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RESEARCH ARTICLE

Decisions involving health and economic losses during the COVID-19 pandemic

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ABSTRACT

We investigated choices between the sacred values and other quantities. Such decisions may be impossible to avoid during a pandemic. And then we studied perception of the COVID-19 pandemic and psychological mechanism behind such choices. Perception of the pandemic was investigated in the first part of this study in which 330 respondents from Prolific Academic evaluated the negative health consequences of being sick with COVID-19, the related fear and perceived risk. Evaluations were made for both themselves and people of different ages from a general population. Participants also evaluated the effectiveness of the spring lockdown in 2020 and answered questions concerning false beliefs about the pandemic. In the second part of this study we tested to what extent acceptance of economic costs of a lockdown is explained by decisions based on: (1) tradeoffs between health and economic losses; (2) a single criterion - either health or economic losses; and (3) the mechanisms described by Terror Management Health Model. Participants declared acceptance of economic costs of possible lockdown for different levels (ranging from low to high) of three pandemic indices: daily new cases, daily new deaths and the basic reproduction number of infection. Acceptance of economic costs increases when the perceived effectiveness of the earlier lockdown is high, when elderly people are perceived as threatened and when subjects do not hold false beliefs about the pandemic. A majority of respondents (57%) was sensitive to the level of health loss: the higher health losses, the higher economic costs were accepted. These respondents used a compensatory strategy to balance health and economic losses. The others reacted in a way consistent with a single criterion strategy – *ca* 20% accepted no economic costs and *ca* 15% accepted any economic costs to fight pandemic, independently of the level of health losses and the way in which they were described.

Keywords: COVID-19, tradeoffs between economic and health losses, lexicographic models, Terror Management Health Model.

INTRODUCTION

We investigated decisions in which choices have to be made between options that have conflicting negative outcomes. A good example is the valuation sacred values against other quantities, e.g. safety *vs.* costs of safety programs, health *vs.* costs of pollution control, effectiveness of various medical treatment *vs.* their costs. Such decisions are hard to make but they may be impossible to avoid in the real world, especially during the pandemic. The COVID-19 pandemic have made people to choose between economic and health values. One choice was to control the pandemic with lockdown - at a high economic cost. This choice initially enjoyed social support in most European countries and in the U.S., but this support has gradually waned over time. The first lockdowns only mitigated the spread of the coronavirus for a short period and at considerable economic costs. Lifting restrictions in late spring led to the second outbreak in the fall 2020. In light of these facts, we asked the question: how can one explain the initial support followed by the subsequent wave of social protests against the lockdowns? To answer this question, we carried out our study at the end of October 2020 when the second outbreak was very prominent. We tested to what extent the following mechanisms accounted for the willingness to accept economic costs of a possible second lockdown: (1) decisions based on tradeoffs between health and economic costs; (2) decisions based on a single criterion - minimizing either perceived health or economic costs (*LEX* strategies), and (3) the Terror Management Health Model (*TMHM*). The answer to this question is important not only in the context of the pandemic but in any situation in which choices have to be made between conflicting negative outcomes such as Public Health policy decisions, choices among medical diagnostic tests and treatments, etc. For example, many countries with socialized medicine face serious problems related to higher longevity and increasing costs of medical treatments as well as to effectiveness and costs of various medical procedures.

1. SENSITIVITY TO THE LEVEL OF HEALTH LOSS IN DECISIONS INVOLVING HEALTH AND ECONOMIC LOSSES

1.1. Compensatory models of decision making

In compensatory models, different attributes of the considered alternatives are traded off against each other. Even though compensatory strategies are common in the decision-making framework, two fundamental assumptions made in these models raise doubts whether they are applicable in the context of a pandemic. First, it is assumed that a poor score on one criterion can be compensated with high scores on other criteria, e.g., increased economic costs can be compensated by reduced morbidity/mortality rates. In reality, choices between conflicting criteria are difficult to make. In the case of COVID-19, the tradeoffs are between economic costs and health losses - including death. This may be the most extreme example of a situation with conflicting criteria: people have to tradeoff sacred values[1] such as human life against other values, e.g. money. The valuation of sacred values against other quantities is often considered either taboo[2–5] or a repugnant transaction[6]. We tested to what extent people were willing to tradeoff health losses against an increase in unemployment - the most salient economic cost of lockdown, and against a decrease in GDP - the most general measure of economic costs. Respondents declared the amount of

economic cost they would be willing to accept to limit the spread of the pandemic for three levels of the health loss. In accordance with compensatory models, one would expect that the greater the health losses, the higher the accepted economic costs.

The second issue with compensatory models is related to the assumption made about the multiplicative integration of outcomes and probabilities. This means that a low-utility, high-probability option may be as attractive or unattractive as a high-utility, low-probability option. This claim has been challenged on the basis of research into people's choices between options with affect-rich outcomes, e.g. the side effects of medical treatment[7,8]. Differences between decisions with affect-rich and affect-poor outcomes could be explained by probability neglect in the former case. Thus, probabilities are neglected in decisions with affect-rich outcomes, such as choices between conflicting health and economic costs during the pandemic. For this reason, we did not introduce probabilities into the decision-making problems presented to respondents and varied only the level of health loss.

1.2. Lexicographic models

Plausible alternatives to compensatory strategies for preferences among options with conflicting attributes, when there is no dominant options, are non-compensatory models (*LEX*)[9], such as lexicographic models. In accordance with these models, conflict is solved by choosing the option superior on the most important attribute. Such strategies allow avoiding conflict[10] and justify choices[11]. One lexicographic model that may be used in situations with two conflicting losses, such as the pandemic, is the lexicographic rule to minimize the most important loss. The relative importance of attributes may stem either from ranges in attributes values (local relative importance[12] or reflect perception of some attributes as always more important (e.g. safety more important than costs[13], health more important than costs of pollution control[14]; saved lives *vs.* the cost of safety program[11]). In the second case, importance reflects the generalized notion of relative importance[12,14].

In accordance with *LEX* strategies, one would expect respondents to minimize the most important loss and then the lack of sensitivity to level of loss. To check this we asked respondents to declare acceptance of economic costs for three different levels of health losses.

1.3. Choices between economic costs and low/medium/high levels of health losses

We introduced two different indices of economic costs: unemployment – the index most pronounced by the mass media and a decrease in GDP – the most general index of economic costs. This was done to determine whether mechanisms behind choices are the same in both cases.

In accordance with compensatory models, one would expect that the greater the health losses, the higher the accepted economic costs. This relation distinguishes compensatory from non-compensatory strategies. The latter, based on a single criterion to minimize the most important loss are not sensitive to values on other dimensions. In accordance with *LEX* strategies, one would expect the lack of sensitivity to level of loss.

In October 2020, both economic losses caused by the spring lockdown and rapidly increasing health losses were very salient. Therefore, one

might expect differences in relative importance of both losses among participants – some would minimize the health loss and others the economic costs.

2. SENSITIVITY TO THE LEVEL OF HEALTH LOSS DESCRIBED BY VARIOUS INDICES OF THE PANDEMIC

2.1. Various indices of the pandemic and the relative importance of attributes

In late October 2020 when health losses were substantial, we expected respondents to minimize health losses and accept economic costs of a possible lockdown. If so, it was interesting to check whether this reflects the generalized or local relative importance. In accordance with the notion of generalized relative importance some attributes are always more important, e.g. saved lives in comparison to the economic cost of a possible lockdown. Local relative importance may stem either from ranges in attribute values or from the fact that some attributes are proxy attributes. To check this, three indices of health loss were used: daily new deaths because of COVID-19, daily new cases of COVID-19 disease, and the basic reproduction index *R*. The first index can be treated as a direct attribute and the others as proxy attributes in a description of health losses. Some authors found that proxy attributes are overweighed,[14] and then people should be more prone to minimize health losses described by such attributes. In accordance with the relative importance that stem from the ranges in attribute values[12], the morbidity rate has the highest range followed by the mortality rate. Summing up, if health losses are always more important than economic costs (generalized relative importance), people should minimize health losses to the same extent independently of the indices that describe such losses. If proxy attributes and attributes with high ranges in values are overweighted (local relative importance), people should be most willing to minimize health losses described by daily new cases of COVID-19.

2.2. Various indices of the pandemic in light of Terror Management Health Model

One can also consider these three indices in the context of direct and indirect death remainders in Terror Management Theory (*TMT*[15–17]). *TMT* describes mechanisms protecting against existential terror prompted by the prospect of death. Two protective mechanisms are proposed: (1) proximal defenses aimed at removing thoughts about death from focal awareness but resulting in subconscious death-thoughts and (2) distal defenses aimed to bolster our faith in a cultural worldview and our self-esteem to suppress subconscious thoughts of death. Direct reminders of death first activate proximal defenses and then - when conscious death-thoughts are already suppressed - distal defenses. Indirect death remainders activate distal defenses.

Courtney, Goldenberg, and Boyd have extended[18] *TMT* to account for behavior during the pandemic and proposed the Terror Management Health Model (*TMHM*,[18,19]). In light of *TMHM* a daily deaths can be treated as a direct death reminder and then this activate conscious death thoughts that leads to two kinds of proximal defenses: (1) Thread-Avoidance i.e., denying susceptibility to disease and suppressing its deadliness, and (2) Health-Oriented behavior such as hand washing, mask-wearing and maintaining social distancing. Support for a lockdown could also be included into Health-Oriented behavior and then the information

about daily new cases of death may motivate people more strongly to support a possible lockdown than indirect information such as daily new cases of COVID-19. We investigated this possibility by confronting participants with these two indices of pandemic development.

We also control the first proximal defense Thread-Avoidance by measuring perception of personal negative health consequences of COVID-19 disease and perceived personal risk. One might expect that those who deny a danger would not accept preventative measures. We also propose extending *TMHM* by introducing false beliefs about COVID-19 that question its existence. False beliefs could be included in Thread-Avoidance proximal defense. Miller[20] argues that, in the U.S., a common public reaction to the pandemic is characterized by anti-mask behavior, and by conspiracy theories about the coronavirus' origin and the 'true target' of vaccination. We measured false beliefs and expected that people holding these beliefs would be less inclined to accept the economic costs of second lockdown.

Courtney, Goldenberg, and Boyd claim[18] that when concerns of death are suppresed, non-conscious death-thought activates distal defenses related to cultural worldviews and self-esteem. This leads either to (1) Health-Defeating behavior, such as violations of preventative measures and defending other values important to one's cultural worldviews (e.g., economic, personal freedom) or to (2) Health-Facilitating behavior motivated by a need to maintain a personal value (e.g., self-esteem) by adherence to demands imposed on the person by her cultural worldview (e.g., the demand of social responsibility). The second proposition was tested here. To do this, we used the *R*-index to describe health losses. This information is an indirect death-reminder that describes the spread of the coronavirus in social terms, thus appealing to social responsibility. In this study *R*-index was intentionally described such as it appealed to social responsibility of respondents: the message contained information how many other people would be infected by her and how many other people would die if infected by her. We expected that those presented with *R*-index would minimize health losses and accept the economic costs of lockdown more willingly than those presented with information about daily new cases of disease.

This relation in our opinion may be affected by factors reflecting Thread -Avoidance, i.e. denying susceptibility to disease and suppressing its deadliness. When denial of danger affects only evaluations referring to oneself whilst assessments concerning others remain realistic, this relation should hold. Therefore, we measured perception of severity of negative health consequences and perceived risk of COVID-19 disease for oneself, for people close to a respondent and for people from general population. We expected that when only evaluations referred to self are affected and evaluations for others are not, people would comply with preventative measures and accept their economic costs, in particular when health loses are described by *R*-index. However, when denial of danger manifests in false beliefs, one may expect equal insensitivity to all indices of the pandemic and low acceptance of economic losses to combat the pandemic.

2.3. Choices between health and economic losses described by different indices

We used the three most frequently employed indices of pandemic development: daily new

cases of infection, daily new cases of deaths, and *R* index.

In accordance with the decision making framework we expected respondents to: (1) minimize health losses and accept high economic costs, independently of the index of the pandemic (generalized relative importance) or (2) minimize health losses more willingly, when described by daily new cases (local relative importance).

In accordance with *TMHM* we expected respondents to minimize health losses and accept economic costs most willingly, when losses were described by daily new deaths (direct death reminder) followed by *R* index (the demand of social responsibility) and least willingly, when losses were described by daily new cases (indirect reminder). This might be moderated by factors reflecting Thread-Avoidance such as extent of denying susceptibility to disease (oneself *vs.* everybody) and false beliefs.

3. MATERIALS AND METHODS

3.1. Participants and design

A total of 330 participants from the crowdsourcing community Prolific Academic took part in this study in exchange for £2.89 (96 women, 233 men; M_{age} = 23.4 years, *SD* = 6.50). A majority (57%) attended college or university and 26% had either a BA or MA, 34% were employed and 9% were unemployed. A vast majority (91%) had an income below the national average. The study had a mixed experimental design with one between-subject factor: the index of pandemic (daily new cases, daily new deaths, *R*-index) with three repeated measures for different values of each pandemic index (low, medium, high). Participants were randomly assigned to one of the three conditions: daily cases (*N* = 110), daily deaths (*N* = 111) or *R* index (*N* = 109). The within-subject factor was the type of economic cost: lost jobs or a decrease in GDP.

3.2. Procedure

Once the participants had provided informed consent, they answered questions how afraid they were of getting ill with COVID-19 and its negative health consequences. These evaluations were made for themselves and for young/elderly persons close to them. The answers were registered on a 100-point slider scale from "very weak fear" to "very strong fear".

The second block consisted of questions concerning severity of negative health consequences of getting ill with COVID-19 and perceived risk for a participant and for young/elderly persons close to her as well as for people form general population in different age groups. Next, participants evaluated the effectiveness of the lockdown. These answers were registered on a 100-point slider scale.

The third block consisted of 8 statements related to common false beliefs about COVID-19, e.g. "The danger of COVID-19 is intentionally magnified by big pharmaceutical companies in order to get large benefits" or "COVID-19 is just like a flu". Participants declared to what extent they agreed or disagreed with these statements on the 5-point Likert scale from "strongly agree" to "strongly disagree". The *False Beliefs* scale had high reliability (α=0.89, *N*=330). All items on the scale were worded in the same direction. However, because we predicted that people who agree with several false beliefs about Covid-19 would disagree with

statements favoring lockdown, a possible acquittance bias could only obscure the true relationship between holding false beliefs and lockdowns (non)acceptance.

The questions within each block of these three blocks were presented in a random order.

The next part of the study was experimental and was designed to test changes in the acceptance of economic costs (lost jobs and a decrease in *GDP*) to combat COVID-19 due to changes in the level of health loss (low, medium, high) described by three various indices of the pandemic development (daily new cases: 15/20/20 thousands; daily new deaths: 200/500/1000; and *R*-index: 1.5/2.0/2.5). At the time of the data collection, the new daily cases level was 10 241, 45 persons died, and the *R* index was *ca* 1.3. The participants were asked to choose the acceptable number of new jobs lost and the acceptable decrease in GDP. In the case of unemployment, they chose among 7 categories: "I do not accept this solution", "I accept less than 50, 75, 100, 150, 200-thousand new lost jobs", "I accept this solution independently of the number of new jobs lost". The two extreme categories for a decrease in *GDP* were: "I do not accept this solution" and "I accept this solution independently of the percent of the GDP decrease". The 5 middle categories for the decrease in *GDP* were: 4%, 6%, 8%, 10%, 12%. The "unemployment" and "*GDP*" scenarios were presented in random order. These scenarios included information about the current pandemic development described by one of three indices and about the economic costs of the spring lockdown. Participants were presented with information about the pandemic from John Hopkins University. The information about unemployment and about GDP was the official data from the National Office of Statistics. In accordance with these data they were told, that "the unemployment rate was equal to 5% in March 2020 and increased by 1% in April and May 2020. When the restrictions had been lifted the labor market stabilized and a few people lost jobs in June 2020."As for *GDP*, participants were told that the decrease in *GDP* during the spring lockdown was 8%. The participants were given current information to set the same reference point for all.

For two pandemic indices, scenarios were accompanied by graphs illustrating daily new cases or deaths from the beginning of the pandemic on March 4 until October 22. In the third condition, the scenario included a graph that illustrated the number of persons infected by one person in 10 and in 60 days, for 3 different values of *R* index: 2.5, 1.25, and 0.625.

The number of lost jobs and the decrease in *GDP* chosen by the participants were dependent variables.

4. RESULTS

4.1. Perception of the pandemic

4.1.1. The evaluation of severity of negative health consequences of getting ill with COVID-19

The estimated marginal means for evaluations of negative health consequences of getting ill with COVID-19 obtained from ANACOVA with sociodemographic variables (age, education, income, and location) as covariates are given in Table 1.

Table 1. The estimated marginal means of the negative health consequences of getting ill with COVID-19.

	N=312	
	Me	*StdError*
Personal consequences	37.37	1.44
Consequences for young persons close to a participant	35.84	1.38
Consequences for elderly persons close to a participant	76.98	1.21
Consequences for people younger than 35 from general population	37.42	1.45
Consequences for people over 60 from general population	82.20	1.20

As can be seen from Table 1, respondents rated highly negative health consequences for the elderly only.

4.1.2. Declared fear of getting COVID-19 disease

We performed MANOVA with one within-subject factors – age (young people *vs.* the elderly close to me) with sociodemographic factors as covariates. It was found that respondents declared higher fear about the elderly (*EMMe* = 75.70, *Std Error* = 1.40, *lower and upper bonds* 72.94 and 78.45) than about young persons (*EMMe* = 40.46, *Std Error* = 1.68, *lower and upper bonds* 37.16 and 43.76) ($F_{(1,1307)} = 26.69$, $p < .001$, $\eta_p^2 = .088$).

4.1.3. Risk ratings

A MANOVA was conducted with two within-subject factors: reference group (persons close to me *vs.* people from general population) and age (young people *vs.* the elderly) with sociodemographic factors as covariates.

The main significant effect of age was observed. The perceived risk for young people (*EMMe* = 47.13, *Std Error* = 1.31, *lower and upper bonds* 44.90 and 49.35) was significantly lower than for elderly people(*EMMe* = 75.59, *Std Error* = 0.93, *lower and upper bonds* 73.75 and 77.42) ($F_{(1,311)} = 23.01$, $p < .001$, $\eta_p^2 = .0.69$). No main effect of the reference group was observed ($F_{(1,311)} = .93$, $p = .336$, $\eta_p^2 = .003$) but the interaction between age and reference group was observed ($F_{(1,311)} = 7.10$, $p = .008$, $\eta_p^2 = .022$). The difference in perceived risk for people close to a respondent and for the others was higher for the elderly (*EMMe* = 73.47 and 77.70, *Std Error* = 1.04 and 0.99, respectively) than for the young people (*EMMe* = 46.48 and 48.25, *Std Error* = 0.93 and 1.17, respectively).

4.1.4. Two dimensions of perception of the pandemic

The results presented in Section 4.1 can be described by two dimensions that emerged from Principal Component analysis with Varimax rotation on ratings of negative health consequences, fear and risk of COVOD-19. The emerged factors that accounted for 63% of variance were: (1) Thread to young people and (2) Thread to the elderly. The results of Factor Analysis are given in Table 2.

Table 2. The Rotated Factor Matrix.

	Factor 1: Thread to young people	Factor 2: Thread to the elderly
Personal fear	.654	
Fear about close young persons	.603	
Personal consequences	.852	
Consequences for close young persons	.791	
Consequences for young people	.764	
Personal risk	.804	
Risk for close young persons	.747	
Risk for young people	.716	
Fear about close elderly		.686
Consequences for close elderly		.795
Consequences for elderly people		.836
Risk for close elderly		.830
Risk for elderly people		.842

4.2. The perceived effectiveness of the spring lockdown

The perceived effectiveness of the spring lockdown was tested with the aid of a UNIANOVA with sociodemographic factors as covariates. The effectiveness was rated low (*EMMe* = 49.61, *Std Error* = 1.57. *lower and upper bonds* 46.52 and 52.70). In this analysis no main effects of sociodemographic factors were observed.

4.3. Perception of the pandemic and acceptance of economic costs to combat it

The two factors' scores that described perception of the pandemic and the perceived effectiveness of the spring lockdown were used as predictors of acceptance of economic costs in Regression Analysis. Two indices of economic costs were used: the number of lost jobs and the decrease in GDP expressed as a percentage. We performed Regression Analyses with the integrated indices of acceptance of the number of lost jobs and of the decrease in GDP as a dependent variables.

These indices were calculated as follows: (1) the three responses concerning the number of lost jobs for three levels of health loss were averaged; (2) the same was done for the three responses concerning the decrease in GDP. The results for acceptance of the number of lost jobs are presented in Table 3.

Table 3. Predictors of acceptance of the number of lost jobs – results of hierarchical regression analysis.

Variables entered in the first step						
Model	B	Bias	Std. Error	p	BCa 95% Confidence Interval	
					Lower	Upper
Constant	2.42	.006	.23	<.001	1.97	2.90
Threat to young people	-.05	.002	.12	ns	-.27	.17
Threat to the elderly	.22	.004	.12	ns	.03	.47
Lockdown effectiveness	.02	.000	.004	<.001	.02	.03

Variables entered in the second step						
Model	B	Bias	Std. Error	p	BCa 95% Confidence Interval	
					Lower	Upper
Constant	4.21	-.007	.48	<.001	3.23	5.16
Threat to young people	-.10	-.004	.12	ns	-.34	.13
Threat to the elderly	.07	.002	.13	ns	-.18	.32
Lockdown effectiveness	.02	.000	.00	.<001	.01	.03
False beliefs	-.66	-.000	.14	<.001	-.93	-.40

The results for acceptance of the decrease in GDP are presented in Table 4.

Table 4. Predictors of acceptance of the decrease in GDP – results of hierarchical regression analysis.

Variables entered in the first step						
Model	B	Bias	Std. Error	p	BCa 95% Confidence Interval	
					Lower	Upper
Constant	2.42	-.01	.24	<.001	1.96	2.87
Threat to young people	-.10	-.01	.12	ns	-.35	.13
Threat to the elderly	.29	.01	.12	.014	.07	.54
Lockdown effectiveness	.02	.00	.00	<.001	.01	.03

Variables entered in the second step

Model	B	Bias	Std. Error	p	BCa 95% Confidence Interval	
					Lower	Upper
Constant	4.48	.01	.50	<.001	3.48	5.51
Threat to young people	-.15	.00	.12	ns	-.39	.09
Threat to the elderly	.13	.01	.13	ns	-.11	.42
Lockdown effectiveness	.01	.00	.04	.<001	.01	.02
False beliefs	-.76	-.001	.15	<.001	-1.04	-.47

The models analyzed during the first step allowed for moderately good predictions of the acceptance of economic costs of a new possible lockdown ($adjR^2$ = .11, $F_{(3,296)}$ = 13.31, p < .001; $adjR^2$ = .12, $F_{(3,296)}$ = 14.44, p < .001 for unemployment and GDP, respectively). Two predictors were significant for GDP: the acceptance of its decrease was higher when respondents highly evaluated the effectiveness of the spring lockdown (p = .001) and the threat to elderly people (p = .014). The acceptance of unemployment was higher when the effectiveness of the spring lockdown was highly evaluated (p <.001).

In the second step, the score on *False Beliefs Scale* was added to the analysis. All the parameters were estimated by the bootstrapping method using 1000 samples and bias-corrected accelerated confidence intervals.When the score on *False Beliefs Scale* was added to the model, the level of explained variance slightly increased ($adjR^2$ = .17, $F_{(4,296)}$ = 16.57, p < .001 and $adjR^2$ = .18, $F_{(4,296)}$ = 17.09, p < .001 for unemployment and GDP, respectively). Two predictors were significant – perceived effectiveness of the spring lockdown (p = .001) and false beliefs (p = .001). In accordance with our predictions, holding false beliefs about COVID-19 resulted in lower acceptance of its economic costs.

Overall, the obtained results imply that acceptance of economic costs of a possible new lockdown increases when the perceived effectiveness of the earlier lockdown is high, when elderly people are perceived as threatened and when subjects do not hold false beliefs about the pandemic.

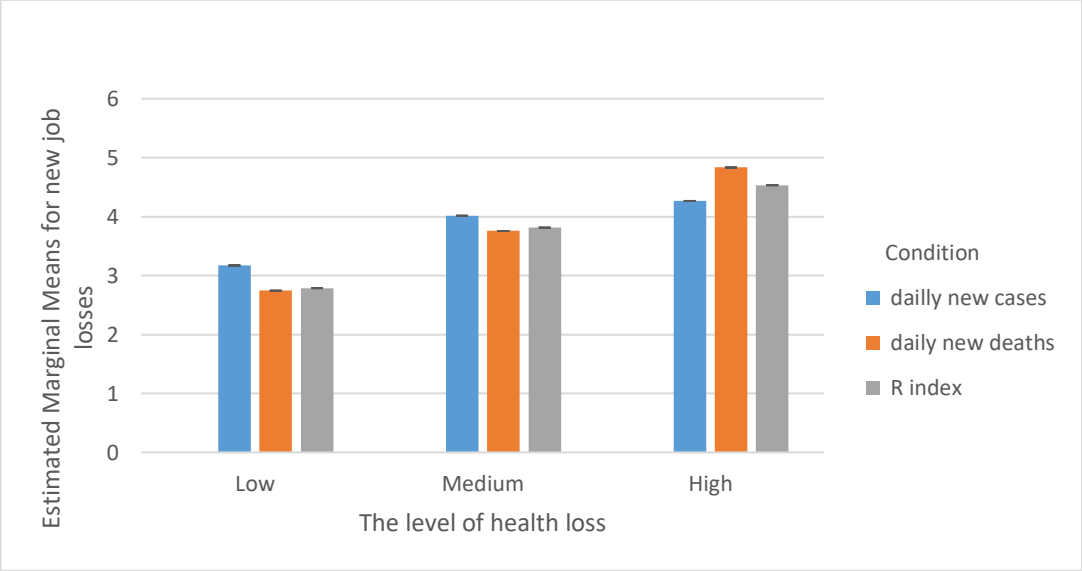
4.4. The effect of levels of health loss described by different indices of the pandemic on acceptance of economic costs

In accordance with the decision making framework, we expected that under the dramatic outbreak of the pandemic respondents either (1) minimize health losses and accept high economic costs, independently of the index of the pandemic (general relative importance) or (2) minimize health losses most willingly, when described by daily new cases - a proxy attribute with high range in value (local relative importance). In accordance with *TMHM* we expected respondents to minimize health losses and accept economic costs most willingly, when losses were described by daily

new deaths (direct reminder) followed by *R* index (demand of social responsibility) and least willingly, when losses were described by daily new cases (indirect reminder).

First, we identified respondents who either never or always accepted the economic costs of a possible second lockdown. 21% of respondents declared no acceptance of new job losses (26% for daily cases, 17% for daily deaths and 19% for *R* index) and 13.3% accepted any new job losses (15.5% for daily cases, 13% for daily deaths and 12% for *R* index) resulting from a possible second lockdown, independently of the level of health loss. No significant differences in frequencies of such respondents across conditions were observed ($\chi^2 = 3.12$, $df=2$, $N=330$, $p = .210$ and $\chi^2 = .665$, $df=1$, $N=330$, $p = .717$, for those who never and those who always accepted job losses, respectively). Similarly, 20% never accepted a decrease in GDP (27% for daily cases, 15% for daily deaths and 18% for *R* index) and 16.4% always accepted a decrease in GDP (17% for daily cases, 17% for daily deaths and 15% for R index) to combat the pandemic. No significant differences in frequencies of such respondents across conditions were observed ($\chi^2 = 5.27$, $df=2$, $N=330$, $p = .072$ and $\chi^2 = .339$, $df=1$, $N=330$, $p = .784$, for those who never and those who always accepted any decrease in GDP, respectively). These respondents were sensitive neither to the level of health losses nor to indices by which health losses were described. Therefore, one may assume that this respondents made choices to minimize either health or economic costs. Since these respondents could use a lexicographic strategy, they were excluded from the further analyses of sensitivity to different levels and indices of the health loss.

Next, we performed a repeated measures analysis of variance to test the effect of the level of health loss across three experimental conditions. The type of pandemic index served as a between-subjects factor, whereas the level of health loss (ranging from low to high) constituted a within-subject factor. The acceptance of economic costs of possible new lockdown served as a dependent variables. The analysis was performed separately for acceptance of new job losses and for acceptance a decrease in GDP. The results are presented in Figure 1.



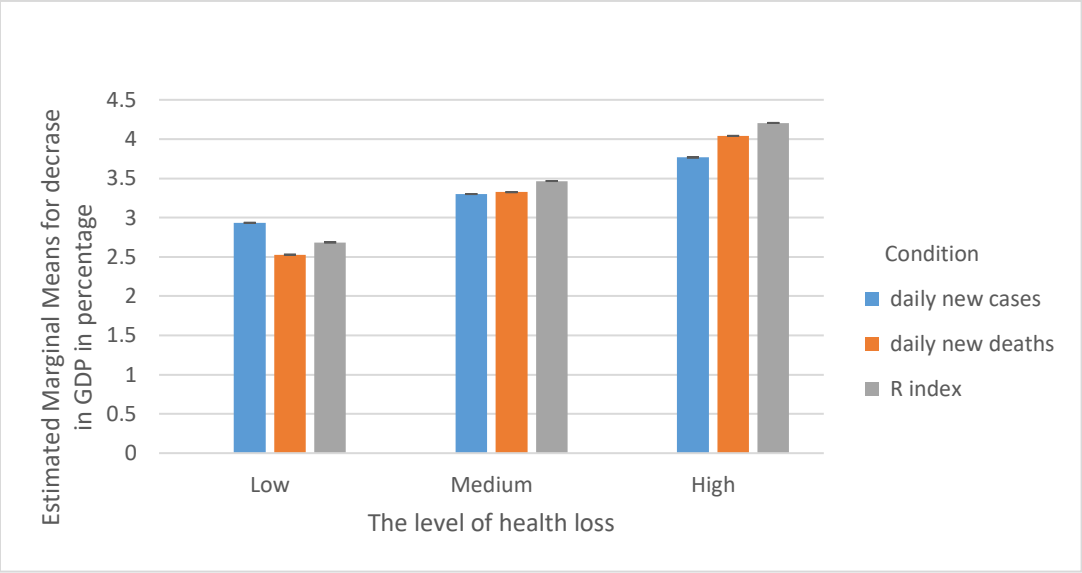


Figure 1

The estimated marginal means for accepted economic costs: job loss – top panel and a decrease in GDP – bottom panel, due to the level of health loss

The analysis for acceptance of new job losses revealed the significant main effect of the level of health loss ($F_{(2,428)} = 165.39$; $p < .001$; $\eta_p^2 = .436$). As can be seen in Figure 1 top panel, the higher the level of health loss, the higher the acceptance of the economic costs independently of the type of the pandemic index. The analyses of repeated contrasts, confirmed that all possible differences between the means were significant, p values < .001. This main effect was modified by the interaction of the level of health loss and the type of the pandemic index (($F_{(4,428)} = 5.71$; $p < .001$; $\eta_p^2 = .051$). However, this interaction was significant only for the medium and high health loss level (($F_{(2,214} = 11.26$; $p < .001$; $\eta_p^2 = .095$). From Figure 1 top panel, it can be seen that the highest increase in the accepted number of lost jobs was observed, when health losses were described by the daily new deaths. However, no main effect of the type of the index of pandemic was observed.

No main effect of the type of the pandemic index was observed either in the analysis of acceptance of a decrease in GDP. This analysis revealed also the significant main effect of the level of health loss ($F_{(2,408} = 112.22$; $p < .001$; $\eta_p^2 = .355$). As can be seen in Figure 1 bottom panel, the higher the level of health loss, the higher the acceptance of the decrease in GDP independently of the type of the pandemic index for all possible comparisons ($p < .001$). The main effect was slightly modified by the interaction of the level of health loss and the type of the pandemic index ($F_{(4,408} = 3.43$; $p = .010$; $\eta_p^2 = .032$). In contrast to the accepted job loss, here such interaction was significant only for the difference between low and medium levels of health loss ($F_{(2,408} = 3.34$; $p = .038$; $\eta_p^2 = .032$). The lowest increase in acceptance was observed, when health losses were described by the daily new cases.

From these results follow that respondents were sensitive to the level of health losses and then that they traded off health and economic costs. The way in which health losses were described had only minor impact on these tradeoffs.

4.5.Results summary

4.5.1.Perception of the pandemic and acceptance of economic costs

The first part of this study addressed perception of the pandemic. Ratings of personal consequences and consequences for young people from the general population were low, whereas such ratings were high for elderly persons. Even though this generally agrees with actual statistics, participants evaluated personal consequences and consequences for persons close to them lower than consequences for the corresponding age groups from the general population. However, they did not underestimate the danger for other vulnerable people, such as the elderly both close to them and not. In accordance with our expectations this was a good predictor of the acceptance of the economic costs.

Another important finding from our study regards risk perception. Risk ratings were low for a participant and for young people but high for the elderly. This pattern observed for COVID-19 is consistent with general patterns of consequences and fear evaluations that point to a high input into perceived risk from ratings of potential damage and fear.

4.5.2.Choices involving conflicting negative outcomes

A majority of respondents (57%) did not ignore economic consequences and instead tried to take into account both losses. To balance health and economic losses, they appeared to use a compensatory strategy – the higher health losses, the higher accepted economic costs to fight them. This is also important that the sensitivity to the level of health loss was similar independently of the index by which it was described and whether it was balanced with job losses or with a decrease in GDP.

Some respondents, however, reacted in a way consistent with a lexicographic strategy – *ca* 20% accepted no economic costs and *ca* 13-16% accepted any economic costs to fight pandemic, independently of the level of health losses and the way in which they were described. These respondents have generalized views about relative importance of different categories of values, here health and economic costs and then are sensitive neither to directness of attributes (proxy or not) nor to ranges in their values.

5. DISCUSSION

5.1. Perception of the pandemic and acceptance of economic costs

Respondents declared higher fear about the elderly and evaluated the negative health consequences and risk of getting sick higher than for young people. Such patterns of consequences and fear ratings point to a high input into perceived risk from ratings of potential damage and fear. This finding is in agreement with previous field studies on perceived risk[21].

Participants were more optimistic in evaluating negative outcomes for themselves and those close to them than for others. Thus, people believe that they and those close to them are less prone to experience adverse events. This finding cannot be interpreted in the light of optimism bias applied to health hazards[22,23]. In this framework such biased evaluations is explained by the perception of one's own susceptibility as lower than the susceptibility

of others. Since this interpretation refers only to probabilities, it does not explain the observed biased perception of consequences. To account for the latter, it may be more appropriate to appeal to the novel approach to optimism that focuses on beliefs updating[24,25]. In accordance with this approach, optimistic (valance-biased) evaluations stem from neglecting undesirable information. For example, young children neglect undesirable information referring to vulnerability[25]. Such valance-dependent bias influences beliefs about oneself and the world. Such interpretation also leads to the conclusion that people think that they are invulnerable to misfortune.

In relation to COVID-19, this is also in agreement with Thread-Avoidance behavior included in *TMHM*. There is, however, one important difference here: even though participants were optimistic they did not underestimate the danger for other vulnerable people, such as the elderly both close to them and not. In accordance with our expectations this was a good predictor of the acceptance of the economic costs. In our opinion, when denial of danger affects only evaluations referring to oneself (undermining negative health consequences and risk) whilst assessments concerning others remain realistic, people would comply with preventive measures and accept their economic costs. The pragmatic aspect is that effective communication about the pandemic or other health hazards should address information about consequences for different social strata in a way that induces fear and appeals to social responsibility.

In contrast, when denial of danger manifests in false beliefs, one may expect equal insensitivity to all indices of the pandemic and low acceptance of economic losses to combat the pandemic. In accordance with our expectations, people who hold false beliefs about the pandemic less willingly accepted the economic costs to fight it. Because holding such beliefs was also associated with reduced fear, these findings support our theoretical proposal to include false beliefs in the Threat-Avoidance path of *TMHM*. The pragmatic aspect here is that effective communication about health hazards should use two-sided messages and such communication should be started very soon before strong false beliefs (attitudes) are formed.

5.2. Decisions involving affect-rich negative outcomes

In the second part of our study, we addressed the situation in which choices have to be made between options that have conflicting, negative outcomes – health vs. economic losses. Some authors claim that valuation of sacred values such as saved lives or health against other quantities is considered either taboo[2–5] or a repugnant transaction [6] but such decisions may be impossible to avoid in the real world. Recently, Dorn et al.[26] have argued that the concept of trade-offs between health and economic losses during the pandemic is misleading and have proposed a non-linear U-shape relation from which follows that the strategy to reduce a reproduction number to 0.75 is the optimal one. This solution, however, is related only to the COVID-19 pandemic and may not be useful in other choices on social and individual level. For example, Green and Venkataramani [27] have argued that tradeoffs should be applied in Public Health Policy. Case et al. discuss[28] tradeoffs related to chronic diseases management. The presented research is related to any situation in which choices have to be done between affect-rich conflicting negative

outcomes. The question is whether people use compensatory strategies in such circumstances. One could argue that people facing threat will instead favor very simple rules, such as minimizing the more important loss[29,30]. This rule, however, allows for minimizing only one loss, which means that it requires strong prioritization of outcomes. The second outbreak was characterized by a much higher morbidity and mortality rates, which once again made health losses very salient. It was accompanied by the knowledge that health losses and mortality rate were very high only in vulnerable groups and by the awareness of high economic costs of a lockdown for everybody. Thus, a majority tried to take into account both losses. To balance economic and health losses, they appeared to use a compensatory strategy

The interpretation of these results, however, requires taking into account that 36% of respondents used single-criterion strategies minimizing either health or economic losses. This indicates that tradeoffs between conflicting values are hard and that people differ in their views about relative importance of such costs[31]. However, no hints that such tradeoffs are affected by directness of attributes (proxy *vs.* non proxy) or ranges in attributes' values were observed. No differences were observed in frequency of such participants due to the indices of the pandemic either.

These findings support neither the global/local relative importance views nor predictions from *TMHM*. In accordance with the global relative importance a majority should minimize one more important attribute, presumably health losses. In accordance with local relative importance, a majority should minimize health losses described by daily new cases. From *TMHM* it follows that people should be most sensitive to health losses described either by daily death or by *R* index. Instead, the results reflect the difficulty of making decisions involving conflicting values, when some people are looking for a "rational" solutions and try to balance costs while other adopt strong views in support of one perspective.

6. CONCLUSIONS

When people face difficult choices among affect-rich undesirable outcomes, all dimensions are salient, and conflict is unavoidable, people either apply compensatory rules to make tradeoffs or opt for minimizing one loss. The importance of various losses varies across people. Taking into account that preferences are not stable when difficult decisions have to be made, one might expect that additional situational or personal factors will moderate such choices. From our findings it follows that perception of effectiveness of prevention and false beliefs as a manifestation of Thread-Avoidance are such factors.

The effective communication about the pandemic or other health hazards should address information about consequences for different social strata in a way that induces fear and appeal to social responsibility. Two-sided messages should be used in communication and communication should be started very soon before strong false beliefs (attitudes) are formed.

Conflict of Interest Statement:

The authors have no conflicts of interest to declare.

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