenomenon of preference reversals describes a situation where different methods yield different preference orderings. **Chapter two** of this thesis used an experiment to investigate if a simplified preference elicitation procedure and/or domain relevant training as a medical or economics student could reduce the amount of preference reversals in familiar and unfamiliar domains. Respondents showed fewer reversals in their own area of expertise than in an unfamiliar domain and a simplified procedure of eliciting preferences using guided choice lists led to fewer reversals overall. Nevertheless, preference reversals remain an important problem across domains and procedures and improving consistency of preference measurement remains an important challenge.

Individuals appear to rely on references points against which they evaluate their wealth, wellbeing, or health. While many empirical studies highlight the relevance of reference points for decision-making, there is still no comprehensive theory of how reference points are formed, or which reference points are used to evaluate outcomes. **Chapter three** contributed to filling this gap in the literature by analysing which reference points people

use in evaluating their wellbeing, and whether these reference points and their influence differ per domain. The study showed that individuals have multiple domain-specific reference points against which they compare their achievements, and that well-being is negatively affected if they fall short of these reference points.

Reasoning failures can also lead to suboptimal health choices and outcomes, such as not vaccinating against COVID-19. This can have severe health consequences, especially for vulnerable groups in society. While some individuals may opt to not live (completely) healthily because it aligns with their preferences, others may have a general preference or the intention to make healthy choices. Still, they may fail to do so or to follow through on healthy choices, for instance because of a lack of self-control or reasoning failures. During the COVID-19 pandemic, European countries experienced excess mortality, meaning a larger number of deaths than expected under normal conditions. Governments in Europe and around the world used non-pharmaceutical containment policies such as restrictions of movement, mask mandates, and later on vaccinations to reduce the spread and mortality of COVID-19. **Part II** of this thesis focuses on **analysing decision-making during the COVID-19 pandemic**, based on results from the European COVID Survey (ECOS).

Understanding the public support for containment policies proved critical to the adherence to measures and their chances of success. **Chapter four** reports on the public sentiment toward the first major containment policies implemented in EU countries in April 2020. The results showed that Europeans largely supported the policies to contain the spread of the COVID-19 pandemic at that time. Chapter four furthermore analysed respondents' worries about various aspects of the pandemic, highlighting that many were concerned that the pandemic might overwhelm their national healthcare systems. **Chapter five** investigated another essential factor that contributed to the compliance with containment policies. Analysis of the ECOS data revealed that altruistic individuals were more likely to engage in behaviour that mainly benefitted others, such as wearing a mask where it was only recommended. Controlling for several other factors, altruism remained significantly and positively associated with behaviours that can be describe as pro-social.

While governments around the world used containment policies to flatten the curve of infections, they also supported pharmaceutical companies in their efforts to rapidly develop effective vaccines against COVID-19 and get these vaccines approved. The willingness of individuals to be vaccinated against COVID-19 has been a highly debated and researched topic. Chapter six contributed to this discussion and line of research by reporting on the willingness to be vaccinated as early as in April 2020. The results highlighted that most Europeans were willing to be vaccinated, but that there was still a lot of uncertainty with regards to the COVID-19 vaccines, Moreover, chapter six highlighted significant differences across countries and subgroups in the population. This early report emphasized the need for information campaigns that addressed vaccine hesitancy and the

population's concerns, which would be important in the success of vaccination campaigns once the vaccines became available.

Vaccines became available in early 2021, but the supply and vaccination capacity initially were insufficient to vaccinate all those willing to be vaccinated. This sometimes resulted in long waiting times before vaccination could actually take place. **Chapter seven** used a willingness to pay methodology to estimate the value respondents associated with earlier access to the vaccine. The results suggest that a majority of respondents would have been willing to pay for faster access, that the effectiveness of the vaccine was taken into account in the valuation and that respondents who perceived COVID-19 as more severe were willing to pay more.

The research presented in this thesis has several policy implications. The findings from part I illustrate the importance of understanding (and ideally overcoming) preference reversals, also by improving preference elicitation techniques. Furthermore, a better understanding of the (multiple and domain specific) reference points people consider when evaluating outcomes is also needed. It would also be relevant to better understand whether and how (the formation of) reference points could be influenced, which might affect evaluations of wellbeing. Part II of this thesis highlighted that policy makers could employ targeted communication strategies to address reasoning failures and potentially change health behaviours. Finally, eliciting the public's willingness to pay for faster access to particular health services may be informative for policymakers. It could allow them to identify high value interventions and allocate more resources to these services in an equitable way, improving access for everyone.

To briefly recapitulate, the first part of this thesis showed how deviations from conventionally defined rationality may exist in the area of health and welfare and suggested some ways forward. The second part, using insights from behavioural health economics, focussed on preferences and perceptions of people in the context of health decisions related to COVID-19, suggesting their relevance in (expected) health behaviours.

NEDERLANDSE SAMENVATTING

Het vakgebied gezondheidseconomie houdt zich bezig met de efficiënte en rechtvaardige toewijzing van middelen in het gezondheids(zorg)systeem. Het onderzoekt hoe de (gezondheids)baten van de gegeven middelen kunnen worden gemaximaliseerd en hoe een eerlijke verdeling van de baten kan worden gewaarborgd. De specialisatie gedragseconomie vult het vakgebied aan door inzichten uit de economie en de psychologie te combineren, toegepast op de gezondheidszorg. Dit proefschrift bestaat uit studies in de gedragseconomie die de effecten van voorkeuren en percepties op de besluitvorming onderzoeken. Het betoogt dat mensen vatbaar zijn voor redeneerfouten, die kunnen leiden tot niet-optimale uitkomsten in gezondheidsgerelateerde beslissingen.

Door de stijgende kosten van de gezondheidszorg moeten beleidsmakers middelen verdelen op een manier die overeen komt met de voorkeuren van de bevolking die het zorgstelsel financiert. Vooral voor nieuwe en vaak dure behandelingsopties moeten beleidsmakers beslissen wat zij vergoeden, aangezien het behoud van de betaalbaarheid van de gezondheidszorgstelsels ook een belangrijke doelstelling is. Gezondheidseconomische evaluaties worden gebruikt om dergelijke financieringsbesluiten te onderbouwen. Sommige elementen in economische evaluaties berusten echter op de veronderstelling dat individuen rationele besluitvormers zijn die hun nut maximaliseren. Deze veronderstellingen zijn problematisch omdat zij waarschijnlijk niet opgaan bij het meten van gezondheidsvoorkeuren in een steekproef van de algemene bevolking. **Deel I** van deze dissertatie gaat over deze kwestie en beoogt bij te dragen aan de **verdieping van de kennis in Behavioural Health Economics** door verslag uit te brengen over verbeteringen om voorkeuren te meten en het effect van referentiepunten op het welzijn te onderzoeken.

Om de voorkeuren van mensen vast te stellen, gebruiken onderzoekers verschillende methoden, die in theorie allemaal dezelfde volgorde van voorkeuren zouden moeten opleveren, bv. de voorkeur voor de ene gezondheidstoestand boven de andere, wanneer alle andere factoren gelijk blijven. Het fenomeen van de omkering van voorkeuren beschrijft een situatie waarin verschillende methoden verschillende voorkeursvolgordes opleveren. **In hoofdstuk twee** van dit proefschrift werd een experiment uitgevoerd om te onderzoeken of een vereenvoudigde procedure voor het meten van voorkeuren en/of een opleiding als student geneeskunde of economie de hoeveelheid omkeringen van voorkeuren in bekende en onbekende domeinen kon verminderen. Respondenten vertoonden minder omkeringen in hun eigen vakgebied dan in een onbekend domein en een vereenvoudigde procedure voor het meten van voorkeuren met behulp van geleide keuzelijsten leidde tot minder omkeringen in het algemeen. Niettemin blijven omkeringen van voorkeuren een belangrijk probleem voor alle domeinen en procedures en blijft de verbetering van de consistentie van de meting van voorkeuren een belangrijke uitdaging.

Individuen blijken zich te baseren op referentiepunten waaraan zij hun welvaart, welzijn of gezondheid toetsen. Hoewel veel empirische studies de relevantie van referentiepunten voor besluitvorming benadrukken, is er nog steeds geen uitgebreide theorie over hoe referentiepunten worden gevormd, of welke referentiepunten worden gebruikt om uitkomsten te evalueren. **Hoofdstuk drie** droeg bij aan het opvullen van deze lacune in de literatuur door te analyseren welke referentiepunten mensen gebruiken bij het evalueren van hun welzijn, en of deze referentiepunten en hun invloed verschillen per domein. De studie toonde aan dat individuen meerdere domeinspecifieke referentiepunten hebben waarmee ze hun prestaties vergelijken, en dat welzijn negatief wordt beïnvloed wanneer personen deze referentiepunten niet bereiken.

Fouten in de redenering kunnen ook leiden tot suboptimale keuzes en resultaten op gezondheidsgebied, zoals niet vaccineren tegen COVID-19. Dit kan ernstige gevolgen hebben voor de gezondheid, vooral voor kwetsbare groepen in de samenleving. Terwijl sommige individuen ervoor kunnen kiezen niet (volledig) gezond te leven omdat dit in overeenstemming is met hun voorkeuren, kunnen anderen een algemene voorkeur of de intentie hebben om gezonde keuzes te maken. Toch is het mogelijk dat zij dit niet doen of de gezonde keuzes niet doorzetten, bijvoorbeeld door een gebrek aan zelfcontrole of een gebrekkige redenering. Tijdens de COVID-19 pandemie was er in de Europese landen sprake van oversterfte, dat wil zeggen een groter aantal sterfgevallen dan onder normale omstandigheden werd verwacht. Regeringen in Europa en de rest van de wereld maakten gebruik van niet-farmaceutisch inperkingsbeleid, zoals bewegingsbeperkingen, mondmaskerverordeningen en later vaccinaties, om de verspreiding van en sterfte door COVID-19 te beperken. **Deel II** van dit proefschrift is gericht op **de analyse van de besluitvorming tijdens de COVID-19-pandemie**, op basis van de resultaten van de European COVID Survey (ECOS).

Inzicht in de publieke steun voor het inperkingsbeleid bleek cruciaal voor de naleving van de maatregelen en de kans van slagen ervan. In **hoofdstuk vier** beschrijft de publieke opinie ten aanzien van de eerste belangrijke inperkingsmaatregelen die in april 2020 in de EU-landen zijn ingevoerd. Uit de resultaten blijkt dat de Europeanen het beleid om de verspreiding van de COVID-19-pandemie in te dammen op dat moment grotendeels steunden. In hoofdstuk vier werd vervolgens de bezorgdheid van de respondenten over diverse aspecten van de pandemie geanalyseerd, waarbij werd benadrukt dat velen bezorgd waren dat de pandemie hun nationale gezondheidszorgstelsels zou kunnen overweldigen. **Hoofdstuk vijf** onderzocht een andere essentiële factor die bijdroeg tot de naleving van het beheersingsbeleid. Uit analyse van de ECOS-gegevens bleek dat altruïstische personen eerder geneigd waren tot gedrag dat vooral anderen ten goede kwam, zoals het dragen van een mondmasker wanneer dat enkel werd aanbevolen. Gecontroleerd voor verschillende andere factoren, bleef altruïsme significant en positief geassocieerd met gedragingen die als pro-sociaal kunnen worden omschreven.

Terwijl regeringen over de hele wereld een beheersingsbeleid voerden om de besmettingscurve af te vlakken, steunden zij ook farmaceutische bedrijven in hun pogingen om snel doeltreffende vaccins tegen COVID-19 te ontwikkelen en deze vaccins goedgekeurd te krijgen. De bereidheid van personen om zich tegen COVID-19 te laten vaccineren is een zeer veelvuldig besproken en onderzocht onderwerp. **Hoofdstuk zes** droeg bij aan deze discussie en onderzoekslijn door te rapporteren over de bereidheid van individuen om zich al in april 2020 te laten vaccineren. Uit de resultaten bleek dat de meeste Europeanen bereid waren zich te laten vaccineren, maar dat er nog veel onzekerheid bestond over de COVID-19-vaccins, Bovendien bracht hoofdstuk zes aanzienlijke verschillen tussen landen en subgroepen van de bevolking aan het licht. Dit vroege onderzoek benadrukte de noodzaak van voorlichtingscampagnes die de aarzeling over vaccins en de bezorgdheid van de bevolking aanpakken, wat belangrijk zou zijn voor het succes van vaccinatiecampagnes zodra de vaccins beschikbaar waren.

Begin 2021 kwamen er vaccins beschikbaar, maar het aanbod en de vaccinatiecapaciteit waren aanvankelijk ontoereikend om alle mensen die dit wilden te vaccineren. Dit leidde soms tot lange wachttijden voordat de vaccinatie daadwerkelijk kon plaatsvinden. In **hoofdstuk zeven** werd een methode om betalingsbereidheid te meten gebruikt om de waarde te schatten die de respondenten toekenden aan eerdere toegang tot het vaccin. De resultaten wijzen erop dat een meerderheid van de respondenten bereid zou zijn geweest te betalen voor snellere toegang, dat bij de waardering rekening werd gehouden met de doeltreffendheid van het vaccin en dat respondenten die COVID-19 als ernstiger ervoeren, bereid waren meer te betalen.

Het in dit proefschrift gepresenteerde onderzoek heeft verschillende beleidsimplicaties. De bevindingen van deel I illustreren het belang van het begrijpen (en idealiter overwinnen) van voorkeursomkeringen, mede door het verbeteren van technieken om voorkeuren te meten. Verder is een beter begrip nodig van de (meervoudige en domeinspecifieke) referentiepunten die mensen in overweging nemen bij het evalueren van uitkomsten. Het zou ook relevant zijn om beter te begrijpen of en hoe (de vorming van) referentiepunten kan worden beïnvloed, wat van invloed zou kunnen zijn op evaluaties van welzijn. In deel II van dit proefschrift werd benadrukt dat beleidsmakers gerichte communicatiestrategieën zouden kunnen inzetten om redeneerfouten aan te pakken en gezondheidsgedrag mogelijk te veranderen. Ten slotte kan het meten van de bereidheid van het publiek om te betalen voor snellere toegang tot bepaalde gezondheidsdiensten informatief zijn voor beleidsmakers. Het zou hen in staat kunnen stellen om hoogwaardige interventies te identificeren en op een rechtvaardige manier meer middelen aan deze diensten toe te wijzen, waardoor de toegang voor iedereen wordt verbeterd.

Om kort samen te vatten: het eerste deel van deze dissertatie liet zien hoe afwijkingen van conventioneel gedefinieerde rationaliteit kunnen bestaan binnen het gezondheid- en welzijnsdomein en stelde opties ter verbetering voor. Het tweede deel richtte zich,

met gebruikmaking van inzichten uit de gedragseconomie, op voorkeuren en percepties van mensen in de context van gezondheidsbeslissingen rondom COVID-19, waarmee de mogelijke relevantie hiervan voor (verwacht) gezondheidsgedrag werd getoond.

DEUTSCHE ZUSAMMENFASSUNG

Das Fachgebiet der Gesundheitsökonomie befasst sich im Wesentlichen mit der effizienten und gerechten Verteilung der Ressourcen im Gesundheitssystem. Sie untersucht, wie der (gesundheitliche) Nutzen aus den gegebenen Ressourcen maximiert und eine gerechte Verteilung des Nutzens gewährleistet werden kann. Die Spezialisierung der verhaltensorientierten Gesundheitsökonomie ergänzt das Fachgebiet durch die Kombination von Erkenntnissen aus der Ökonomie und der Psychologie, angewandt auf den Bereich der Gesundheitsversorgung. Diese Arbeit besteht aus Studien zur verhaltensorientierten Gesundheitsökonomie, welche die Auswirkungen von Präferenzen und Wahrnehmungen auf die Entscheidungsfindung untersuchen. Es wird argumentiert, dass Menschen zu Denkfehlern neigen, die zu sub-optimalen Ergebnissen bei gesundheitsbezogenen Entscheidungen führen können.

Steigende Gesundheitskosten machen es erforderlich, dass die Entscheidungsträger:innen die vorhandenen Gelder entsprechend den Präferenzen der Bevölkerung, die das Gesundheitssystem finanziert, verteilen. Insbesondere bei neuen und oft teuren Behandlungsoptionen müssen die Entscheidungsträger:innen entscheiden, welche Kosten übernommen werden sollen, da die Bezahlbarkeit der Gesundheitssysteme ebenfalls ein wichtiges Ziel darstellt. Gesundheitsökonomische Bewertungen werden häufig als Grundlage für solche Finanzierungsentscheidungen herangezogen. Einige Elemente der ökonomischen Bewertungen beruhen jedoch auf der Annahme, dass Individuen rationale Entscheider:innen sind, die ihren Nutzen maximieren. Diese Annahmen sind problematisch, da sie wahrscheinlich nicht zutreffen, wenn man die Präferenzen für den Gesundheitszustand in einer allgemeinen Bevölkerungsstichprobe erhebt. **Teil I dieser** Arbeit befasst sich mit dieser Problematik und soll zur **Vertiefung des Wissens im Bereich der verhaltensorientierten Gesundheitsökonomie** beitragen, indem dieser Teil Verbesserungen bei der Messung von Präferenzen und die Auswirkungen von Referenzpunkten auf das Wohlbefinden untersucht.

Um die Präferenzen der Menschen zu ermitteln, verwenden Forscher eine Vielzahl von Methoden, die theoretisch alle die gleiche Reihenfolge der Präferenzen ergeben sollten, z. B. die Bevorzugung eines Gesundheitszustands gegenüber einem anderen, wenn alles andere gleichbleibt. Das Phänomen der Präferenzumkehrung beschreibt eine Situation, in der verschiedene Methoden zu unterschiedlichen Präferenzordnungen führen. In **Kapitel zwei** dieser Arbeit wurde anhand eines Experiments untersucht, ob ein vereinfachtes Verfahren zur Präferenzerhebung und/oder domänenspezifisches Wissen durch eine Ausbildung als Medizin- oder Ökonomiestudent die Anzahl der Präferenzumkehrungen in vertrauten und unbekannten Domänen verringern kann. Die Befragten zeigten in ihrem eigenen Fachgebiet weniger Umkehrungen als in einem unbekannten Gebiet, und ein vereinfachtes Verfahren der Präferenzerhebung mit geführten Auswahllisten führte insgesamt zu weniger Umkehrungen. Dennoch bleiben Präferenzumkehrungen in allen

Bereichen und Verfahren ein großes Problem, und die Verbesserung der Konsistenz der Präferenzmessung bleibt eine wichtige Herausforderung.

Menschen scheinen sich auf Referenzpunkte zu verlassen, anhand derer sie ihren Wohlstand, ihr Wohlbefinden oder ihre Gesundheit bewerten bzw. in Relation setzen. Während viele empirische Studien die Bedeutung von Referenzpunkten für die Entscheidungsfindung hervorheben, gibt es immer noch keine umfassende Theorie darüber, wie Referenzpunkte gebildet werden oder welche Referenzpunkte von Menschen verwendet werden. **Kapitel drei** trug dazu bei, diese Lücke in der Literatur zu schließen, indem es analysierte, welche Referenzpunkte Menschen bei der Bewertung ihres Wohlbefindens verwenden und ob sich diese Referenzpunkte und ihr Einfluss in verschiedenen Domänen (hier Einkommen und Gesundheit) unterscheiden. Die Studie zeigte, dass Personen mehrere bereichsspezifische Referenzpunkte haben, mit denen sie ihre Leistungen vergleichen, und dass das negativer Einfluss auf das Wohlbefinden zu beobachten ist, wenn sie diese Referenzpunkte nicht erreicht werden.

Denkfehler können auch zu suboptimalen Gesundheitsentscheidungen und -ergebnissen führen, z. B. zur Nichtimpfung gegen COVID-19. Dies kann schwerwiegende gesundheitliche Folgen haben, insbesondere für gefährdete Gruppen in der Gesellschaft. Während sich manche Menschen dafür entscheiden, nicht (stets) gesund zu leben, weil es ihren Präferenzen entspricht, haben andere möglicherweise eine Präferenz oder die Absicht, gesunde Entscheidungen zu treffen. Dennoch kann es sein, dass sie nicht in der Lage sind diese Präferenzen umzusetzen oder durchzuhalten, z. B. wegen mangelnder Selbstkontrolle oder Denkfehlern. Während der COVID-19-Pandemie kam es in den europäischen Ländern zu einer Übersterblichkeit, d. h. zu einer höheren Zahl von Todesfällen als unter normalen Bedingungen zu erwarten wäre. Die Regierungen in Europa und auf der ganzen Welt nutzten nicht-pharmazeutische Eindämmungsmaßnahmen wie Ausgangsbeschränkungen und eine Maskenpflicht und später Impfungen, um die Ausbreitung und Sterblichkeit von COVID-19 zu verringern. **Teil II** dieser Arbeit konzentriert sich auf die **Analyse der Entscheidungsfindung während der COVID-19-Pandemie**, basierend auf den Ergebnissen der Europäischen COVID-Erhebung (ECOS).

Das Verständnis der öffentlichen Unterstützung für Eindämmungsmaßnahmen erwies sich als entscheidend für die Einhaltung der Maßnahmen und ihre Erfolgschancen. **Kapitel vier** berichtet über die öffentliche Meinung zu den ersten großen Eindämmungsmaßnahmen, die im April 2020 in den EU-Ländern umgesetzt wurden. Die Ergebnisse zeigen, dass die Europäer die Maßnahmen zur Eindämmung der Ausbreitung der COVID-19-Pandemie zu diesem Zeitpunkt weitgehend unterstützten. In Kapitel vier wurden darüber hinaus die Sorgen der Befragten über verschiedene Aspekte der Pandemie analysiert, wobei sich herausstellte, dass viele befürchteten, die Pandemie könnte ihre nationalen Gesundheitssysteme überfordern. In **Kapitel fünf** wurde ein weiterer wesentlicher Faktor untersucht, der zur Einhaltung der Eindämmungsmaßnahmen beitrug. Die Analyse der

ECOS-Daten ergab, dass altruistische Personen eher ein Verhalten an den Tag legten, das hauptsächlich anderen zugutekam, wie z. B. das Tragen einer Maske, wenn dies nur empfohlen wurde. Unter Beachtung mehrerer anderer Faktoren blieb Altruismus signifikant und positiv mit Verhaltensweisen verbunden, die als pro-sozial beschrieben werden können.

Während Regierungen auf der ganzen Welt Maßnahmen zur Eindämmung des Virus ergriffen, um die Infektionskurve abzuflachen, unterstützten sie auch Pharmaunternehmen in ihren Bemühungen, rasch wirksame Impfstoffe gegen COVID-19 zu entwickeln und diese Impfstoffe zuzulassen. Die Bereitschaft der Menschen, sich gegen COVID-19 impfen zu lassen, ist ein viel diskutiertes und erforschtes Thema. **Kapitel sechs** trug zu dieser Diskussion und Forschungsrichtung bei, indem es über die Bereitschaft berichtete, sich bereits im April 2020 impfen zu lassen. Die Ergebnisse zeigten, dass die meisten Europäer bereit waren, sich impfen zu lassen. Jedoch gab es noch große Unsicherheit in der Bevölkerung in Bezug auf die COVID-19-Impfstoffe. Kapitel sechs fand auch erhebliche Unterschiede in der Impfbereitschaft zwischen den betrachteten Ländern sowie innerhalb der Bevölkerung der jeweiligen Länder. Diese frühe Analyse unterstrich die Notwendigkeit von Informationskampagnen, die sich mit Impfzurückhaltung und den Bedenken der Bevölkerung befassen sollten, da wurde vermutet, dass dies zum Erfolg der Impfkampagnen beitragen würde.

Anfang 2021 wurden die Impfstoffe verfügbar, aber das Angebot und die Impfkapazität reichten zunächst nicht aus, um alle Impfwilligen zu versorgen. Dies führte mitunter zu langen Wartezeiten, bevor die Impfung tatsächlich stattfinden konnte. In **Kapitel sieben** wurde der Wert, den die Befragten mit einem früheren Zugang zu dem Impfstoff verbinden, mit Hilfe einer Zahlungsbereitschaftsmethode untersucht. Die Ergebnisse deuten darauf hin, dass die Mehrheit der Befragten bereit gewesen wäre, für einen schnelleren Zugang zum Impfstoff eigenes Geld aufzuwenden, dass die Wirksamkeit des Impfstoffs bei der Bewertung berücksichtigt wurde und dass die Befragten, die COVID-19 als schwerwiegender empfanden, bereit waren, mehr zu zahlen.

Die in dieser Arbeit vorgestellten Forschungsergebnisse haben mehrere Implikationen für Entscheidungsträger:innen. Die Ergebnisse aus Teil I zeigen, wie wichtig es ist, Präferenzumkehrungen zu verstehen (und idealerweise zu überwinden), auch durch die Verbesserung von Techniken zur Präferenzerhebung. Darüber hinaus ist ein besseres Verständnis der (vielfältigen und bereichsspezifischen) Referenzpunkte erforderlich, die Menschen bei der Evaluation von Ergebnissen (z.B. des eigenen Vermögens oder der Gesundheit) nutzen. Ebenfalls wäre es wichtig, besser zu verstehen, ob und wie (die Formation von) Bezugspunkten beeinflusst werden kann, da sich dies auf die Bewertung des Wohlbefindens auswirken könnte. In Teil II dieser Arbeit wurde hervorgehoben, dass politische Entscheidungsträger:innen gezielte Kommunikationsstrategien einsetzen könnten, um Denkfehler anzusprechen und möglicherweise das Gesundheitsverhalten zu

ändern. Schließlich kann es für die politischen Entscheidungsträger:innen aufschlussreich sein, die hypothetische Bereitschaft der Öffentlichkeit zu ermitteln, für einen schnelleren Zugang zu bestimmten Gesundheitsleistungen zu bezahlen. Dies könnte es ihnen ermöglichen, Behandlungen oder Innovationen zu identifizieren die als besonders relevant angesehen werden. Für diese Interventionen könnten dann mehr öffentliche Ressourcen aufgewandt werden, um einen verbesserten Zugang für alle zu erreichen.

Um es kurz zusammenzufassen: Im ersten Teil dieser Arbeit wurde aufgezeigt, das Abweichungen von der konventionell definierten Rationalität im Bereich Gesundheit und Wohlfahrt bestehen können, und es wurden einige Lösungsansätze vorgeschlagen hiermit umzugehen. Der zweite Teil, nutze Erkenntnisse der verhaltensorientierten Gesundheitsökonomie. Die Untersuchung konzentrierte sich auf die Präferenzen und Wahrnehmungen der Menschen so wie ihren Gesundheitsentscheidungen im Zusammenhang mit COVID-19 und zeigte deren Relevanz für das (erwartete) Gesundheitsverhalten auf.

PHD PORTFOLIO

PhD Candidate	Sebastian Neumann-Böhme
Promotor	Werner B.F. Brouwer
Co-promotor	Arthur E. Attema
PhD Period	October 2017-March 2023

Training activities	Year	ECTS
European Training Network courses		
Microeconomics I + II	2017	10
Micro econometrics	2017	5
Writing skills & intellectual property rights & research integrity	2017	
Project management & time- and self-management skills	2017	
Epidemiology and Economics	2017	5
STATA	2018	5
Panel Data	2018	5
Experimental design	2018	5
Survey design and effectiveness research	2018	5
Economic evaluation and quality of care	2018	5
Measuring quality of care using administrative data	2018	5
Defining and measuring patient satisfaction	2018	5
Risk adjustment methods for quality of care outcomes with administrative data	2018	5
Communication and presentation skills	2018	
Funding opportunities & drafting a research proposal	2019	
Leadership- and Team building training	2019	
Interpersonal and networking skills	2019	
Introduction into international health care systems analysis	2019	5
Inequality in health and health care	2019	5
Further courses & workshops		
Behavioural Experiments in Health Network Summer School	2018	
English academic writing for PhD candidates	2018	
Behavioural Experiments in Health Network Summer School	2019	
PRINCE2 (project management) foundation certificate	2020	
PRINCE2 practitioner certificate	2020	
Media and communication training	2022	
Learn2Lead (training for personnel management)	2023	

Teaching activities	Year(s)
Lectures & Practicals	
- Business Administration in the Health Sector (3 Lectures) - HAW Hamburg	2017 - 2023
- Advanced Economic Evaluation (3 Lectures) - EUR	2019 - 2021
- Minor Understanding Health Behaviour (2 Lectures) – EUR	2019 - 2021
- Introduction to Health Care Management (4 Lectures) – Uni Hamburg	2021 - 2023
- Bachelor & Master Seminars and term paper supervision – Uni Hamburg	2021 - 2023
Supervision	
- Bachelor Thesis – EUR (2/2 graduated)	2019
- Bachelor Thesis – HAW Hamburg (2/2 graduated)	2021 - 2022
- Master Thesis – Uni Hamburg (4/4 graduated)	2021 - 2023
Conferences & Seminars	
- EuHEA (Maastricht) – Poster	2018
- Lowlands Health Economic Study Group conference (Hoenderloo) - Presentation	2018
- iHEA (Basel) – 2 Presentations	2019
- EuHEA PhD Conference (Porto) - Presentation	2019
- German Association for Health Economics conference (Augsburg) - Presentation	2019
- Health Economic Research Unit Seminar Series (Aberdeen) – Invited talk	2019
- EuHEA (Oslo – online) - Presentation	2020
- Mercator Roundtable for Policy makers – Speaker	2020
- German Association for Health Economics conference (Hamburg) - Presentation	2022
- German Association for Health Economics conference (Hannover) - Presentation	2023
Other activities	
- Reviewer for *Behavioural Public Policy* (1)	2020
- Reviewer for *BMJ Open* (1)	2021
- Reviewer for *Health policy* (1)	2021
- Reviewer for *PLOS ONE* (1)	2021
- Reviewer for *The European Journal of Health Economics* (1)	2022
- Reviewer for *Journal of Economic Behavior and Organization* (1)	2022
- Reviewer for *the Economic Journal* (1)	2022
Media communication	
- TV Interview in ARD Tagesthemen (Germany)	2021
- TV Interview RTL Nord (Germany)	2021
- Podcast Interview Apothekenumschau (Germany)	2021
- Radio Interview MDR Wissen (Germany)	2021
- Radio Interview NDR Hamburg (Germany)	2021
- Podcast Interview DetektorFM	2021

LIST OF PUBLICATIONS

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Neumann-Böhme, S., Varghese, N. E., Sabat, I., Barros, P. P., Brouwer, W., van Exel, J., Schreyögg, J., Stargardt, T. (2020). Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. *The European Journal of Health Economics, 21*, 977-982.

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Neumann-Böhme, S., Sabat, I., & Attema, A. E. (2022). Altruism and the Link to Pro-social Pandemic Behavior. *Frontiers in Health Services*, *2*, 43.

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Chandler, T., Neumann-Böhme, S., Sabat, I., Barros, P. P., Brouwer, W., van Exel, J., ... & Stargardt, T. (2021). Blood donation in times of crisis: early insight into the impact of COVID-19 on blood donors and their motivation to donate across European countries. *Vox Sanguinis*, *116*(10), 1031-1041.

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ABOUT THE AUTHOR

Sebastian Neumann-Böhme was born in Dortmund, Germany in 1986. After completing an apprenticeship at an insurance company in 2008, he studied Socioeconomics at the University of Hamburg. He received his bachelor's degree in 2013, after returning from a year abroad at Temple University in Philadelphia in the United States. He specialised in health economics receiving a master's degree in International Health Policy & Health Economics from the London School of Economics and Political Science in 2015 and a master's degree from the University of Hamburg in Health Economics and Health Care Management in 2016. Afterwards he worked for the consultancy and accounting firm KPMG in the health care and public sector advisory team.

In 2017, Sebastian successfully applied for a Marie Skłodowska Curie PhD fellowship awarded by the European Commission under the Horizon 2020 programme. The fellowship was part of a European training network (ETN) entitled "Improving Quality of Care in Europe (IQCE)" and funded his position as PhD candidate at the Erasmus School of Health Policy & Management in Rotterdam. During the ETN Sebastian completed academic secondments at the Centre for Health Economics at the University of York in 2019 and at the Hamburg Center for Health Economics in 2020. The PhD trajectory of the European training network consisted of a course oriented first 1,5 years (see PhD portfolio) with a research focus in the remainder. Together with other PhD candidates and supervisors from the ETN, Sebastian started the European Covid Survey (ECOS) in April 2020, resulting in a European research collaboration addressing the COVID-19 pandemic.

After his time at the Erasmus School of Health Policy and Management, Sebastian joined the Hamburg Center of Health Economics at the University of Hamburg in 2021.