Universität Basel

Fakultät für Psychologie

# Framework Application (Rahmenantrag): Risk Trace: How Risk Perception and Risk Taking affect Digital Contact Tracing

| | |
|---|---|
| **Project Leader:** | Professor Dr. Jörg Rieskamp |
| **Study personnel:** | Dr. Jana B. Jarecki,<br>Rebecca Albrecht, M.Sc.,<br>Dominik Meier, M.Sc.,<br>Florian I. Seitz, M.Sc.,<br>Elina Lutz<br>Dr. Markus Schöbel |
| **Planned start of the project**: | 2020-05-01 |
| **Planned termination of project** | 2023-11-31 |
| **Further information:** | NA |

The project leader approves the research plan version 1 (2020-04-17)

**Project Leader:** _____

(Basel, 2020-04-17)

# 1. INTRODUCTION

## 1.1 Background

This research investigates risk attitudes, risk knowledge, and risk perceptions related to the new coronavirus using various different samples. This research also examines the usage of, comprehension of, and behavioral responses to information provided by digital health devices including mobile digital contact tracing applications.

## 1.2 Rationale for the research project

The rationale for this project is twofold. First, understanding the population's general assessment of the actual risks related to the current COVID-19 pandemic is key to plan treatments that target risk behavior. Therefore we will conduct a fast-track **online risk survey** to assess the relative and absolute risk comprehension related to the pandemic and cognitive correlates thereof. Second, it has been theoretically shown by mathematical simulations that a powerful and effective technological means to contain the spread of infectious diseases (such as COVID-19), consists in digitally tracing close personal contacts and informing individuals about their infection risks based on this fine-grained information. Therefore, we will conduct a series of **online survey studies regarding digital health devices (including mobile contact tracing devices)** examining the psychological factors influencing the usage of such digital health devices (hereafter DHD).

## 1.3 Risk-Benefit Assessment

### 1.3.1 Risks

*Project 1 (Online risk survey).* The surveys will be anonymous online surveys, in which participants will be distinguished by alphanumeric ID codes in the data. The questionnaire involves no financial or health costs, it only involves a time investment. Therefore, the risk for participants is considered minimal, the questions asked may cause slight discomfort (e.g., estimation of mortality risks) and may be personal in nature (e.g. financial situation, own health), about which participants will be informed prior to the study in the informed consent (Appendix A). The survey will also include screenshots of DHDs that people have to evaluate.

*Project 2 (Online DHD studies).* Project 2 involves several studies in the form of anonymized online surveys with alphanumeric ID codes (as stated above), including questions that may

cause minimal discomfort (as stated above). Project 2 will also rely on online-surveys but will additionally implement some non-invasive between-subjects manipulations. The related studies are conducted in the form of online surveys (as Project 1), which involve the same minimal risks stated above.

#### 1.3.2. Benefits

In Projects 1 & 2 participants are reimbursed for the time invested (see 2.2.3. Reimbursement).

# 2. PROJECT DESIGN

## 2.1 Type of research and general project design

The design involves two research projects (Table 1). Project 1 will be a correlational cross-sectional online survey using a Swiss sample and a cross-section online survey in the US. Project 2 will be a series of studies with manipulations to test how different risk information influences people's risk perception and behavior. In the following we will describe the designs of Project 1 study 1 and Project 2 study 2.1. In detail, the studies 2.2. to 2.6 are similar to no. 2.1.

**Table 1**. Project Overview

| Project/Study | | Main Aims | Methods and Design | Information treatment |
|---|---|---|---|---|
| **Project 1:** Basel COVID-19 Risk Questionnaire | 1 | Does the population understand COVID-19 related risks? | Online questionnaire, representative sample | (not applicable) |
| **Project 2:** The use of Digital Health Devices | 2.1 | How do people use information about social contacts in the first place? | Randomized online treatment study (2x3 design) | ● Positive reinforcements<br>● Information about contacts and infection risks |
| | 2.2 | Compliance and the Role of Individual Risks versus Prosocial Protecting Others | Randomized online treatment study (2x2 design) | ● Public vs. personal benefits of DHD use<br>● Local vs. global risks |
| | 2.3 | Adolescents and the Role of Gamification: Nudging by Social Comparisons | Randomized online treatment study (2x4 design) | ● Age (quasi-experimental)<br>● Aggregated/personal social comparisons and disapproval |
| | 2.4 | Social Networking: How well do individuals recall their social contacts? | Randomized online treatment study | Information about group activity and associated risks |
| | 2.5 | Goals Setting: Can Goals Impact Risk-taking Behavior? | Randomized online treatment study (2x2 design) | ● Distance to goals<br>● Format: graphics |

| | | | |
|---|---|---|---|
| 2.6 | Personality and Cognitive Factors predicting Risk-taking Behavior | Online questionnaire, existing inventories to assess personality and cognitive factors | (not applicable) |

## 2.2 Recruitment, Screening, and Reimbursement

### 2.2.1. Recruitment

*Project 1 and 2.* Participants residing in Switzerland between the ages of 14 through 79 will be recruited through the panel provider LINK (https://www.link.ch/) and the University of Basel panels (BAPS, ORSEE). The US sample will be recruited through Mturk or Prolific Academic, two recruitment organizations.

### 2.2.2. Screening

In both projects, sociodemographic screening takes place, as detailed in section 3.1. Inclusion criteria.

### 2.2.3. Reimbursement

*Project 1 & 2*. Reimbursement will consist of a fixed duration-based reimbursement, which is based on the estimated study completion time (estimated from pre-testing), and will take the form of course credits if participants are University of Basel psychology students (2 credit stickers/h), and a monetary amount otherwise (20 CHF/h for laboratory and 7.5 CHF/h for CH/US online studies). For participants recruited by Link, a reimbursement will be provided by the standards used by the LINK-Institut.

*In Project 2*, the studies may in addition to the fixed duration-based reimbursement involve an additional variable bonus payment (e.g. based on an incentivized choice task, in which a randomly selected number of trials are realized and paid out). In this case the participants will receive an hourly reimbursement as described above (i.e. 2 credits stickers/h, 20 CHF/h for laboratory or 7.5 CHF/h for CH/US online studies) and the additional bonus (the minimum bonus can be 0CHF).

## 2.3 Procedures

*2.3.1 Procedures Project 1:*

In an online questionnaire, participants will be asked to report their knowledge and perception of the absolute risk, relative risk, modifying risk factors related to an infectious disease like the coronavirus, and they will report their acceptance of contact tracing and the willingness for

behavior change. The survey also includes evaluations of DHD screen shots. A detailed list of the planned survey questions is presented in Appendix B.

### *2.3.2 Procedures Project 2:*

Data for the Subprojects 2.1 through 2.5 will be collected in several online studies using treatment designs. Participants will be randomly assigned to between-subjects groups; manipulations consist in changing the format and information related to the DHD. We will use an existing DHD (e.g. www.coepi.org). Different groups of participants will receive variations of screenshots of the DHD. The studies aim to test for effects on risk-taking behavior (e.g. social distancing) and the perception of the information provided by DHDs related to the personal risk and the risk to infect others.

In Subproject 2.6 we will test which personality and cognitive factors predict risk-taking behavior concerning infectious disease such as COVID-19. With an online questionnaire we will test people's risk taking behavior (see Section 2.3.1. and Appendix B) and in an online study we will use several different instruments to assess several different relevant psychological constructs (see Appendix C for an overview).

## 2.4 Objectives

Project 1: The objective of this research is to descriptively map the Swiss and US populations' perception and knowledge about COVID-19-related risks in comparison to the objective risks and to explore people's acceptance of DHDs.

Project 2: The objective of this research is to investigate the usage of DHDs and perception of the information provided by the DHDs. Table 2 lists the hypotheses for the subprojects 2.1 to 2.5 (see Table 1). Subproject 2.6 tests which personality and cognitive constructs (see Appendix C) predict COVID-19 related risk-taking behavior.

**Table 2**. Hypotheses Project 2

| Study | Main Aims | | Hypotheses |
|---|---|---|---|
| 2.1 | How do people use information about social contacts in the first place? | H 2.1.1 | Providing information about the number of close contacts has a negative effect on the number of future contacts. |
| | | H 2.1.2 | Positive reinforcements increase compliance with the digital tracing app. |
| | | H 2.1.3 | Providing information about the potential number of people becoming infected by non-isolation increases the compliance rate. |
| 2.2 | Compliance and the Role of Individual Risks versus Prosocial Protecting Others | H 2.2.1 | Providing information about the public benefits of using a mobile contact tracing app will be more effective than providing information about the personal benefits. |

| | | | |
|---|---|---|---|
| | | H 2.2.2 | Providing information about relevant numbers on the level of the local community and the local health care system is more effective than providing those numbers at a national level. |
| 2.3 | Adolescents and the Role of Gamification: Nudging by Social Comparisons | H 2.3.1 | For young adults it is more effective to highlight the public benefits of NPI; for people with a higher case-fatality rate it is more effective to highlight the personal benefits of NPIs. |
| | | H 2.3.2 | Continued use of contact tracing apps will be higher with users who see social comparisons in a grouped format, e.g. distribution with how many people are checking their health status frequently over time. |
| | | H 2.3.3 | Individualized social comparison (like sharing one's own usage profile) increases the continued use for younger adults but not for older adults. |
| | | H 2.3.4 | A disapproval message converts non-users to users. |
| 2.4 | Social Networking: How well do individuals recall their social contacts? | H 2.4.1 | People that know about belonging to a group with above-average number and durations of contacts will be more likely to adapt their risk-taking behavior (i.e. increased social distancing or higher probability of self-isolation) in case of close contact with infected cases. |
| 2.5 | Goals Setting: Can Goals Impact Risk-taking Behavior? | H 2.5.1 | Providing information about the distance to societal goals leads to increased behavior change compared to sole provision of the social tracing information |
| | | H 2.5.2 | Providing information about the relative benefits of individual risk taking compared to the costs leads to increased behavior change compared to the sole provision of social tracing information. |
| | | H 2.5.3 | Providing graphical information about the risks related to a lack of compliance with NPIs increases compliance compared to numerical information. |
| | | H 2.5.4 | Providing graphical information helps particularly those individuals with low numeracy. |

## 2.5 Outcome variables

Project 1: The main outcome variables of interest are the self-reported absolute and relative risk perception regarding the COVID-19-related risks.

Project 2: The main outcome variables are self-reported risk perception related to COVID-19, behavioral responses (e.g. social-distancing), compliance to official behavioral recommendations, continuation of the usage of contact tracing apps.

## 2.6 Predictor variables

Project 1. The predictor variables will be the remaining variables.

Project 2. The predictor variables will be the treatment condition.

## 2.7 Other study variables

NA

# 3. PROJECT POPULATION and SAMPLE

## 3.1 Inclusion criteria

*Project 1.* Participants will be included based on a sampling scheme (age, gender).

*Project 2.* Participants aged 14 or above will be included based on usage of DHDs and to achieve a roughly equal gender split, except in Study 2.3., in which the age-based inclusion criteria is an age range from 14 to 17 years for the adolescent group, and 18 or above for the adults group (where needed, e.g. H 2.3.3.).

Please note that the ethics board of the faculty and the ethics board of the canton allows conducting surveys with low risks with persons from the age of 14 up, without the permission of their parents or legal representatives.

## 3.2 Exclusion criteria

*Project 1.* Participants will be excluded based on the sampling scheme (age, gender).

*Project 2.* Participants will be excluded based on usage of DHDs and age.

## 3.3 Criteria for withdrawal/discontinuation of participants

*Projects 1 & 2.* Participants need to discontinue the project if they withdraw their informed consent during a study, in which case their data will be deleted. However, because of the anonymized data collection, after a participant completed a study, the data cannot be excluded anymore. Participants will be informed about the latter in the informed consent.

# 4. DATA ANALYSIS

## 4.1 Sample Size Requirements

*Project 1.* The target population is adults of both genders. The planned sample size is N = 465, according to a power analysis (Gpower) following a multiple-linear regression analysis with a medium effect size of rho = .30, alpha = .05 and 1-beta = .80.

*Project 2.* All the studies are randomized between-subjects studies. Power analyses will be conducted and be based on the specific design of each study. In doing so we will use the smallest meaningful effects (smallest effect size of interest, SESOI) to determine the sample size (Lakens, McLatchie, Isager, Scheel, & Dienes, 2018). Data analysis will be linear-model-based. We will use SESOI of **Cohen's $f^2$=0.07** to determine the sample size. The concrete power analyses to determine the number of participants to test in each study will be based on **alpha = .05** and **power = .80**. For example, in Study 2.5, where we intend to test the Hypotheses in a 2x2 design (distance to goals vs. format: graphics) we will test *161* participants. We expect to additionally recruit 10 to 20 participants to pre-test the designs. In study 2.6 we will test the same number of participants as in Project 1.

## 4.2 Missing Values

Missing values will be handled by list-wise deletion or imputation as appropriate, we do not expect many missing values, because the non-response rate is typically very low in behavioral surveys.

# 5. DATA AND QUALITY MANAGEMENT

Data quality can be ensured by automated quality checks for the correct input format in online surveys (e.g. only numerical, forced responses, etc.)

## 5.1 Data handling and record keeping / archiving

## 5.2 Confidentiality, Data Protection

*Project 1 & 2.* The collected data will be stored during the project on the password-protected Economic Psychology file servers (Psychology Department, University of Basel), during the project the data will be shared with the involved study personnel via secure file sharing (switchdrive.ch). Version management will use Git (c.f. https://github.com). The collected data that will form the basis of publications, will be made available in an open science repository upon publication (e.g. osf.io). Before data sharing we will remove or code that could, given current scientific standards, identify individual participants. All participants receive explicit information in the informed consent that their de-identified data will be shared online with the research community upon publication.

Personal data will be anonymized before dissemination of the datasets based on the recommendations layed out in the Federal Act on Data Protection (FADP) of 19 June 1992 (Status as of 1 March 2019) (see CC 235.1 Federal Act of 19 June 1992 on Data Protection (FADP)). If de-identification is a risk this risk will be addressed by the R-package SDCMicro (see Package sdcMicro), ensuring that each data set has a k-anonymity of 3 or better.

## 5.3 Coding

NA

## 5.4 Debriefing

*Project 1 & 2.* The informed consent informs participants about the aims and contents of the research.

## 5.5 Archiving and Destruction

*Project 1 & 2.* Data will be archived at the file-servers (Economic Psychology, University Basel) and the data, that underlies publications, will be made accessible via a FAIR-compliant open-access repository (OSF) or a repository required by the publisher. The data will be deleted from the local machines of the involved personnel upon acceptance of the related publication.

# 6. FUNDING AND SUPPORT

The project is financed by a pending application for funding through the BOTNAR foundation, the Swiss National Science Foundation, and by the Center for Economic Psychology (Department of Psychology, University of Basel).

There are no conflicts of interest.

# 7. REFERENCES

Ferguson, N., Laydon, D., Nedjati Gilani, G., Imai, N., Ainslie, K., Baguelin, M., ... & Dighe, A. (2020). Report 9: Impact of non-pharmaceutical treatments (NPIs) to reduce COVID19 mortality and healthcare demand. https://www.preventionweb.net/go/71079

Ferretti, L., Wymant, C., Kendall, M., Zhao, L., Nurtay, A., Abeler-Dörner, L., Parker, M., Bonsall, D., & Fraser, C. (2020). Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. Science, eabb6936. https://doi.org/10.1126/science.abb6936

Galesic, M., Garcia-Retamero, R., & Gigerenzer, G. (2009). Using icon arrays to communicate medical risks: Overcoming low numeracy. Health Psychology, 28(2), 210–216. https://doi.org/10.1037/a0014474

Lakens, D., McLatchie, N., Isager, P. M., Scheel, A. M., & Dienes, Z. (2018). Improving Inferences about Null Effects with Bayes Factors and Equivalence Tests. The Journals of Gerontology: Series B, XX(Xx), 1–13. https://doi.org/10.1093/geronb/gby065

# 8. APPENDICES

### Appendix A: Informed Consent

***Note to IRB:*** *the consent will be translated into English for English-speaking samples (Project 2). The wording of the consent might change slightly.*

Sehr geehrte Studieninteressierte,

vielen Dank für Ihr Interesse an dieser Studie.

Die Informationen auf dieser Seite sollen Ihnen dabei helfen zu entscheiden ob Sie an dieser Studie teilnehmen möchten.

**Ziel und Ablauf der Studie**

Ziel dieses Online-Fragebogens ist es, die Wahrnehmung und Einstellungen in Bezug auf den Coronavirus zu untersuchen. Ihre Aufgabe ist es eine Reihe an Fragen in Ruhe ehrlich und wahrheitsgemäß zu beantworten. Das

Ausfüllen des Fragen dauert etwa 15 Minuten ***Note to IRB:*** *precise ¨duration will be based on pre-test*. Auf den nachfolgenden Seiten werden Ihnen verschiedene Fragen zu Ihrer Person, dem Coronavirus, und damit verbundenen Dingen gestellt. Die Fragen in dieser Studie enthalten potenziell emotional berührende Fragen (z.B. Sterblichkeitsraten) und Fragen persönlicher Natur (z.B. Gesundheitsstatus, Einkommen).

**Risiken und Vorteile**

Die Teilnahme an dieser Studie ist, soweit bekannt, mit keinen gesundheitlichen Risiken oder finanziellen Kosten verbunden, abgesehen von der Zeit die Sie investieren. Als Entschädigung erhalten Sie eine finanzielle Aufwandsentschädigung für die investierte Zeit in Höhe von X CHF/U.S. dollars.***Note to IRB:*** *the fixed compensation will be based on time as specified in 2.3.2. Recruitment.*

***Note to IRB:*** *the following sentence will only be shown if the study involves a bonus.* Zusätzlich können Sie, abhängig von Ihren Antworten in dieser Studie, eine Bonuszahlung zwischen X CHF und Y CHF erhalten.

Die Studie wird durch das Center for Economic Psychology an der Universität Basel und (evtl. Drittmittelrescourcen) finanziert.

**Datenschutz**

Die in dieser Studie gesammelten Daten und Ergebnisse werden anonymisiert ausgewertet und für wissenschaftlichen Zwecke verwendet. Die Ergebnisse werden anonymisiert und in einer Gruppe zusammengefasst auf wissenschaftlichen Konferenzen präsentiert und in wissenschaftlichen Zeitschriften und anderen Medien veröffentlicht.

**Wichtig:** Die de-identifizierten Daten—die Daten ohne Informationen die Sie nach dem jetzigen Wissensstand als Einzelperson identifizieren können—werden in einer Online Datenbank anderen Forschenden zur Verfügung gestellt um den wissenschaftlichen Fortschritt zu beschleunigen. Wir werden alle persönlichen Informationen entfernen oder abändern bevor die Daten veröffentlicht werden, um zu verhindern, dass Sie, nach aktuellem Stand der Wissenschaft, als Einzelperson in den Daten identifizieren werden können. Insbesondere entfernen wir Angaben zu IP-Adressen. Die online geteilten Daten enthalten zum Beispiel Angaben zu Geschlecht, Alter, Gesundheitsstatus, Risikoeinschätzungen, und Einkommensklasse.

**Freiwilligkeit und Abbrechen der Studie**

Die Teilnahme an der Studie ist freiwillig. Sie haben jederzeit die Möglichkeit, ohne Angabe von Gründen die Studie abzubrechen. Die Einwilligung zur Verwendung der Daten kann während der Teilnahme an der Studie jederzeit widerrufen werden. Da die Daten in anonymisierter Form gespeichert werden ist ein nachträglicher Widerruf nach Beendigung der Studie nicht möglich. Als Teilnehmer an der Studie erhalten Sie eine Kopie dieser Einverständniserklärung für Ihre Unterlagen.

**Interessenkonflikte**

Es gibt bei der Durchführung dieser Studie keine Interessenskonflikte.

**Noch Fragen?**

Falls Sie weitere Fragen haben, können Sie diese an xxxx.xxxxx@unibas.ch stellen.

Bitte drucken Sie sich diese Einverständniserklärung für Ihre Unterlagen aus.

**Ich habe die aufgeführten Bedingungen gelesen und verstanden und hatte genügend Zeit eine Entscheidung zu treffen. Ich bin damit einverstanden, an dieser Studie teilzunehmen und dass die erhobenen de-identifizierten Antworten für weitere Wissenschaftliche Forschung online veröffentlicht werden.** ***Note to IRB:*** *in studies with age-restrictions, we add:* **ich bin mindestens 18 (or 14) Jahre alt.**

## Appendix B: Project 1 - Survey Questions

Absolute risks

- The infection fatality rate of COVID-19
- The infection fatality rate of the seasonal flu (i.e. influenza virus)
- The reproduction rate (R0): How many people an infected person will an average individual infect?
- The proportion of infected people who require intensive care unit
- The infection fatality rate for different age groups (i.e. 10-29; 30-49; 50-69; 70-older; see also Table 1 in Ferguson, et al., 2020)
- The proportion of infected people who require intensive care unit differentiated for different age groups (i.e. 10-29; 30-49; 50-69; 70-older)
- The proportion of the society that needs to be immunized before to stop the further transmission of the virus

Predictions of absolute risks

- Questions about absolute risks for 1, 6, 12 months in the future

Personal absolute risks

- Individual
    - Risk perception
    - Relative risk perception
    - R0
- Number of infected/recovered/diseased close relatives
- Number of infected/recovered/diseased friends
- Number of infected/recovered/diseased acquaintances

Relative risks

- Relative risk of COVID-19 in comparison to the seasonal influenza virus
- Relative risk of COVID-19 in comparison to other health risks (e.g., diabetes)

Modifying risk factors

- The importance of personal hygiene (hand washing)
- The importance of social distancing of around 1.5-2 meters
- The importance of the durations of close contacts (e.g. more than 15 minutes)

Acceptance of digital contact tracing

- Acceptance of installing a mobile application allowing social tracing
- Worry about data security related to mobile applications allowing social tracing

Motivation and willingness for behavior change

- Motivation of using the application for personal protection
- Motivation of using the application for protecting others (family/strangers)
- Concerns about privacy and data protection issues
- Willingness to inform others about own infection through health authorities as compared to individual decision
- Willingness for self-isolation in case of individual infection
- Willingness for self-isolation in case of close contact with infected cases
- Estimates of own daily close contacts (number of people with contacts of more than 15 minutes)

Related risks

- Loss of employment/company
- Loss of (socio-)economic status
- Problems to pay rent
- Problems to pay for medical bills

Socio-cognitive Information, for example.

- Age
- Gender
- Education
- Infection status (healthy, infected-mild case, infected-strong case, recovered)
- Employment
- Income bracket
- Mother tongue
- Numeracy (Cokely, Galesic, Schulz, Ghazal, Garcia-Retamero, 2012)

## Appendix C: Project 2 - Psychological Constructs to Predict Risk-Taking Behavior

**Table C1.** Overview of Psychological Constructs to Predict Risk-Taking Behavior

| Construct | Description |
|---|---|
| Risk preference | Preference toward safer (less variable) outcomes as compared to more variable outcomes with larger expected value |
| Ambiguity preference | Preference for risky gambles with known outcome probabilities in comparison to uncertain gambles with unknown outcome probabilities |
| Time preference | Preference toward larger rewards in the future as compared to smaller but earlier rewards in the present |
| Reward sensitivity | Sensitivity to primary (e.g., appetitive juice) or secondary rewards (e.g., monetary gain) |
| Punishment sensitivity | Sensitivity to primary (e.g., aversive juice) or secondary punishment or losses (e.g., monetary loss) |
| Self-control | Ability to control emotions and behavior in the face of temptation and impulses |
| Intelligence, Learning | The ability to take up information and adapt to new stimulus-response contingencies |
| Prosocial preferences | Prosocial preferences are beliefs and values by an individual that promote concern and care for the benefit of others. |