Public perceptions of and behavioral responses to urban heat stress in Bern

Master thesis

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Abstract

Temperature extremes may severely affect human health, especially in cities due to combined effects of anthropogenic climate change and urban heat islands. Individual adaptation behavior can reduce the risks to human health. In order to develop targeted information campaigns, it is important to know about housing characteristics, socio-demographic, and socio-psychological factors influencing individual heat adaptation behavior. This master thesis aims at analyzing this relationship empirically among the general public in Bern, Switzerland.

In March and May 2022, questionnaires were distributed to citizens in six different neighborhoods that are differently affected by urban heat island intensity. Based on multiple linear regression analyses (N=228), my results indicate that psychological factors play a superimposed role in explaining adaptive behavior regarding urban heat stress when compared to housing and socio-demographic factors. Among the socio-psychological factors, perceived benefits and perceived barriers to adaptive behaviors explain most of the variance in adaptive behaviors, whereas perceived vulnerability and perceived severity are not important predictors. My recommendation for risk communication is thus to focus on reducing the barriers for adaptive behaviors and communicating the benefits of practicing such behaviors during periods of extreme heat.

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1. Introduction

Scientists expect an increase in the frequency, duration, and intensity of temperature extremes in Switzerland due to ongoing anthropogenic climate change. That is, more heat days (daily maximum temperature ≥ 30 °C) as well as tropical nights (daily minimum temperature ≥ 20 °C) are expected to occur (NCCS 2018; MeteoSchweiz 2021). Such temperature extremes may severely affect human health. Negative health effects include exhaustion, heat strokes, as well as exacerbations of existing conditions, such as cardiovascular, respiratory, renal, or mental illnesses (Ragettli & Röösli 2020). Heat-related health risks are higher, especially for older people, infants, and people with pre-existing chronic diseases, due to poorer physical conditions with regard to heat compensation such as sweating (Ragettli et al. 2017). Negative health effects due to heat waves even lead to an increase in emergency hospital admissions and deaths (Ragettli & Röösli 2020). In recent decades, heat waves have been the deadliest extreme weather event in Europe (EEA 2017). During the heat wave summer of 2003, a premature mortality of 70'000 people was estimated across Europe (EEA 2017), and in Switzerland 1'000 additional deaths occurred compared to previous years (BAFU 2019).

People living in cities are more affected by heat extremes than people on the countryside. Urban environments are exposed to higher temperatures than the rural areas surrounding them due to the Urban Heat Island (UHI) effect (Oke et al. 2017). Factors which influence the UHI effect are dark, sealed and rapidly drying surfaces with enhanced heat capacity, reduced vegetation, anthropogenic waste heat, and the blocking of cold air drainage flows. During calm summer nights after radiation-intensive days, such as during heat waves, the UHI effect is most pronounced, and for example in the city of Bern it can be as high as 10 °C (Burger & Gubler 2020). In addition to the urban heat island effect, the Swiss population is changing. More precisely, the average age of Swiss people is rising (BFS 2021) and more than 75% of the Swiss population already live in urban areas (SSV & BFS 2021). Therefore, a higher portion of vulnerable people in Switzerland will be affected by increasing and more frequent urban heat stress in the future (NCCS 2018). Within the IPCC risk framework (Fig. 1), the increasing urban

heat stress represents “hazard”, the aging Swiss population equals “vulnerability”, and people living in urban areas stands for “exposure”. These factors influence the risk of adverse health effects during heat extremes.

Fig. 1: IPCC risk framework (IPCC AR5 2014)

A crucial factor for risk reduction is individual protective behavior (Akompab et al. 2013). Multiple studies have shown that people do not usually perceive heat extremes as a risk to themselves (Lefevre et al. 2015; Wolf et al. 2010a; Wolf et al. 2010b). Heat is often perceived as merely a nuisance rather than a serious threat, even though statistically, it causes the most deaths in Europe due to natural hazards (Heidenreich et al. 2020). As a result, people often do not adopt strategies or behaviors to protect themselves from the heat (Lefevre et al. 2015). Some heat protection behaviors are known from the literature and advice by federal offices such as: keeping out of the sun around noon, staying in the shade, avoiding extreme physical exertion, keeping windows that are exposed to the sun closed during the day, opening windows at night, using electric fans, wearing light clothing, and drinking water regularly and sufficiently (BAG 2016; Lefevre et al. 2015). Furthermore, there might be misconceptions among the public about heat protection measures such as taking cold showers (Vincenz 2022; NDR 2022; TWC 2022). However, dealing with heat is highly individual and therefore misconceptions differ between people.

Several factors influence individual protective behavior. Firstly, socio-psychological variables can affect adaptive behavior and thus indirectly influence susceptibility to heat-related health effects. There are studies, which show that although elderly people assess their health risks realistically, they are still unlikely to use coping strategies, such as asking family members for help. The reason is that they fear to be perceived as vulnerable and lose personal control and independence. Although they believe that social connections are important, the stigma surrounding vulnerability acts as a barrier to seeking support (Eady et al. 2020; Hansen et al. 2011). In addition to socio-psychological factors, socio-demographic variables such as gender, age, education and socio-economic status, as well as housing characteristics, may also influence adaptive behavior. As these factors can facilitate or hinder adaptation to heat, they also influence how vulnerable people are to heat-related mortality (Gronlund 2014; Khare et al. 2015; Hass et al. 2021; Hansen et al. 2011; Madrigano et al. 2018; Eady et al. 2020). For example, women and people with higher education tend to adopt more protective behaviors (Khare et al. 2015, Hass et al. 2021), whereas lower income and higher age can increase barriers to adopt certain adaptive behaviors (Madrigano et al. 2018; Eady et al. 2020). Moreover, higher surface temperature around the building or higher indoor temperature can lead to increased subjective heat stress which could lead to more adaptation (Vandentorren et al. 2006; Beckmann et al. 2021).

To strengthen awareness and individual protective behavior during heat extremes, information campaigns can be a helpful tool. After summer 2003, confederation and cantons have taken measures to protect the population during heat waves. There are measures which exist on three different levels. The first one is to inform about and educate the population on heat-related health risks. The second level includes special measures during heat waves and the third is about long-term adaptation measures to a warmer climate. Such protective measures can prevent heat-related health problems and deaths. Timely targeted information and behavior recommendations, especially, are an important prevention measure (Ragettli & Röösli 2020). In order to develop targeted information campaigns, it is crucial to know about psychological, socio-demographic and housing factors influencing individual heat adaptation behaviors. This thesis examined these relationships and thus contributes to the first level of measures, namely,

recommendations for risk communication to the population about health risks during heat waves.

Up to now, a lot of studies focused on drivers of risk perception and how risk perception influences adaptation to heat (Gronlund 2014; Beckmann & Hiete 2020; Liu et al. 2013). Less studied are other psychological factors, such as perceived benefits and barriers, which could influence adaptive behavior. In addition, the Health Belief Model has been used rather rarely in the context of adaptation to heat.

Explaining adaptation to heat stress

There is the Risk Information Seeking and Processing Model (RISP) which focuses on how people seek and process risk information, and how this information seeking and processing ultimately influence behaviors that people might adopt regarding a specific health risk (Griffin et al. 1999). The model includes factors which can influence people's engagement with risk information such as perceived hazard characteristics, beliefs about the channel where the information is coming from, their own capacity in gathering the information, their past experience, and the extent to which they feel informed about the risk (Thompson 2014).

The Health Belief Model (HBM; Fig. 2) focuses more on explaining behaviors than on handling risk information. The relationship between health beliefs and adaptive behaviors regarding a health risk is examined. Health beliefs include individuals' threat perception, also called risk perception, and evaluation of behaviors. Risk perception consists of two components: perceived vulnerability to health problems, and perceived severity of the consequences of illnesses. Behavioral evaluation comprises perceived benefits of a behavior for one's own well-being, and perceived barriers to enacting the behavior (Abraham & Sheeran 2015).

In this thesis the goal is to examine factors that explain individual adaptation to heat stress, therefore the Health Belief Model was chosen as the core framework. In addition to socio-psychological factors two other explanatory approaches were used: socio-demographic and housing characteristics. I use the four major components of the HBM as predictor variables: perceived vulnerability, perceived severity, perceived benefits, and perceived barriers. Socio-demographic factors and household characteristics are used as additional predictor variables.

Adaptive behavior represents the dependent variable. Positive relationships between perceived benefits and adaptive behavior and negative relationships between perceived barriers and adaptive behavior are expected (Rauf et al. 2017; Akompab et al. 2013; Madrigano et al. 2018). For perceived vulnerability and perceived severity, no clear results are expected as their relationship with adaptive behavior diverge in literature (Liu et al. 2013; Kalkstein & Sheridan 2007; Madrigano et al. 2018; Eady et al. 2020). The additional variables "Cues to action" and "Health motivation" are not considered in this thesis as their broad definitions pose a challenge in operationalizing them (Abraham & Sheeran 2015). Here I focus on the risk perception and behavioral evaluation of individuals. Risk perception is sometimes used as the combination of perceived vulnerability and severity (Abraham & Sheeran 2015; Akompab et al. 2013). However, in this study I look at the two variables separately. Still, comparisons with the term risk perception in literature are made. To sum up, this master thesis aimed at analyzing how socio-psychological factors from the HBM, socio-demographic and housing characteristics influence adaptive behavior regarding heat stress among the general public in Bern, Switzerland.

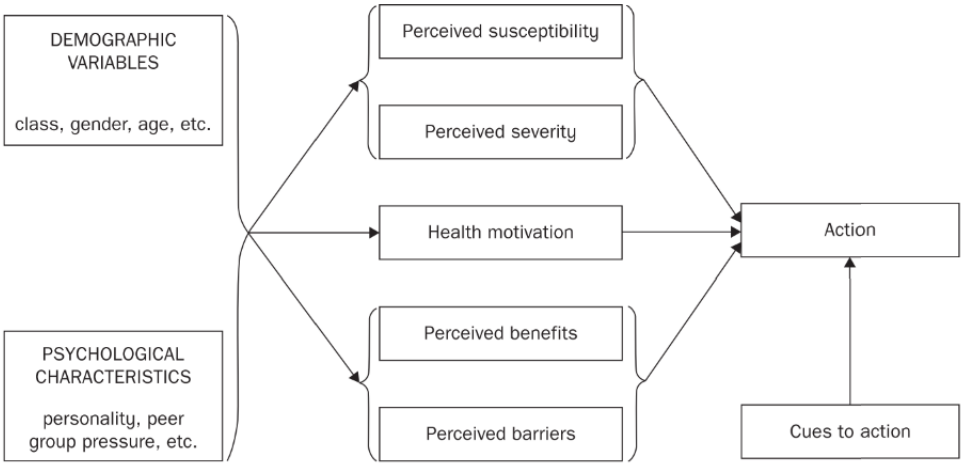

Fig. 2: The health belief model showing the factors which influence health-related actions (Abraham & Sheeran 2015)

2. Data and methods

2.1 Questionnaire development

To develop the written questionnaire, three expert interviews and a small qualitative online survey for the broader population was conducted first (Appendix B). The experts include a professor at the Center for Medical-Meteorological Research (University of Freiburg), a Medical Specialist in Prevention and Public Health, and a project leader working at the Swiss Tropical and Public Health Institute (TPH). The goal of these two pre-studies was to help design the individual items of the HBM variables to be studied (Table 1). The expert interviews were beneficial in gathering heat protection measures for the variables "perceived benefits" and "adaptive behavior". Additionally, the online survey helped to collect protective measures as well and reasons for not implementing such measures to build the variable "perceived barriers".

Table 1:Example item and reliability for each HBM variable

	Perceived vulnerability	Perceived severity	Perceived benefits	Adaptive behavior	Perceived barriers
Example item	How **often** are you **affected** by dizziness?	How **strongly** are you **affected** by dizziness?	How do you **rate** the **benefit** of the behavior "eating light food" during heat?	How **often** do you **perform** the behavior "eating light food" during heat?	"I forget to have enough drinks with me." How does this statement **apply** to you personally?
Internal reliability (Cronbach's alpha)	0.83	0.85	0.75	0.75	0.70

Item description

Perceived vulnerability & perceived severity

In the first part of the questionnaire participants were asked to think about past heat days/periods and their possible effects on them personally. Then, 14 different physical or psychological effects were listed that can occur in relation to heat. The participants were asked two questions about each effect. First, for perceived vulnerability, the frequency was asked, that is, how rarely or frequently they were affected by each effect during periods of heat (5-point scale; never - very often). For all other variables, each answer ranges from 1 to 5 as well. To obtain an overall score for each psychological variable per participant, I added up the scores of all answered questions and divided by the number of answered questions for each person. Next, I assessed the correlation between the items that are intended to measure one variable. This way I could make sure that all of the items really reflect the variable I want to examine. For this, I calculated internal reliability with Cronbach's Alpha for each psychological variable. For perceived vulnerability, reliability is very good (Cronbach's alpha = 0.83; Table 1), so that all of the questions can be used to compute the variable.

Secondly, for perceived severity, questions were asked about how weakly or strongly they were affected by each effect during periods of heat (5-point scale; not at all - extremely). Reliability is also very good (Cronbach's alpha = 0.85; Table 1).

Perceived benefits & adaptive behavior

In the second part of the questionnaire, participants were asked to think about ways to mitigate any physical or psychological effects. Then, 25 different behaviors are listed on how to deal with heat. For each behavior, the participants are asked two questions. The first question, for perceived benefits, asks how low or high they consider the benefit of this behavior to be (5-point scale; very low - very high). Before computing reliability, I omitted three items that could imply misconceptions or confusions about "useful" behaviors during heat extremes, namely: "drinking cold beverages", "taking cold showers", and "showering several times a day". The same items are also omitted for adaptive behavior. As dealing with heat is highly individual and

thus misconceptions are very individual, these items are not included in statistical tests. For the remaining 22 items, reliability is good (Cronbach's alpha = 0.75; Table 1).

The second question, for adaptive behavior, is about how rarely or frequently they personally typically perform each behavior at such times (5-point scale; never – very often). Again, reliability is good (Cronbach's alpha = 0.75; Table 1).

Perceived barriers

There are several reasons why people do not implement behaviors during heat days/periods. In the questionnaire 27 of such reasons are listed. For each statement, participants are asked to indicate how it applies to them personally (5-point scale; does not apply at all – applies completely). I omitted the following items that could imply misconceptions: "I do not drink cold beverages because I feel no cooling", "Due to water costs, I do not shower several times a day" and "I do not open the windows during the day because warm air comes in". For the remaining 24 questions, reliability is sufficient (Cronbach's alpha = 0.70; Table 1).

2.2 Data collection / sampling

Study site. The studied neighborhoods are differently affected by urban heat stress. By using a map of the UHI intensity of Bern during a heatwave in 2019 (Fig. 3), I selected neighborhoods with two rather low (Kirchenfeld & Bümpliz), two rather high (Breitenrain & Old Town), and two medium UHI intensities (Länggasse & Mattenhof). According to Burger et al. (2021) the UHI intensity is defined as the difference in air temperature between any station of the measurement network and the station situated in Zollikofen. I selected the exact areas in the neighborhoods (Fig. 4). For this, I tried to cover as many different housing situations as possible. Such housing situations are individual houses with and without access to a garden or balcony, older and younger buildings, row of houses, blocks with different number of floors, and so forth.

Questionnaire. The data collected includes the four psychological variables and individual adaptive behavior of the Health Belief Model, socio-demographic factors, and household characteristics. Demographic characteristics comprise age, gender, level of education, and chronic disease. Although chronic disease is not a demographic variable, it fits better in this category than to housing or psychological variables. Household characteristics include, for example, information about how many days per week participants spend at home; if they live in a single-family house or apartment house as well as in an old or new building; if they have access to a balcony or garden; and if they own an air conditioner or ventilator. Whether they live in an old or new building is self-declared by the participants. The questionnaire, which can be found in Appendix A, is divided into three parts and structured chronologically as follows: the psychological variables and adaptive behavior, housing characteristics, and socio-demographic factors. The participants received a paper questionnaire, a stamped reply envelope and a QR-Code to the online version of the questionnaire. They could choose whether to complete the questionnaire on paper or in digital form.

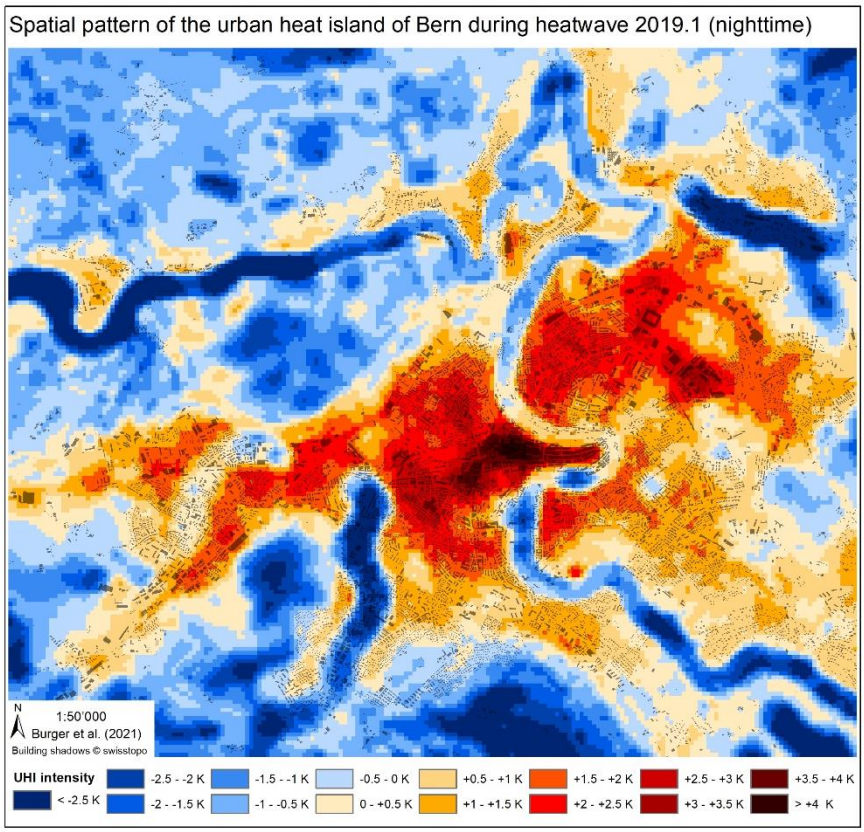

Fig. 3: UHI intensity of Bern during heatwave from June 24th to July 1st 2019 (Burger et al. 2021)

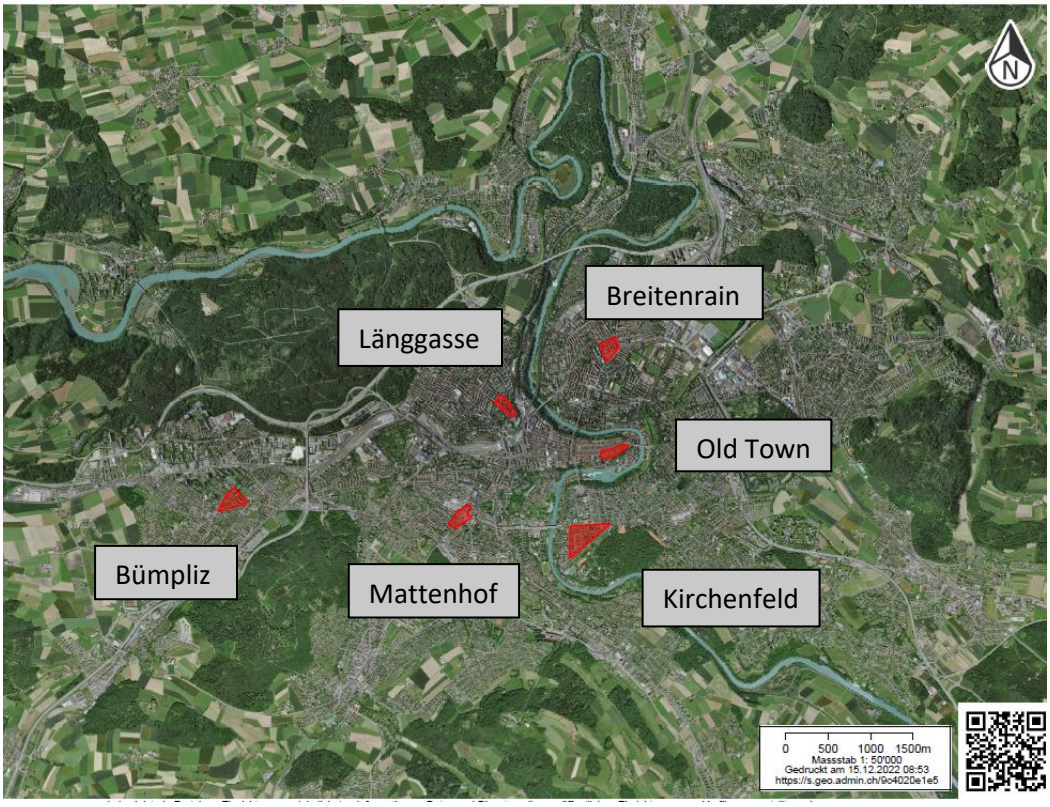

Fig. 4: Selected perimeters (red) of six neighborhoods in Bern (map.geo.admin)

Data collection. In March 2022, 600 questionnaires were manually distributed to citizens in the six neighborhoods of the city of Bern. Since the response rate to the first wave was only about 20%, I distributed another 310 questionnaires in May 2022 in the same neighborhoods but in different households. I also put out flyers at bus stops and supermarkets with information about the online questionnaire. Overall, I received almost twice as many paper-pencil as digital questionnaires.

2.3 Data analysis

First, the questionnaires received digitally and on paper were merged and cleaned up. Online questionnaires that were filled out in less than five minutes were removed. In such a short time, it is very likely that they rushed to complete the survey, and the responses probably do not reflect the truth. In addition, across all paper and digital questionnaires, those with over 40% missing responses were excluded.

All data analyses were performed in RStudio. To examine linear relationships between variables, I conducted Pearson correlation tests between adaptive behavior and the psychological factors as well as age. All these variables fulfill the assumptions of normal distributions and linear relationship between each other (STHDA n.d.).

In order to identify the relationship between adaptive behavior and socio-demographic, housing and psychological factors, I applied multiple linear regression. For this, I created several models. In each model, adaptive behavior is the response variable and only the predictor variables change. Dummy variables were created for the dichotomous variables such as gender (female = 0, male =1) and all yes/no (1/0) questions. As only one participant chose the response option “other” for gender, it was set to “not available”.

The first regression model includes all demographic factors (gender, age, education) and chronic disease. A second model contains all the housing factors: UHI intensity of neighborhood, number of adults, number of children, number of days staying at home per week, number of rooms, living in a single-family house, number of floors, living on which floor, living in a new or old building, having a ventilator, AC, garden and balcony. Another model includes

all the psychological variables: perceived vulnerability, perceived severity, perceived benefits, and perceived barriers. Further, one model with only perceived vulnerability and severity and one with perceived benefits and barriers were created. Lastly, there is a model which consists of all the predictor variables in this study.

Then, the assumptions for multiple linear regression after Hair et al. (2013) were checked for each model. According to residuals vs. fitted- and QQ-plots, the assumptions of linear relationships between dependent and independent variable, normal distribution of residuals, independence of error terms, and homoscedasticity are fulfilled (Appendix C.2). After calculating the variance inflation factors (VIF) and setting a threshold at a VIF of 10 according to Hair et al. (2013), there is no multicollinearity among the predictor variables (Appendix C.1).

Analysis of variance (ANOVA) was performed in some cases to identify differences in adaptive behavior between different factor levels. Assumptions for ANOVA were checked according to Statistics Solutions (2013). The data of each group are normally distributed (Appendix C.2). Also, the variance among the groups is approximately equal according to Levene's tests (Table 2). For visualization, I created violin plots where group sizes and results of ANOVA are included. In some cases, where ANOVA was significant, Tukey's HSD test was conducted to examine between which groups there are significant differences.

Table 2: P-values of Levene's tests for homogeneity of variance

	Gender	Age groups	Education	Neighborhood
p-value	0.287	0.349	0.558	0.587

3. Results

3.1 Descriptive statistics

3.1.1 Socio-demographic and household characteristics of survey participants

In the following I describe the socio-demographic and household characteristics of the survey participants (Table 3). Around half (51.8%) of the participants are between 30 and 60 years old, 11.3% of the participants are under 30 years old, and 36.9% are 60 years or older. More than half (60.3%) of the participants are females. According to the statistics of the bernese population, people under 30 years are underrepresented, citizens over 60 years as well as female respondents are overrepresented in the sample (Statistik Stadt Bern 2022). With regard to the level of education, the majority (61.3%) of the participants have a university degree and 15.6% graduated from colleges of higher education. Nearly all (86.2%) of the participants do not suffer from a chronic disease. The number of participants living in neighborhoods with low (37.7%), medium (30.9%), and high (31.4%) UHI intensity is almost equal. The majority of the participants has access to a balcony (82.1%) while a few participants own a ventilator (30.2%) or garden (37.9%). Nearly all (93.3%) participants do not live in a single-family house. The majority of the participants live on a middle floor (59.8%) of a building and nearly all respondents reside in an old building (92.9%).

Table 3: Socio-demographic and household characteristics of the survey participants

Characteristic	N = 228[1]
Age Group	
< 30	25 (11.3%)
30-59	115 (51.8%)
≥ 60	82 (36.9%)
Gender	
Female	135 (60.3%)
Male	89 (39.7%)
Level of Education	
Compulsory Education	4 (1.8%)
Vocational Education (Apprenticeship)	28 (12.4%)
Baccalaureate or Specialized School	20 (8.9%)
Colleges of Higher Education	35 (15.6%)
Universities	138 (61.3%)
Disease	
Yes	31 (13.8%)
No	194 (86.2%)
UHI intensity of Neighborhood	
Low	83 (37.7%)
Medium	68 (30.9%)
High	69 (31.4%)
Number of Adults	1.00 (1.00, 2.00)
Number of Children	0.00 (0.00, 1.00)
Number of Days per Week at Home	4.00 (3.00, 6.00)
Number of Rooms	3.50 (3.00, 4.00)
Single-Family House	
Yes	15 (6.7%)
No	209 (93.3%)
Number of Floors	4.00 (3.00, 5.00)
Type of Floor	
Ground floor	40 (19.1%)
Middle floor	125 (59.8%)

Top floor	44 (21.1%)
New/Old Building	
Old building	209 (92.9%)
New building	11 (4.9%)
I don’t know	5 (2.2%)
Ventilator	
Yes	68 (30.2%)
No	157 (69.8%)
Air Conditioner	
Yes	5 (2.2%)
No	220 (97.8%)
Garden	
Yes	85 (37.9%)
No	139 (62.1%)
Balcony	
Yes	184 (82.1%)
No	40 (17.9%)

[1]n (%); Median (IQR)

3.1.2 Psychological variables

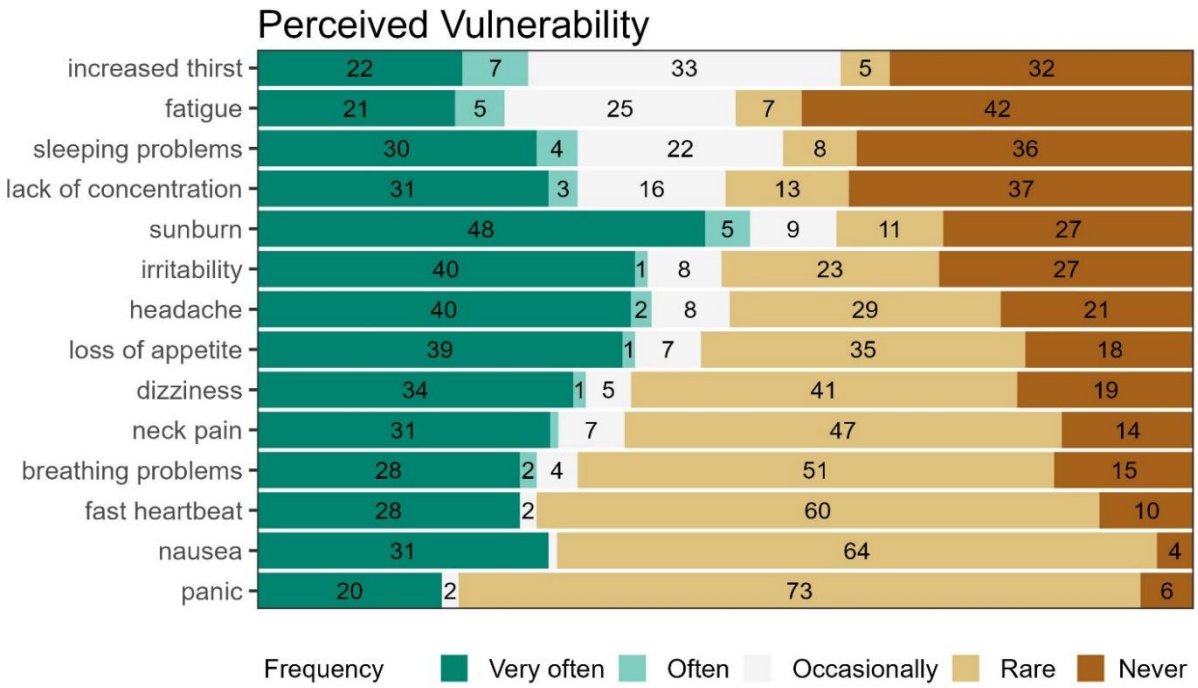

Fig. 5: Stacked bar chart showing how many participants (%) reported how often they suffer from the listed health effects of heat

In general, around 55% of the respondents state that they rarely or never experience the listed health effects (Fig. 5). The discomforts that are most frequently reported as experienced very often or often are: getting a sunburn (53%), having headache (42%), irritability (41%).

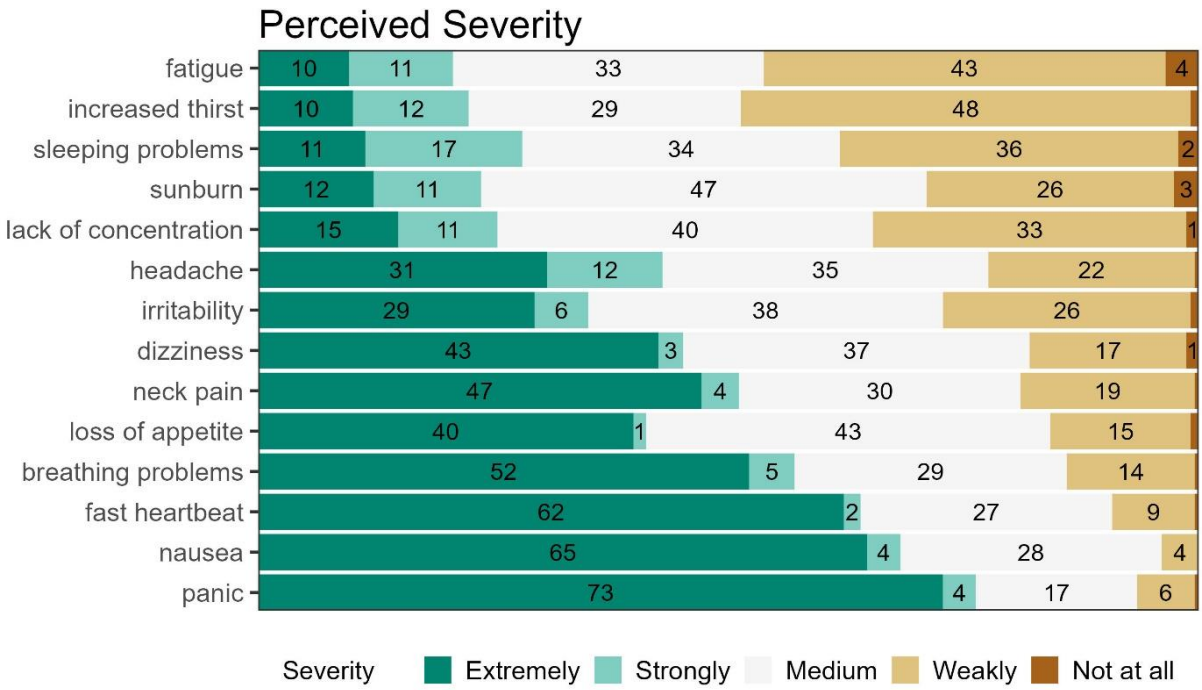

Fig. 6: Stacked bar chart showing how many participants (%) reported how strongly they are affected by the listed health effects of heat

Overall, around 42% of the participants are affected strongly or extremely by the listed health effects (Fig. 6). The discomforts that are most frequently reported as having an extreme or strong impact on oneself are: panic (77%), nausea (69%) and fast heartbeat (64%). The discomforts that are most frequently reported as having a weak or no impact are: increased thirst (49%), fatigue (47%) and sleeping problems (38%).

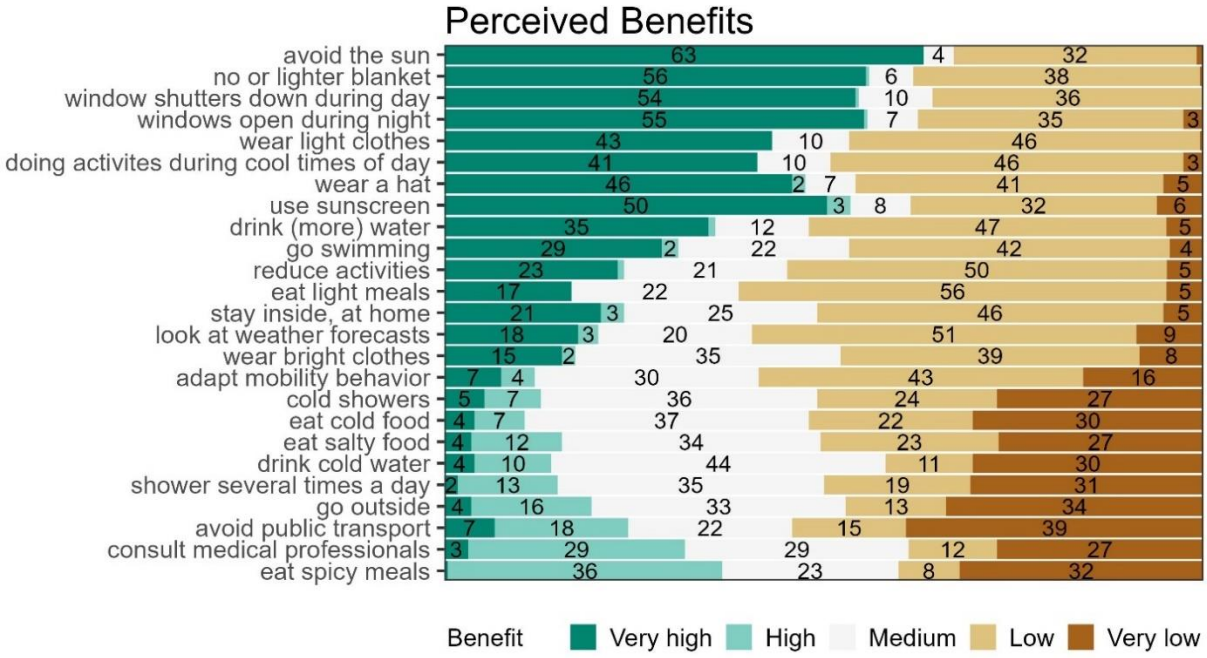

Fig. 7: Stacked bar chart showing how many participants (%) reported how much benefit they see in doing the listed behaviors during heat

Generally, around 30% of the participants see very high or high benefits in the listed behaviors during heat (Fig. 7). The behaviors with the highest percentage that are reported as having very high or high benefit are: avoid the sun (63%), use no or lighter blanket (56%) and windows open during night (55%). There are a lot of adaptive behaviors where participants see very low or low benefit. These include “Wear light clothes”, “doing activities during cool times of the day”, “eat light meals”, and “reduce activities”.

The percentages of the respondents who see a very high or high benefit in behaviors which may indicate misconceptions are as follows: “drinking cold beverages” (14%), “taking cold showers” (12%), and “showering several times a day” (15%).

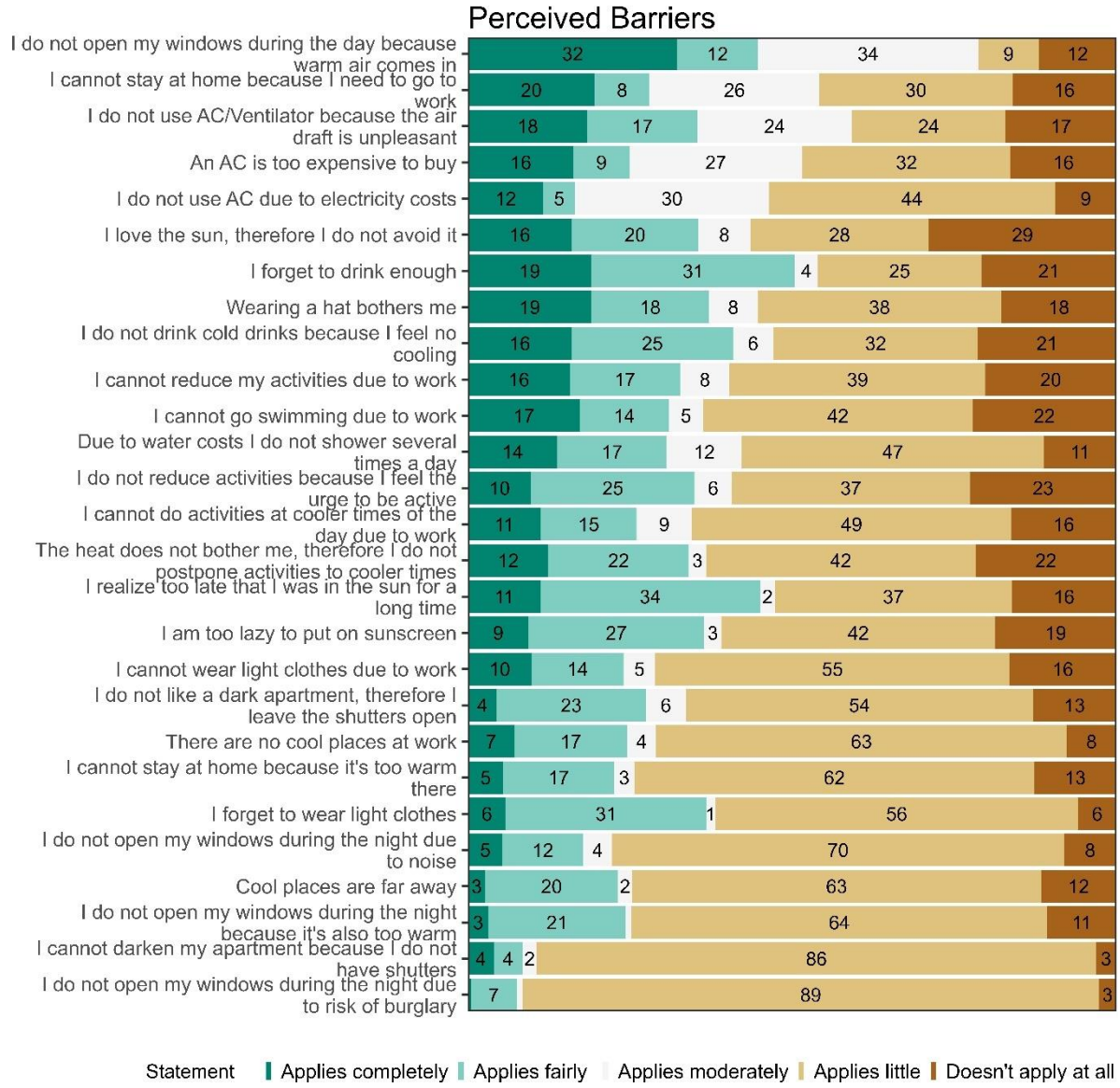

Fig. 8: Stacked bar chart showing how many participants (%) reported how statements about not implementing behaviors apply to them

Around 30% of the participants indicate that the listed statements about not implementing behaviors apply completely or fairly to them (Fig. 8). The most common statements reported as applies completely or applies fairly are: I forget to drink enough (50%), I realize too late that I was in the sun for a long time (45%), I do not open my windows during the day because warm air comes in (44%).

The percentages of the participants to whom the statements that might indicate misconceptions apply completely or fairly are as follows: “I do not drink cold beverages because I feel no cooling” (41%), “Due to water costs, I do not shower several times a day” (31%), and “I do not open the windows during the day because warm air comes in” (44%).

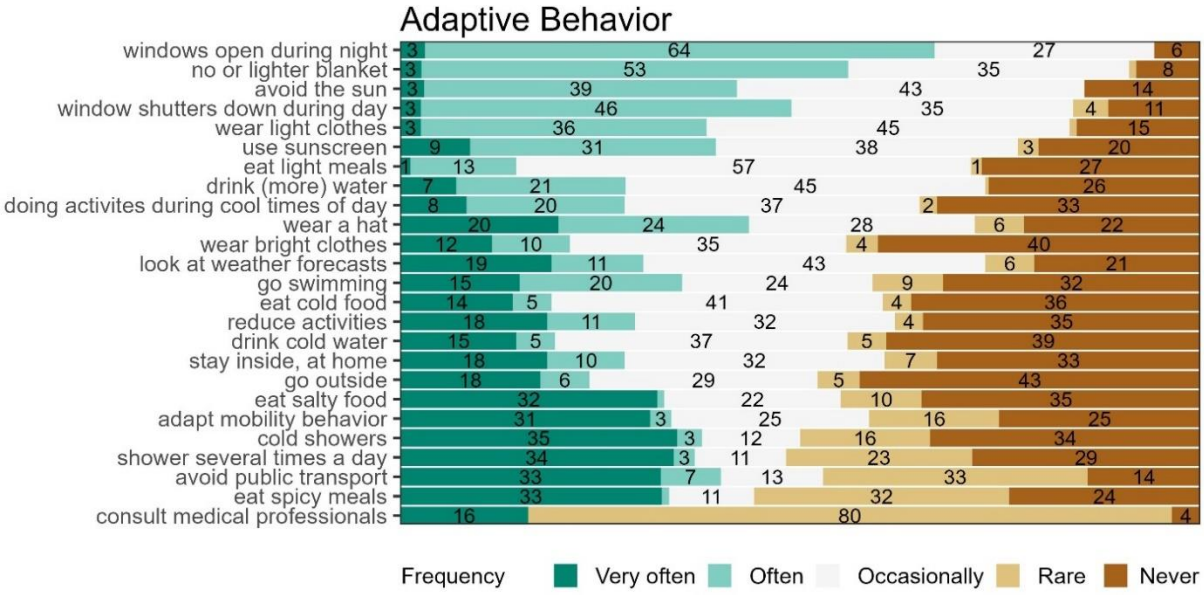

Fig. 9: Stacked bar chart showing how many participants (%) reported how often they practice the listed behaviors during heat

In general, 35% of the participants state that they practice the listed behaviors rarely or never during heat (Fig. 9). The adaptive behaviors with the highest percentage that are reported as done very often or often are: windows open during night (67%), use no or lighter blanket (56%), and window shutters down during the day (49%). The adaptive behaviors that are most frequently reported as done never or rare are: consult medical professionals (84%), eat spicy meals (56%), and shower several times a day (52%).

The percentages of respondents who very often or often engage in behaviors that could imply misconceptions are as follows: “drinking cold beverages” (20%), “taking cold showers” (38%), and “showering several times a day” (37%).

3.2 Statistical tests

For the conduction of statistical tests, the psychological variables are referred to on averaged scales (Table 4).

Table 4: Information on the averaged scales of psychological variables and adaptive behavior

	Perceived vulnerability	Perceived severity	Perceived benefits	Perceived barriers	Adaptive behavior
minimum	1.00	1.00	2.45	1.08	1.73
maximum	4.00	3.79	4.45	3.12	4.18
median	2.14	2.00	3.66	2.20	3.36
mean	2.17	2.05	3.65	2.18	3.36

3.2.1 Correlation of adaptive behavior and psychological variables

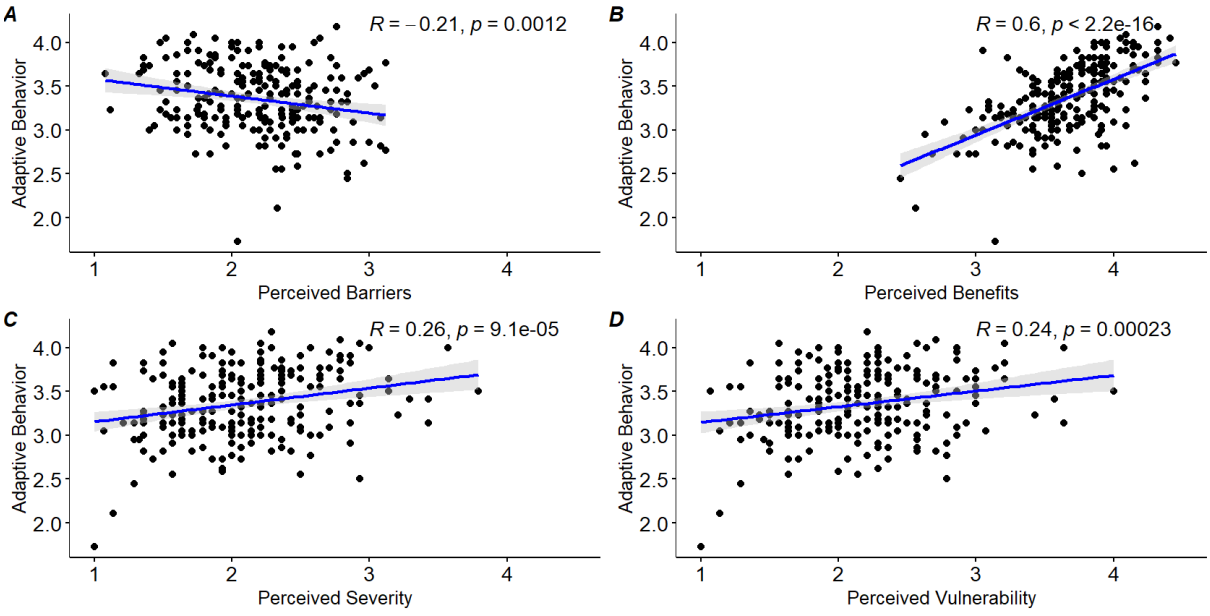

Fig. 10: Scatterplots A-D for adaptive behavior and psychological factors showing results of Pearson correlation including p-value of t-test (p), correlation coefficient (R), linear regression line (blue line), and confidence interval (CI) of 0.95 (light gray)

The relationships between each of the psychological variables and adaptive behavior is examined with scatterplots (Fig. 10). For every plot a Pearson correlation was conducted

showing the p-value of the t-test and correlation coefficient R. Perceived barriers and adaptive behavior are negatively correlated (P=0.0012, 95% confidence interval CI = -0.33 to -0.09; Fig. 10A). In other words, the more barriers people perceive to adaptive behaviors during heat, the less they perform them. In contrast, between perceived benefits and adaptive behavior there is a positive relationship (P<0.001, 95% CI = 0.50 to 0.67; Fig. 10B). The more benefits people perceive to adaptive behaviors during heat, the more they implement them. Perceived severity and adaptive behavior are positively correlated (P<0.001, 95% CI = 0.13 to 0.37; Fig. 10C). This means that the more strongly people perceive the effects of heat on their health, the more protective measures they will take. Similarly, there is a positive relationship between perceived vulnerability and adaptive behavior (P=0.0002, 95% CI = 0.12 to 0.36; Fig 10D). Hence, the more frequently people perceive heat-related health effects, the more protective measures they implement.

3.2.2 Predictors of adaptive behavior

Multiple linear regression was performed in order to identify the relationship between adaptive behavior and socio-demographic, housing and psychological factors. The six regression models consist of the following predictor variables: (1) socio-demographic factors, (2) housing characteristics, (3) all psychological variables, (4) perceived vulnerability & perceived severity, (5) perceived benefits & perceived barriers, and (6) the full model with all predictor variables (Table 5). In the first model, the negative regression coefficient of males is significant. Hence, gender is inversely related to adaptive behavior, meaning that males are less likely to take protective measures. Also significant is the positive coefficient of number of adults in the second and full model. This means that living with a larger number of adults increases adaptive behavior. The most significant regression coefficients are of perceived benefits and perceived barriers in the third, fifth and sixth model. With an increase in perceived benefits, adaptive behavior increases. Whereas, with an increase in perceived barriers, adaptive behavior decreases.

The model which includes all socio-demographic, housing and psychological variables explains 35.5% ($R^2_{adjusted} = 0.355$) of the variance in adaptive behavior. Furthermore, perceived benefits and barriers alone explain most of the variance ($R^2_{adjusted} = 0.378$) in adaptive behavior, whereas perceived vulnerability and severity are not found to be significant predictors ($R^2_{adjusted} = 0.057$). These four variables together explain nearly 40% ($R^2_{adjusted} = 0.392$) of the variance in adaptive behavior. Socio-demographic ($R^2_{adjusted} = 0.006$) and housing-related factors ($R^2_{adjusted} = 0.021$) explain almost no variance in adaptive behavior.

When we look at the residual standard error, we can see that it is the lowest for the model with perceived benefits and barriers, for the model with all the psychological variables, and for the full model. This again shows that these three models represent the data better than the others.

Table 5: Results of multiple linear regression with the six models including: (1) socio-demographic factors, (2) housing characteristics, (3) all psychological variables, (4) perceived vulnerability & perceived severity, (5) perceived benefits & perceived barriers, and (6) the full model with all predictor variables. For each independent variable the regression coefficient and its standard error (in brackets) is listed.

Regression Results

	Dependent variable:					
	adaptive behavior					
	demographic	housing	all psychological factors	vulnerability, severity	benefits, barriers	all
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-0.115**					-0.004
	(0.054)					(0.050)
Age	-0.001					0.003
	(0.002)					(0.002)
Level of Education	0.018					0.015
	(0.024)					(0.022)
No disease	0.007					-0.057
	(0.077)					(0.068)
Temperature of neighborhood		-0.020				-0.017
		(0.034)				(0.029)
Number of adults		0.089**				0.073**
		(0.035)				(0.031)
Number of children		0.040				-0.003
		(0.039)				(0.034)
Number of days at home per week		-0.001				-0.009
		(0.012)				(0.011)
Number of rooms		-0.013				-0.007
		(0.014)				(0.012)
No single family house		0.307				0.153
		(0.386)				(0.320)
Number of floors		-0.026				-0.016
		(0.018)				(0.016)
Which floor		0.009				0.020
		(0.047)				(0.039)
Old building		-0.078				-0.012
		(0.133)				(0.110)
No ventilator		0.079				0.053
		(0.061)				(0.053)
No air conditioner		-0.093				-0.170
		(0.220)				(0.182)
No garden		0.029				0.052
		(0.064)				(0.056)

No balcony		-0.016				0.020
		(0.073)				(0.061)
Perceived vulnerability			-0.029	0.018		-0.021
			(0.105)	(0.130)		(0.123)
Perceived severity			0.133	0.176		0.129
			(0.106)	(0.131)		(0.127)
Perceived benefits			0.588***		0.623***	0.598***
			(0.058)		(0.056)	(0.075)
Perceived barriers			-0.171***		-0.162***	-0.132**
			(0.048)		(0.048)	(0.061)
Constant	3.467***	3.320***	1.376***	2.958***	1.435***	1.019**
	(0.150)	(0.190)	(0.236)	(0.107)	(0.237)	(0.417)
Observations	221	190	226	228	226	186
R^2	0.024	0.088	0.402	0.066	0.384	0.428
Adjusted R^2	0.006	0.021	0.392	0.057	0.378	0.355
Residual Std. Error	0.387 (df = 216)	0.372 (df = 176)	0.302 (df = 221)	0.376 (df = 225)	0.305 (df = 223)	0.303 (df = 164)
F Statistic	1.320 (df = 4; 216)	1.314 (df = 13; 176)	37.217*** (df = 4; 221)	7.913*** (df = 2; 225)	69.441*** (df = 2; 223)	5.844*** (df = 21; 164)
Note:						*p<0.1; **p<0.05; ***p<0.01

3.2.3 Adaptive behavior and socio-demographic / housing variables

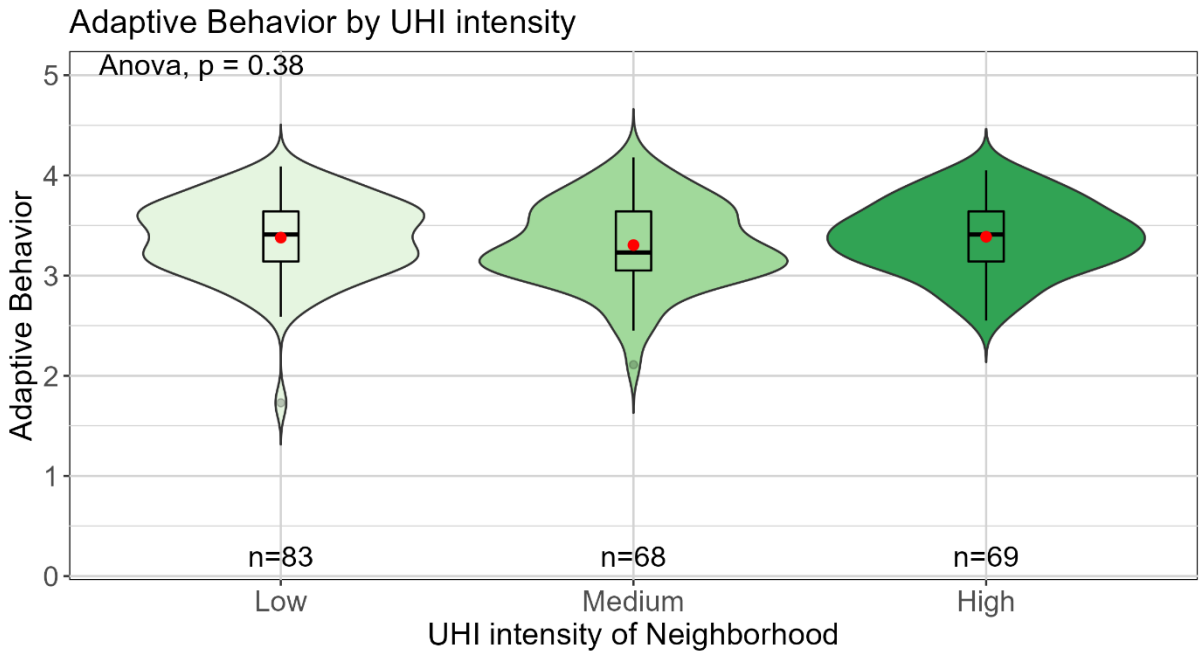

Fig. 11: Violin plot for adaptive behavior and neighborhoods with low, medium, and high UHI intensity, including p-value of ANOVA, group mean (red point), boxplot (black), and group size (n)

There are no significant differences in adaptive behavior of people living in neighborhoods differently affected by urban heat stress (Fig. 11). The ANOVA is not significant as the p-value is larger than the significance level (p=0.38). The density distributions and group sizes of the three categories are also very similar.

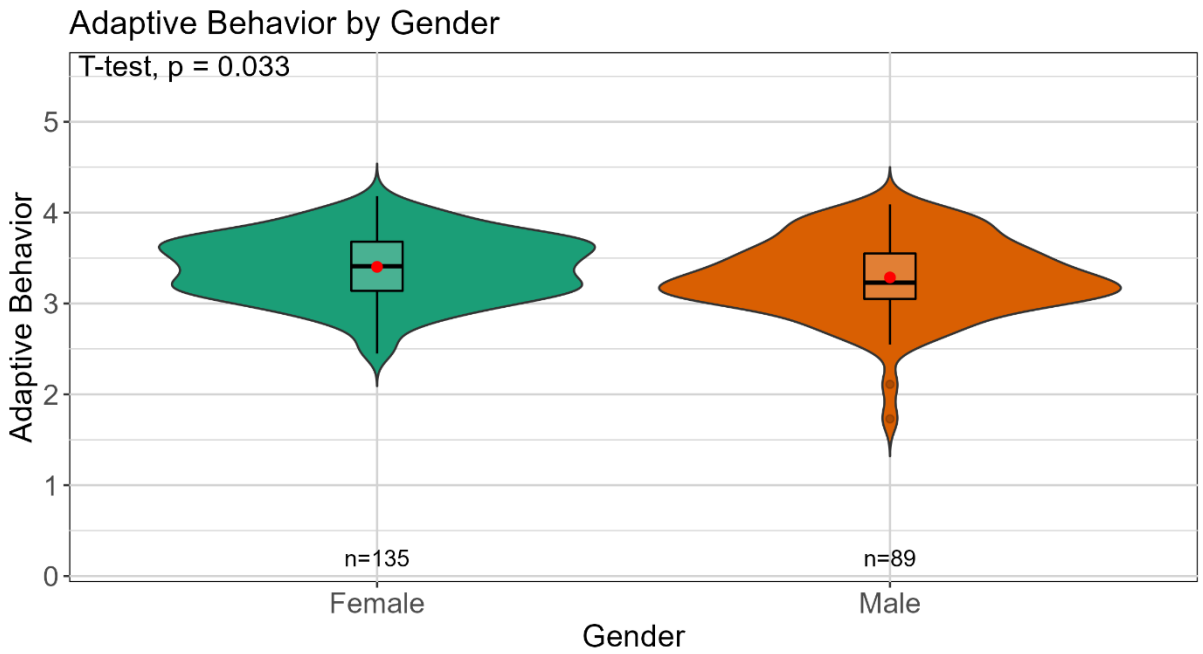

Fig. 12: Violin plot for adaptive behavior and gender, including p-value of t-test, group mean (red point), boxplot (black), and group size (n)

With regard to gender, there are differences in adaptive behavior, meaning that the mean of adaptive behavior for females differs from the mean for males (Fig. 12). More precisely, the mean value for women is slightly higher than that for men. The density distribution shows that the adaptive behavior score for male respondents varies more than for females.

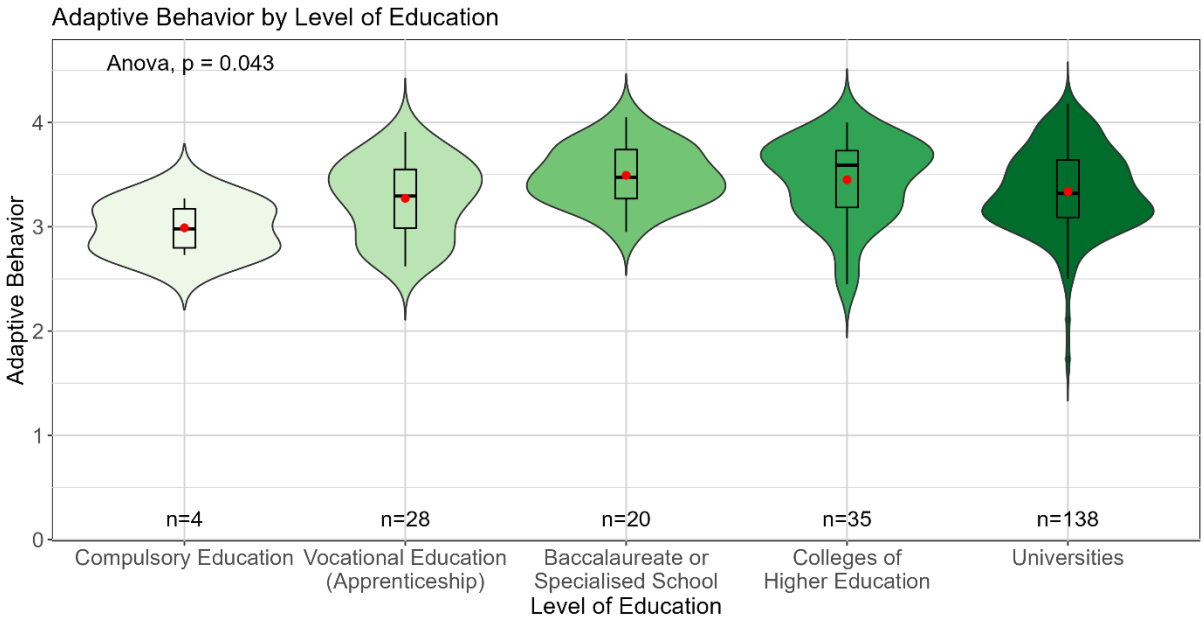

Fig. 13: Violin plot for adaptive behavior and level of education, including p-value of ANOVA, group mean (red point), boxplot (black), and group size (n)

The ANOVA (p=0.043) suggests that there might be differences in adaptive behavior of people with different levels of education (Fig. 13). For this to find out, a Tukey HSD test was conducted. However, there are no significant differences between groups (Fig. 14).

Furthermore, it almost looks like the mean in adaptive behavior increases with higher level of education, but then decreases again at the two highest levels of education. However, the group sizes are very unequal with the highest level of education being by far the biggest group.

Fig. 14: Tukey HSD test result for all pairwise comparisons of levels of education

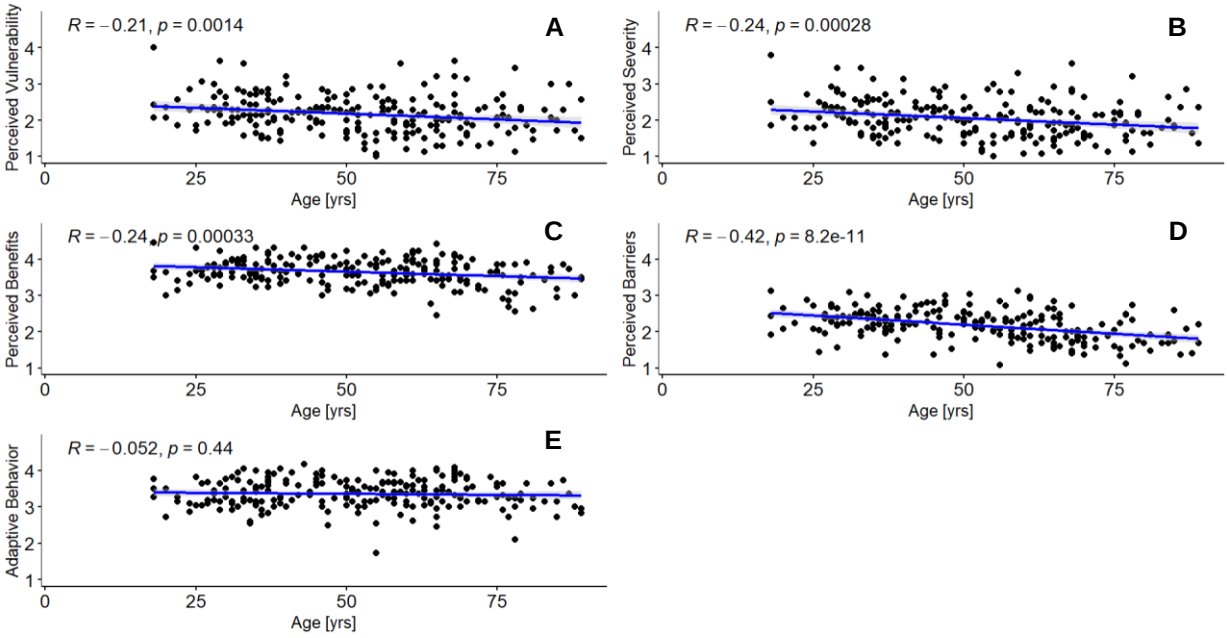

Fig.15: Scatterplots A-E with relationships between age and psychological factors as well as adaptive behavior showing results of Pearson correlation including p-value of t-test (p), correlation coefficient (R), linear regression line (blue line), and confidence interval (CI) of 0.95 (light gray)

The relationships between the participants' age and each of the psychological variables as well as adaptive behavior is investigated with scatterplots (Fig. 15). For every plot a Pearson correlation was conducted showing the p-value of the t-test and correlation coefficient R. There

are negative relationships between age and the psychological variables (Fig. 15A-D). This means that with increasing age, people perceive to experience heat-related health effects less frequently and less severely. In addition, they see fewer benefits to performing behaviors, but also fewer barriers to implementing behaviors. However, adaptive behavior does not seem to differ between younger and older people (Fig. 15E).

Fig. 16: Violin plot for adaptive behavior and the age groups under 30 years, between 30 and 60, and 60 and older, including p-value of ANOVA, group mean (red point), boxplot (black), and group size (n)

There are no significant differences in adaptive behavior of people in the three different age groups (Fig. 16). The density distributions of the three age groups are more or less similar but the group sizes are unequal, with the majority of participants being between 30 and 60 years old.

4. Discussion

In this thesis, I examined the influence of socio-psychological, socio-demographic and housing factors on heat adaptation behavior among citizens in six neighborhoods of Bern that are differently affected by urban heat stress. Because adaptive behavior is important for reducing the risk of heat-related health problems, understanding the factors that influence heat adaptation behavior is useful for designing targeted information campaigns and risk communication.

4.1 Predictors of adaptive behavior

In order to examine the relationship between adaptive behavior and socio-demographic, housing and psychological factors, multiple linear regression was performed. According to the results of the regression analysis, the model with perceived benefits and barriers, the model with all the psychological variables, and the full model are the ones which explain most of the variance in adaptive behavior (Table 5). Of these three models, the model with all psychological variables fits the data best and explains around 40% of the variance in adaptive behavior. This is partly in line with other studies. Lefevre et al. (2015) found a model which explains around 50% of variance in heat protection behavior. Rauf et al. (2017) also state that perceived benefits and perceived barriers significantly affect adaptive behavior. Akompab et al. (2013) discovered perceived benefits to be a significant predictor of adaptive behavior but not risk perception. However, there are studies which state that risk perception is a relatively good predictor of adaptive behavior (Liu et al. 2013; Kalkstein & Sheridan 2007). Still, there are studies that mention that also people with higher risk perception have low protective behavior. This is often because there are barriers that prevent them from taking behavioral action (Madrigano et al. 2018, Eady et al. 2020, Akompab et al. 2013). For example, risk perception is higher among people with lower income who are more likely to be affected by heat-related illnesses due to a lack of protective measures and fewer opportunities to adapt (Eady et al. 2020; Madrigano et al. 2018; Khare et al. 2015). Hence, even if risk perception is high, as long as the barriers to adapt protective measures are high, fewer protective actions are adapted and more heat-related illnesses occur (Madrigano et al. 2018, Eady et al. 2020, Akompab et al. 2013). This coincides

with my result that more barriers lead to the adoption of less protective behaviors (Fig. 10A; Table 5).

One reason for the contradictory results in literature might be that the variables such as risk perception are not always measured the same way. Different survey questions are used for constructing risk perception. Furthermore, risk perception sometimes is created as the combination or multiplication of perceived vulnerability and perceived severity (Akompab et al. 2013). Although the psychological variables explain most of the variance in adaptive behavior, there is still some variance that is not explained by any of the independent variables used in my study, which suggests for the investigation of other factors.

4.2 Adaptive behavior and socio-demographic / housing variables

According to ANOVA, there are no significant differences in means in adaptive behavior between people living in neighborhoods with low, medium and high UHI intensity. The used UHI intensity map (Fig. 3) contains mean nighttime temperature values for a heatwave of about one week and a spatial resolution of 50 x 50 m (Burger et al. 2021). However, the UHI intensity distribution in the city may be even more heterogeneous, meaning there might be microclimatic conditions within neighborhoods that affect surface temperature very locally. In a study of the summer 2003 in France, Vandentorren et al. (2006) found that the surface temperature directly around the building was an important risk factor for heat-related deaths. Furthermore, Beckmann et al. (2021) found that indoor temperatures influence subjective heat stress. So, the used heat map may not correspond exactly to the temperature distribution perceived by the participants. There might be a difference between objective and subjective temperature, and the latter could be more important for changing individual adaptation behavior. Hence, for future studies, it would be very interesting to know about subjective temperature potentially influencing adaptive behavior.

In terms of gender, there are differences in adaptive behavior (Fig. 12), with females practicing more adaptive behaviors. However, we need to take into account that women are overrepresented in this survey which could influence the result. Nevertheless, there is a study

which also found that women take up more adaptive behaviors (Khare et al. 2015). One explanation could be that women are more likely to inform themselves about health risks and adapt their behavior accordingly than men (Ek 2015).

The ANOVA suggests differences in adaptive behavior between some of the levels of education (Fig. 13). However, a Tukey's HSD test showed no significant differences between the groups (Fig. 14). It seems like the mean in adaptive behavior increases with higher level of education, but then slightly decreases again. However, the highest level of education (Universities) has by far the largest sample size. In general, the sample sizes of the groups are not evenly distributed. Therefore, the test results should be interpreted with caution. Nonetheless, some studies found that people with higher education tend to use more adaptive behaviors, which indicates knowledge about heat adaptation methods (Khare et al. 2015; Akompab et al. 2013; Hass et al. 2021, Hass & Ellis 2019).

Elderly people are looked at more closely because they are one of the most vulnerable groups in extreme heat. In my sample, older people have lower risk perception than younger people (Fig. 15A-B). In literature, there are studies, which also found low risk perception among elderly people (Liu et al. 2013; Beckmann & Hiete 2020). However, a study found accurate risk perception in retired people, but barriers, which prevent them from taking protective actions (Eady et al. 2020). The barriers are of different nature and include for example social isolation, fear of losing independence, costs of running air-conditioning, and lower probability of receiving heat warnings (Hansen et al. 2011; Eady et al. 2020; Hass et al. 2021). Older people are proud to be able to look after themselves. They might not ask for help because they think that they would be perceived as vulnerable and, as a consequence, would be put into nursing homes. Another barrier is that they have fixed opinions and are reluctant to change behaviors (Hansen et al. 2011; Eady et al. 2020). Moreover, studies state that the adoption of air conditioning depends on age. Older people are less likely to use or have access to AC especially if they have low pensions and are less familiar with modern AC (He et al. 2021; Hansen et al.

2011). All of these barriers older people face could be one reason why younger people are more likely to engage in adaptive behaviors (Hass et al. 2021, Khare et al. 2015).

In this sample, older participants show lower perceived barriers than younger participants (Fig. 15D). However, perceiving less barriers does not necessarily mean they actually experience less barriers. It could be similar to perceived vulnerability and severity. The elderly in my sample seem to experience less frequently and less severe health effects although they are part of the most vulnerable people during heat waves. They may also be unaware of the barriers to implementing behaviors, which prevents them from adjusting their behavior accordingly. This could be a reason for their low adaptive behavior, which should actually be higher than that of younger people as they are more vulnerable (Fig. 15E).

4.3 Recommendations for risk communication

According to my results, the most important predictors of adaptive behavior are perceived benefits and perceived barriers. Therefore, the focus of risk communication should be on these aspects. In my sample, the negative evaluations regarding the benefit of behaviors outweigh the positive ones (Fig. 7). Hence, it is important to emphasize advantages of adaptive behaviors during heat extremes, so that people are more likely to adopt them.

According to the respondents, the most common barriers to enacting behaviors are, on the one hand, associated with forgetfulness (“I forget to drink enough”) or unawareness (“I realize too late that I was in the sun for a long time”) (Fig. 8). On the other hand, they might be associated with particular beliefs or fixed opinions (“I do not open my windows during the day because warm air comes in”). Thus, it is important that citizens are regularly reminded, for example through phone and radio messages, of protective measures and are given clarity about the usefulness of behaviors in different situations. The latter could also help to eliminate potential misconceptions regarding heat protection measures. For example, in my sample, a lot of participants state they do not open the windows during the day because of warm air coming inside the house. There are barely academic papers on this but in the media, it is widely discussed if it is better to open or close the windows during the day. According to Paál (n.d.) and Poetschke (2018) it is usually preferable to open the windows even during the day to ensure

ventilation. Otherwise, the humidity inside will increase for example through breathing of people, cooking, and showering. This increase in humidity will be more exhausting for the human body. In addition, ventilation can be created when either two windows are open, or one window is open and a ventilator working. The resulting draft has a pleasant effect, as it helps to cool the body due to faster evaporation. However, when no one is home, it is better to keep the windows closed to keep the warm air out. In addition, it also depends on the material of the building, which strategy is most suitable. Hence, more precise information about when to take what measures will help people better adapt to the heat.

Furthermore, attention to the most vulnerable group, the elderly, should be given. In my sample, older participants show generally lower risk perception, lower perceived benefits, and similar adaptive behavior as younger people (Fig. 15). It should be ensured that they actually receive risk information and recommendations for protective behaviors, even if through different channels than younger people. Such channels might be family doctors, family members, friends, neighbors, or radio/TV messages. In literature, there are some recommendations for designing and improving the effectiveness of risk communication. Especially with seniors, it is important to avoid words like “vulnerable” or “elderly” because they might not identify with them (Eady et al. 2020). Peer-based approaches are recommended particularly for seniors. Checking on other people’s well-being not only de-stigmatizes asking for help, but also likely increases the effectiveness of risk information (Eady et al. 2020). This is similar to the Buddy-System in some cantons of Switzerland. Instead of neighbors and friends, people volunteer to check on vulnerable people during heat extremes (Ragettli & Röösli 2021).

4.4 Limitations

There are some limitations that need to be acknowledged in this study. Firstly, the data were collected through a self-reported questionnaire, which means there could have been response biases. Such biases could be that respondents answered in such a way that they appeared to have good heat adaptation behaviors, in order to look good or to be in line with perceived study goals (Nikolopoulou 2022). Avoiding naming survey targets can help minimize response bias.

Secondly, groups of some demographic factors, such as level of education, age, and gender are over- or underrepresented in the sample, which could lead to biased results. Thirdly, my sample size of 228 is not very large. Strategies that might lead to a larger sample size include incentives such as money or coupon or sending a reminder letter/message. Furthermore, the ANOVA of a lot of items show relatively low p-values and are just significant. For future studies, it is important to have a larger sample size, this might lead to a clearer picture. Fourthly, I found a regression model that explains around 40% of the variance in adaptive behavior, but there is still some variance that is not explained by any of my predictor variables. For further studies, it might be helpful and interesting to include other variables, which are also used in other studies such as cues to action, health motivation, knowledge about heat stress, income and health conditions of the participants. Furthermore, it would be interesting to see if there are geographical disparities in adaptive behavior by comparing urban and rural areas, or on a micro-level if there are differences within the same building or different buildings but next to each other. For this purpose, information on indoor temperature and building material should be collected.

5. Conclusion

This is the first study on public perceptions and behavioral responses to urban heat stress in the city of Bern. Despite the mentioned limitations, my findings might be important for local authorities and emergency responders. They help to design and implement information campaigns and strategies for heat risk communication. According to multiple linear regression analysis (N=228), psychological factors are more important in explaining heat adaptation behavior than housing and socio-demographic factors. Of the psychological factors, perceived benefits and perceived barriers regarding adaptation behaviors explain most of the variance in adaptive behaviors. In contrast, perceived vulnerability and perceived severity are not significant predictors. Therefore, my recommendation for risk communication is to focus on reducing the barriers for adaptive behaviors and communicating the benefits of practicing such behaviors during periods of extreme heat.

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Appendix A - Main questionnaire

Umfrage zum Thema Hitze und Gesundheit in der Stadt Bern

1. Hintergrund und Zweck

Im Rahmen meiner **Masterarbeit** am Oeschger-Zentrum für Klimaforschung der Universität Bern führe ich in der **Stadt Bern** eine grössere **Umfrage** zum Thema **Hitze und Gesundheit** durch. Ziel ist herauszufinden, wie die **Wahrnehmung von Hitze** und die **Beurteilung von bestimmten Verhaltensweisen** den eigenen **Umgang mit Hitze** beeinflussen. Dabei sollen auch die Wohnsituation und demografische Hintergründe der befragten Personen berücksichtigt werden.

Die **Teilnahme an der Umfrage ist freiwillig**. Sie können die Befragung jederzeit unterbrechen und zu einem späteren Zeitpunkt weiterführen. Die Befragung dient als Datengrundlage meiner Masterarbeit und erfolgt **ausschliesslich zu wissenschaftlichen Zwecken**. Ihre Antworten werden **absolut vertraulich behandelt und anonymisiert**. Das heisst, dass die Antworten nicht einer bestimmten Person zugeordnet werden können. Das **Mindestalter** für die Teilnahme ist **14 Jahre**.

2. Ablauf und Dauer

Im **ersten Teil** werden Ihnen einige Fragen zu **hitzebedingten Auswirkungen und Verhaltensweisen** zur Minderung von Beschwerden während Hitzephasen gestellt. Im **zweiten Teil** geht es um **Gründe**, weshalb bestimmte **Verhaltensweisen nicht ausgeführt werden** können. Zum **Abschluss** folgen einige Fragen zu Ihrer **Wohnsituation und Person**. Die Umfrage dauert ca. **15-20 Minuten.**

3. Einverständniserklärung

Ich habe den **Zweck und Ablauf der Umfrage verstanden** und **meine Angaben dürfen anonymisiert für wissenschaftliche Zwecke verwendet werden:**

O Ja
O Nein

4. Kontakt und Rückfragen

Falls Sie **Fragen** haben oder **Unklarheiten** auftauchen, wenden Sie sich bitte ungeniert direkt **via Mail** an doriana.sabbatini@students.unibe.ch

Herzlichen Dank für Ihre wertvolle Mithilfe!

Doriana Sabbatini

Was kommt Ihnen in den Sinn, wenn Sie **an Hitzetage oder -phasen denken**?
Nennen Sie stichwortartig **drei erste Gedanken, Bilder oder Gefühle**.

1. _____

_____

2. _____

_____

3. _____

_____

Denken Sie bitte an **vergangene Hitzetage/-phasen** und deren allfällige **Auswirkungen auf Sie persönlich**. Im Folgenden werden unterschiedliche körperliche oder psychische **Auswirkungen** erwähnt, die im Zusammenhang mit Hitze auftreten können. **Zu jeder Auswirkung** werden Ihnen **zwei Fragen** gestellt:

Zuerst wird nach der **Häufigkeit** gefragt, also **wie selten oder häufig Sie während Hitzephasen von dieser Auswirkung betroffen waren**. Die zweite Frage zielt auf den **Schweregrad** der jeweiligen Auswirkung ab, also **wie schwach oder stark Sie betroffen waren**. Bitte kreuzen Sie **nur eine Antwort pro Frage** an.

Erhöhtes Durstgefühl					
Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Sonnenbrand					
Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Kopfschmerzen					
Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Nacken- oder Halsschmerzen					
Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Atembeschwerden

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Schwindel

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Übelkeit

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Herzrasen

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Schlafprobleme

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Müdigkeit

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Konzentrationsschwäche

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Gereiztheit

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Appetitlosigkeit

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Panik/Angst

Wie **häufig** sind Sie von dieser Auswirkung betroffen?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O
Wie **stark** sind Sie von dieser Auswirkung betroffen?	Überhaupt nicht	Schwach	Mittel	Stark	Extrem
	O	O	O	O	O

Denken Sie bitte wieder an **vergangene Hitzetage/-phasen** und **Möglichkeiten, wie allfällige körperliche/psychische Auswirkungen gemindert werden** können. Im Folgenden werden unterschiedliche **Verhaltensweisen** erwähnt, wie mit **Hitze umgegangen** werden kann. **Zu jeder Verhaltensweise** werden Ihnen im Folgenden **zwei Fragen** gestellt:

Zuerst wird nach dem **Nutzen** der Verhaltensweise gefragt, also **wie gering oder gross Sie den Nutzen dieser Verhaltensweise einschätzen**. Die zweite Frage zielt auf die **Häufigkeit** ab, also **wie selten oder häufig Sie persönlich diese Verhaltensweise in solchen Zeiten typischerweise ausführen**. Bitte kreuzen Sie **nur eine Antwort pro Frage** an.

(mehr) Wasser trinken					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering O	Gering O	Mittel O	Gross O	Sehr gross O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie O	Selten O	Gelegentlich O	Oft O	Sehr oft O

Kalte Getränke trinken					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering O	Gering O	Mittel O	Gross O	Sehr gross O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie O	Selten O	Gelegentlich O	Oft O	Sehr oft O

Salzhaltiges Essen und/oder Getränke zu sich nehmen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering O	Gering O	Mittel O	Gross O	Sehr gross O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie O	Selten O	Gelegentlich O	Oft O	Sehr oft O

Kalte Speisen essen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering O	Gering O	Mittel O	Gross O	Sehr gross O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie O	Selten O	Gelegentlich O	Oft O	Sehr oft O

Leichte Speisen essen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Scharfe Speisen essen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Luftige Kleidung tragen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Helle Kleidung tragen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Kopfbedeckung/Sonnenhut tragen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Sonnencreme auftragen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Mehrmals am Tag duschen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Kalt duschen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Schwimmen/baden gehen

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Zuhause bzw. drinnen bleiben

Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Nach draussen gehen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Die Sonne meiden bzw. schattige/kühle Orte aufsuchen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Eigene Aktivität reduzieren bzw. alles langsamer angehen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Körperliche Aktivitäten auf die kühleren Tageszeiten verschieben					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Wetterprognosen verfolgen, um Aktivitäten besser zu planen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Mobilitätsverhalten anpassen (z.B. andere Reisezeiten, andere Verkehrsmittel)					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Öffentliche Verkehrsmittel (wenn möglich) meiden					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Fensterläden/Rollläden oder Sonnenstoren tagsüber herunterlassen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Während der Nacht Fenster öffnen					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Keine oder dünnere Bettdecke verwenden					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Medizinisches Fachpersonal konsultieren					
Wie schätzen Sie den **Nutzen** dieser Verhaltensweise bei Hitze ein?	Sehr gering	Gering	Mittel	Gross	Sehr gross
	O	O	O	O	O
Wie **häufig** führen Sie diese Verhaltensweise bei Hitze selbst aus?	Nie	Selten	Gelegentlich	Oft	Sehr oft
	O	O	O	O	O

Es gibt verschiedene **Gründe**, warum man während Hitzetagen/-phasen **empfohlene Handlungen nicht umsetzt**. Im Folgenden finden Sie verschiedene solche Gründe. Bitte geben Sie für jede Aussage an, **inwiefern diese auf Sie persönlich zutrifft (1 Kreuz pro Aussage).**

	trifft nicht zu	trifft wenig zu	trifft mittelmässig zu	trifft ziemlich zu	trifft sehr zu
Ich vergesse, ausreichend Getränke bei mir zu haben.	O	O	O	O	O
Ich trinke keine kalten Getränke, da ich dadurch keine Abkühlung empfinde.	O	O	O	O	O
Ich vergesse, luftige Kleidung anzuziehen.	O	O	O	O	O
Aufgrund meiner Arbeit kann ich keine lockere Kleidung anziehen.	O	O	O	O	O
Ich trage keine Kopfbedeckung, da sie mich stört.	O	O	O	O	O
Ich bin zu faul oder habe keine Lust, Sonnencrème aufzutragen.	O	O	O	O	O
Ich bemerke zu spät, dass ich lange an der Sonne war.	O	O	O	O	O
Ich bin gerne an der Sonne, deshalb meide ich sie nicht.	O	O	O	O	O
Ich dusche nicht mehrmals am Tag wegen zu hoher Wasserkosten.	O	O	O	O	O
Kühlere Orte (Wald, Park oder Gewässer) sind zu weit von meinem Wohnort entfernt.	O	O	O	O	O
Ich kann nicht schwimmen/baden gehen, da ich arbeiten muss.	O	O	O	O	O
An meinem Arbeitsort kann ich die Sonne nicht meiden oder kühle Orte aufsuchen.	O	O	O	O	O
Ich kann meine körperliche Aktivität tagsüber nicht reduzieren, da ich arbeiten muss.	O	O	O	O	O
Aufgrund meiner Arbeitszeiten kann ich meine körperlichen Aktivitäten nicht auf kühlere Tageszeiten verschieben.	O	O	O	O	O

	trifft nicht zu	trifft wenig zu	trifft mittelmässig zu	trifft ziemlich zu	trifft sehr zu
Ich verschiebe meine Aktivitäten nicht auf kühlere Tageszeiten, da mir die Hitze nichts ausmacht.	O	O	O	O	O
Ich kann meine Aktivität nicht reduzieren, da ich den Drang verspüre, mich zu bewegen bzw. körperlich aktiv zu sein.	O	O	O	O	O
Ich kann nicht zuhause bleiben, da ich zur Arbeit muss.	O	O	O	O	O
Ich kann nicht zuhause bleiben, da es dort zu warm wird (z.B. Dachwohnung).	O	O	O	O	O
Ich kann meine Wohnung nicht abdunkeln, da meine Fenster keine Läden/Storen haben.	O	O	O	O	O
Für mich ist es tagsüber mit geschlossenen Fensterläden/Storen zu dunkel, daher schliesse ich sie nicht.	O	O	O	O	O
Ich öffne die Fenster tagsüber nicht, da sonst warme Luft reinkommt.	O	O	O	O	O
Ich öffne die Fenster nachts nicht, da es auch in der Nacht zu warm ist.	O	O	O	O	O
Ich öffne die Fenster in der Nacht nicht wegen Lärm**.**	O	O	O	O	O
Ich öffne die Fenster nachts nicht wegen Einbruchsgefahr.	O	O	O	O	O
Ich benutze keine Klimaanlage wegen zu hoher Stromkosten.	O	O	O	O	O
Eine Klimaanlage zu kaufen ist zu teuer.	O	O	O	O	O
Ich benutze keine Klimaanlage oder Ventilator, da sich der Luftzug unangenehm anfühlt.	O	O	O	O	O

Zum Schluss bräuchte ich noch einige Angaben zu **Ihrer Wohnsituation und Person**:

a) Wohnsituation

- Wie lautet die Postleitzahl Ihres Wohnorts? _____

- Mit wie vielen Erwachsenen bzw. Kindern (unter 18 Jahren) wohnen Sie zusammen? (Bitte schreiben Sie jeweils «0», wenn Sie mit keinen Erwachsenen bzw. Kindern zusammenleben).
  Anzahl Erwachsene: _____
  Anzahl Kinder: _____

- Wie viele Tage pro Woche (inkl. Wochenende) verbringen Sie ungefähr zuhause? Anzahl Tage: _____

- Wie viele Zimmer hat Ihre Wohnung bzw. Ihr Haus? Anzahl Zimmer: _____

- Wohnen Sie in einem Einfamilienhaus?

  O Ja
  O Nein

- Falls Sie in einem Mehrfamilienhaus wohnen: Wie viele Stockwerke hat Ihr Mehrfamilienhaus? Anzahl Stockwerke: _____

- Falls Sie in einem Mehrfamilienhaus wohnen: In welchem Stockwerk wohnen Sie?

  O Erdgeschoss/Parterre
  O Zwischengeschoss (Zwischen Erdgeschoss und Dachgeschoss)
  O Dachgeschoss/oberster Stock

- Ist Ihr Haus bzw. Ihre Wohnung in einem

  O Neubau
  O Altbau
  O Weiss nicht

- Besitzen Sie einen Ventilator?

  O Ja
  O Nein

- Besitzen Sie eine Klimaanlage?

  O Ja
  O Nein

- Besitzen Sie einen Garten?

  O Ja
  O Nein

- Besitzen Sie einen Balkon bzw. eine Terrasse?

  O Ja
  O Nein

b) Persönliche Angaben

- In welchem Jahr wurden Sie geboren? _____
- Was ist Ihr Geschlecht?

  O Weiblich
  O Männlich
  O Andere

- Was ist Ihr höchster Bildungsabschluss?

  O obligatorische Schule
  O Berufliche Grundbildung (Lehre)
  O Gymnasium oder Fachmittelschule
  O Höhere Fachschule
  O Universitäre Hochschule / Pädagogische Hochschule / Fachhochschule

- Leiden Sie an einer chronischen Erkrankung?

  O Ja
  O Nein

  Wenn ja, an welcher? _____

Das waren alle Fragen… Bitte **legen Sie den ausgefüllten Fragebogen** in das **beiliegende Antwortcouvert** und werfen Sie es in einen **Briefkasten der Post**. **Vielen Dank!**

Haben Sie noch **Anmerkungen oder Hinweise** zur Umfrage? Gerne können Sie diese hier notieren:

Für weitere **Fragen oder Unklarheiten** wenden Sie sich bitte ungeniert via **Mail** an:

doriana.sabbatini@students.unibe.ch

Herzlichen Dank nochmals für Ihre wertvolle Teilnahme und Unterstützung meiner Arbeit!

Viele Grüsse

Doriana Sabbatini

Appendix B – Pre-studies

B.1 Small online survey

Kurz-Umfrage zu Hitze und Gesundheit

Herzlich Willkommen zur Umfrage!

Diese Befragung findet im Rahmen einer Masterarbeit zum Thema **Hitze und Gesundheit** statt (am Oeschger-Zentrum für Klimaforschung der **Universität Bern**). Inhalt der Umfrage sind die Erfahrungen und der Umgang mit stark ausgeprägter Hitze (z.B. Tage mit Höchsttemperaturen von über 30 °C oder Nächte mit Tiefsttemperaturen von über 20 °C) und die daraus folgenden körperlichen und/oder psychischen Auswirkungen. Die Befragung erfolgt ausschliesslich zu wissenschaftlichen Zwecken. Die Antworten werden vertraulich und anonym behandelt. Das Mindestalter für die Teilnahme ist 14 Jahre.
Die Umfrage dauert ca. **10 Minuten.**
Bei Fragen wenden Sie sich bitte an:
Doriana Sabbatini
doriana.sabbatini@students.unibe.ch

Herzlichen Dank für Ihre wertvolle Teilnahme an dieser Befragung!

1 In welchen Situationen haben **Sie persönlich** negative Auswirkungen / Beeinträchtigungen auf Körper und/oder Psyche durch stark ausgeprägte Hitze erlebt? Bitte verwenden Sie die folgenden Textfelder, um bis zu fünf solcher Situationen stichwortartig zu beschreiben.

2 In welchen Situationen haben **Personen, die Sie kennen**, negative Auswirkungen / Beeinträchtigungen auf Körper und/oder Psyche durch stark ausgeprägte Hitze erlebt? Bitte verwenden Sie die folgenden Textfelder, um bis zu fünf solcher Situationen stichwortartig zu beschreiben.

3 Welche Massnahmen ergreifen **Sie persönlich**, um negative Auswirkungen / Beeinträchtigungen auf Körper und/oder Psyche durch stark ausgeprägte Hitze zu reduzieren? Bitte verwenden Sie die folgenden Textfelder, um bis zu fünf solcher Massnahmen stichwortartig zu beschreiben.

4 Welche Massnahmen ergreifen **Personen, die Sie kennen**, um negative Auswirkungen / Beeinträchtigungen auf Körper und/oder Psyche durch stark ausgeprägte Hitze zu reduzieren? Bitte verwenden Sie die folgenden Textfelder, um bis zu fünf solcher Massnahmen stichwortartig zu beschreiben.

5 Fallen Ihnen Gründe ein, warum bestimmte Massnahmen von Ihnen oder anderen Personen **nicht** ausgeführt werden können? Bitte beschreiben Sie jeweils die Gründe im Textfeld neben der entsprechenden, zuvor genannten Massnahme.

6 Zu welcher Altersgruppe gehören Sie?

- 14-17 Jahre
- 18-30 Jahre

- 31-60 Jahre
- 61-80 Jahre
- 80+ Jahre

B.2 Questions of expert interviews

Experten-Interview

Im Rahmen meiner Masterarbeit an der Uni Bern (Master in Klimawissenschaften; Oeschger-Zentrum) untersuche ich, wie die Berner Stadtbevölkerung das Gesundheitsrisiko von Hitzestress wahrnimmt, individuelle Massnahmen zum Schutz der eigenen Gesundheit bewertet und wie diese Faktoren das individuelle Schutzhandeln beeinflussen.

Dieses Interview ist für meine Arbeit vor allem in methodischer Hinsicht von Relevanz. Die dadurch gewonnenen Erkenntnisse und Einblicke dienen der Erstellung und Überarbeitung eines schriftlichen Fragebogens, welcher für eine grösser angelegte Bevölkerungsumfrage in unterschiedlichen Quartieren der Stadt Bern eingesetzt wird. Konkret sollen die Antworten dabei helfen, die Einzelitems der zu untersuchenden Konstrukte zu konzipieren, um einerseits eine möglichst grosse Bandbreite an Antwortmöglichkeiten einzufangen und andererseits, um zwischen relevanten und weniger relevanten Aspekten diesbezüglich zu unterscheiden.

Das Interview wird ca. 30 Minuten dauern. Wäre es für Sie in Ordnung, wenn ich unser Gespräch aufnehmen würde (nur Audio)?

- In der folgenden Frage geht es darum, herauszufinden, wie stark bzw. schwach verschiedene Bevölkerungsgruppen von Hitzestress betroffen sind und was Gründe für ihre Verwundbarkeit bzw. Widerstandsfähigkeit.
  Inwiefern sind oder könnten die folgenden Bevölkerungsgruppen von städtischem Hitzestress betroffen sein? Sowohl direkt wie auch indirekt?
  ➔ Aufzählung: Säuglinge, Kleinkinder (2-6 Jahre), Schulkinder (7-13 Jahre), Jugendliche (14-17 Jahre), junge Erwachsene (18-26 Jahre), Erwachsene (27-69 Jahre), Senior*innen (70-79 Jahre), Greise (80+ Jahre), chronisch Kranke.

- Welche Bevölkerungsgruppen unterschätzen gesundheitliche Risiken durch Hitze Ihrer Erfahrung nach häufig?
  Kennen Sie Studien - sowohl peer-review als auch «graue Literatur» - dazu, wie Personen Gesundheitsrisiken von Hitzewellen wahrnehmen bzw. ob sie sich von der Hitze bedroht fühlen?
  Kennen Sie Studien dazu, welcher Nutzen bzw. welche Barrieren bezüglich verschiedener Schutzmassnahmen Personen feststellen?
  Welche Faktoren könnten die Risikowahrnehmung Ihrer Erfahrung nach beeinflussen? (Wenn noch nicht erwähnt, nach Folgendem fragen: Demografische Variablen, Wohnsituation, Zugang zu Garten/Park/Gewässer, soziales Netzwerk, eigene Erfahrungen mit Hitze?)

- Was sind, Ihrer Meinung nach, wirkungsvolle Massnahmen zum Schutz der eigenen Gesundheit bei Hitzewellen? Gibt es Unterschiede zwischen Bevölkerungsgruppen?
- Was sind typische Fehlvorstellungen bezüglich Massnahmen zum Schutz der eigenen Gesundheit bei Hitzewellen?

- Welchen Anteil der Gesundheitsvorsorge bezüglich Hitze sollen/können Individuen leisten und wo müsste die öffentliche Hand mehr tun?

So, ich denke, das ist im Grunde alles, was ich Sie fragen wollte. Haben Sie noch irgendwelche abschliessende Gedanken oder Dinge, worüber Sie noch etwas sagen wollen?
Sind Sie an den Resultaten der Arbeit interessiert?
Vielen Dank, dass Sie sich für dieses Gespräch Zeit genommen haben!

Appendix C – Assumptions checking for statistical analysis

C.1 Checking for multicollinearity

Table 6: Variance inflation factors (VIF) for each variable in the six regression models

	Variance inflation factors (VIF)
Model 1	
Gender	1.03
Age	1.07
Education	1.08
Disease	1.03
Model 2	
UHI intensity of neighborhood	1.12
Number of adults	1.37
Number of children	1.13
Number of days at home per week	1.11
Number of rooms	1.29
Single family house	1.07
Number of floors	1.12
Type of floor	1.19
New / old building	1.09
Ventilator	1.05
Air conditioner	1.03
Garden	1.31
Balcony	1.13
Model 3	
Perceived vulnerability	7.42
Perceived severity	7.39
Perceived benefits	1.07
Perceived barriers	1.01
Model 4	
Perceived vulnerability	7.36
Perceived severity	7.36
Model 5	
Perceived benefits	1.00
Perceived barriers	1.00
Model 6	
Gender	1.21
Age	1.90
Education	1.34
Disease	1.15
UHI intensity of neighborhood	1.19
Number of adults	1.52

Number of children	1.27
Number of days at home per week	1.25
Number of rooms	1.42
Single family house	1.11
Number of floors	1.26
Type of floor	1.25
New / old building	1.12
Ventilator	1.15
Air conditioner	1.06
Garden	1.44
Balcony	1.15
Perceived vulnerability	7.68
Perceived severity	8.06
Perceived benefits	1.23
Perceived barriers	1.42

C.2 Checking for linearity, normality of residuals, independence of error terms, and homoscedasticity

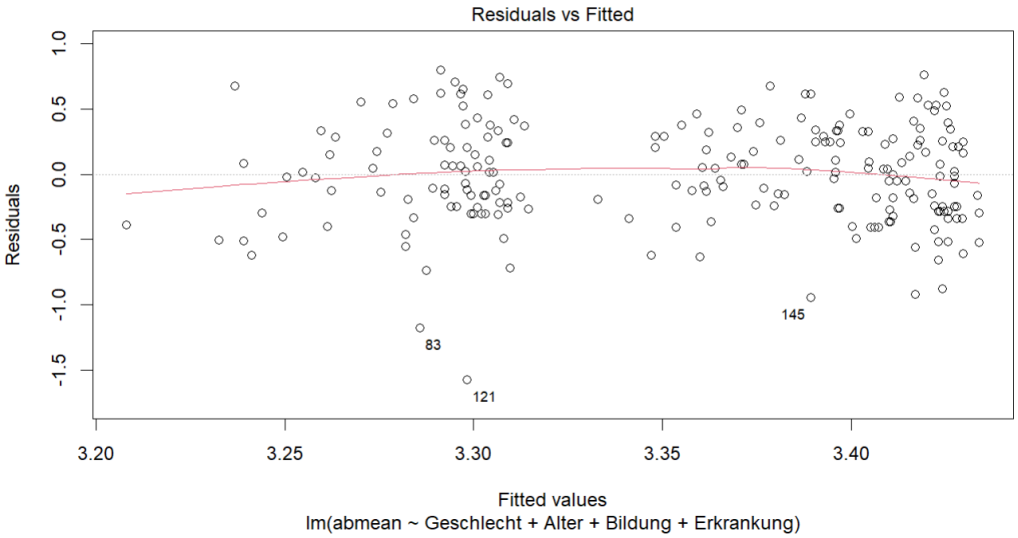

Figure 17: Residuals vs. fitted plot for the regression model with demographic variables

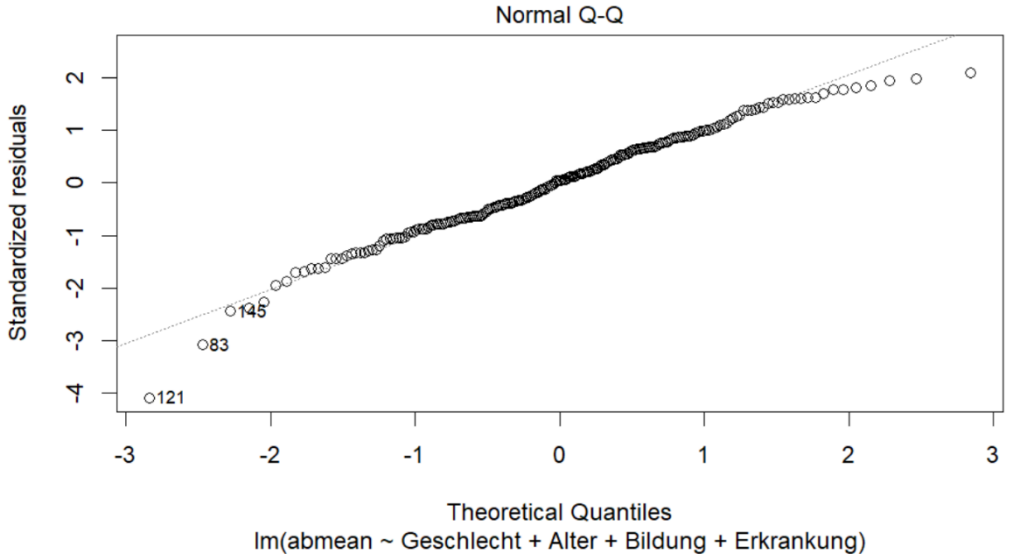

Figure 18: QQ-plot for the regression model with demographic variables

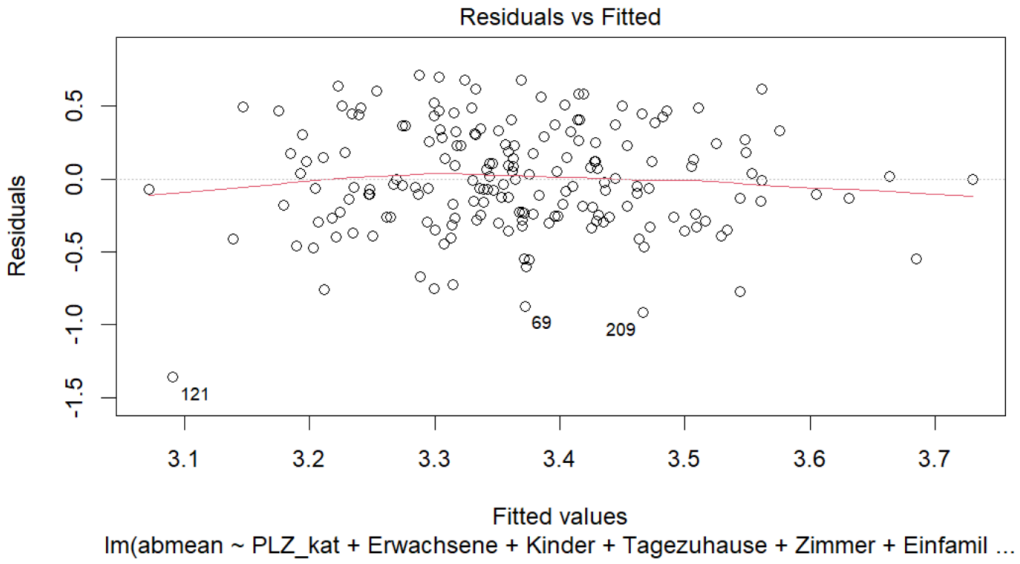

Figure 19: Residuals vs. fitted plot for the regression model with housing characteristics

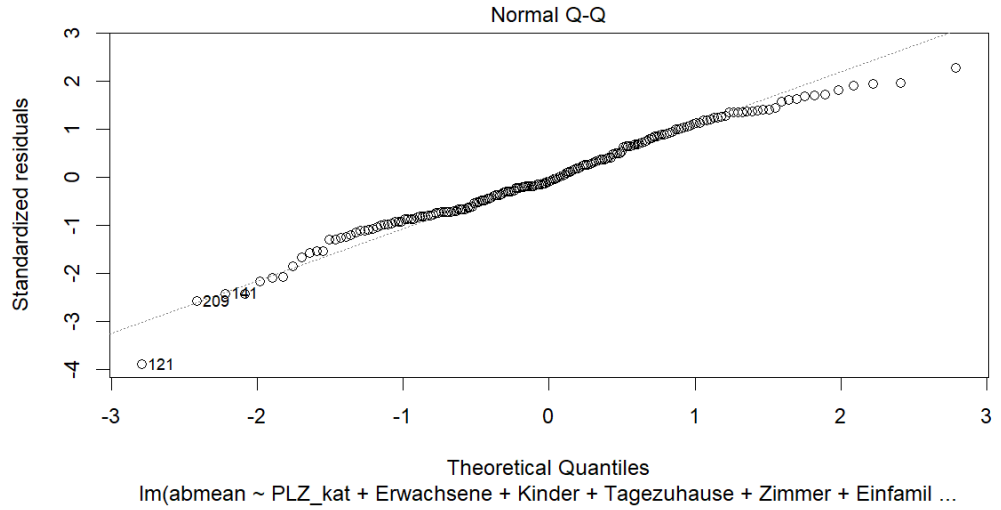

Figure 20: QQ-plot for the regression model with housing characteristics

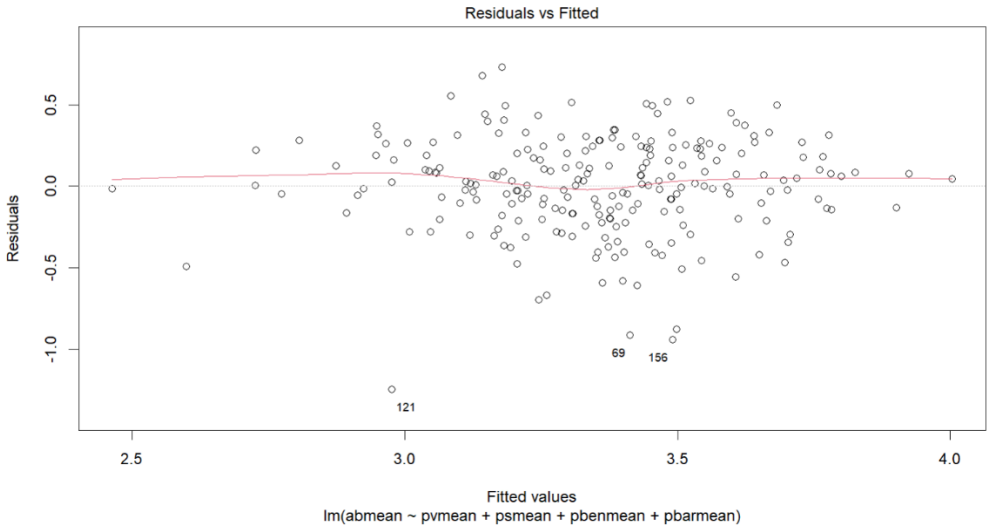

Figure 21: Residuals vs. fitted plot for the regression model with psychological factors

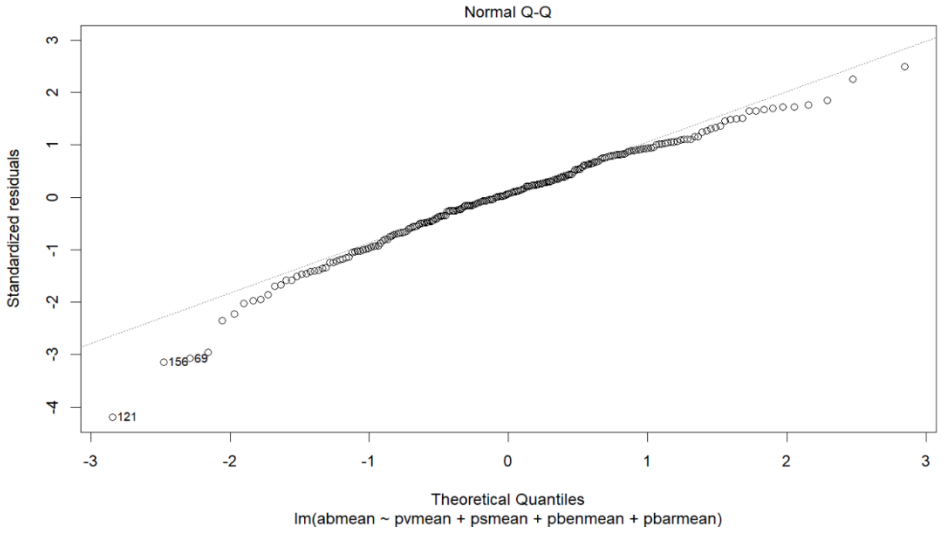

Figure 22: QQ-plot for the regression model with psychological factors

Figure 23: Residuals vs. fitted plot for the regression model with perceived vulnerability and perceived severity

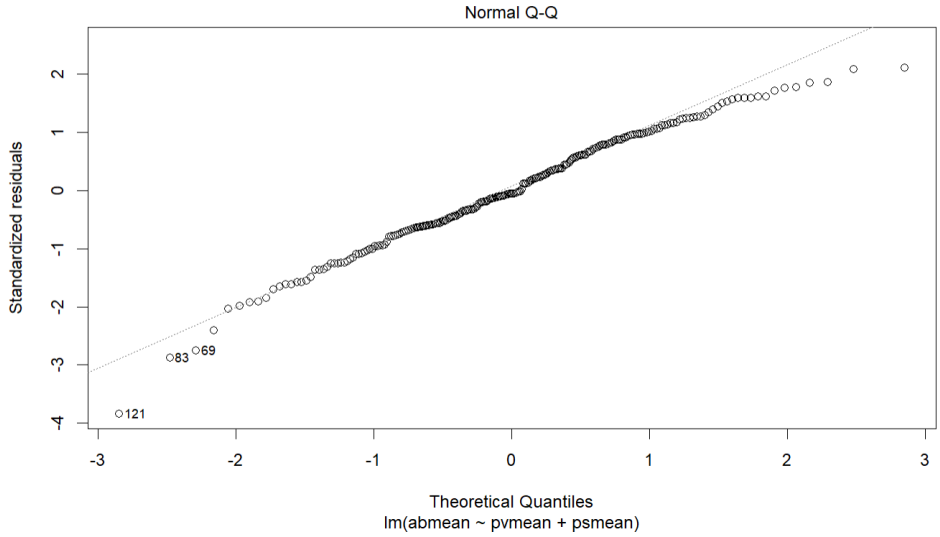

Figure 24: QQ-plot for the regression model with perceived vulnerability and perceived severity

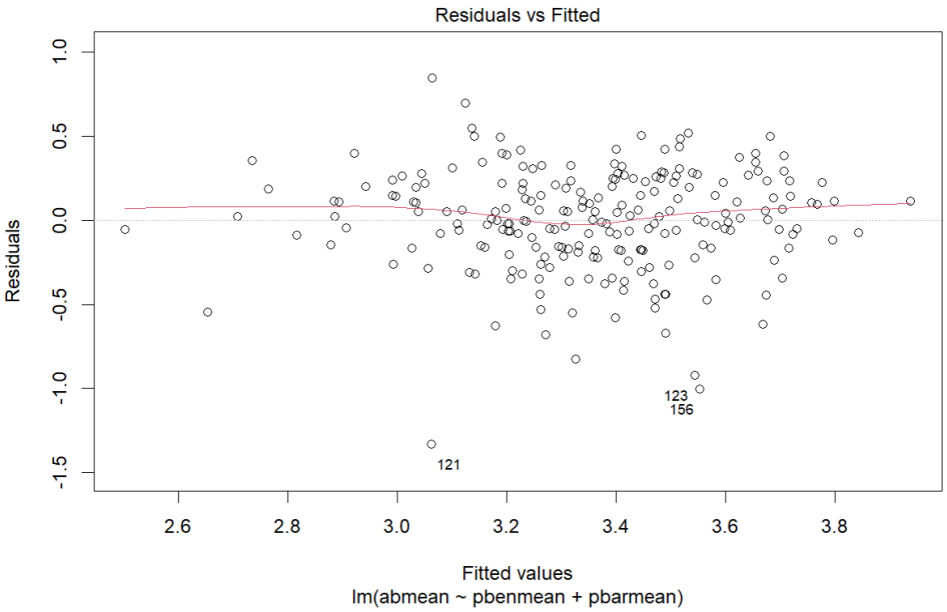

Figure 25: Residuals vs. fitted plot for the regression model with perceived benefits and perceived barriers

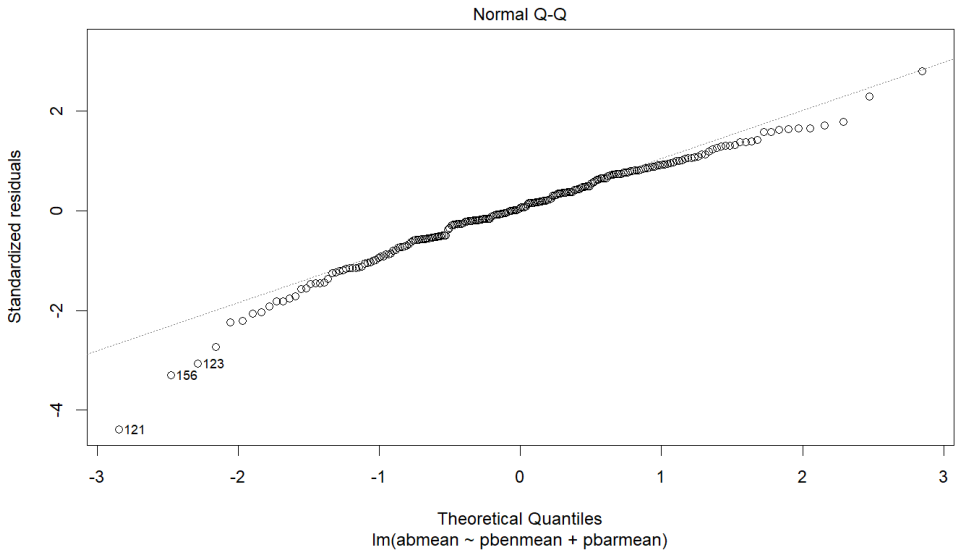

Figure 26: QQ-plot for the regression model with perceived benefits and perceived barriers

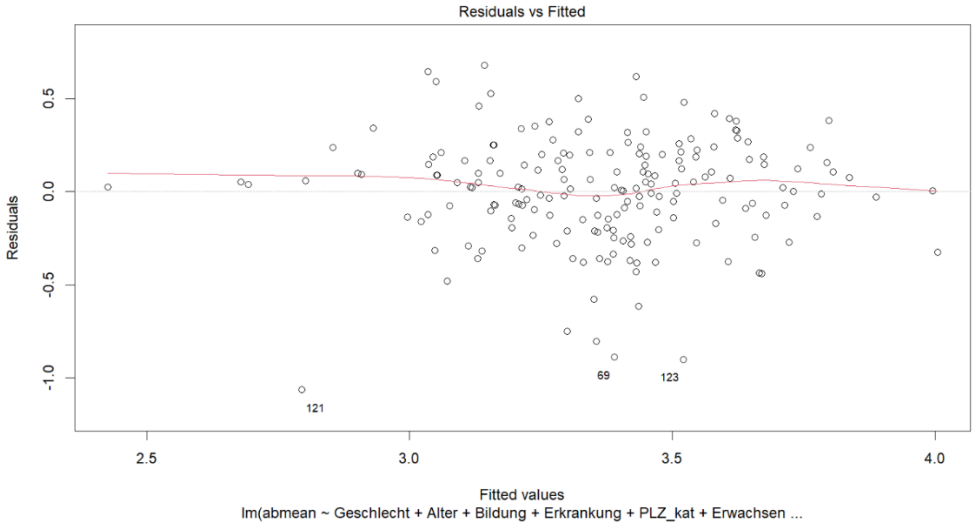

Figure 27: Residuals vs. fitted plot for the regression model with all predictor variables

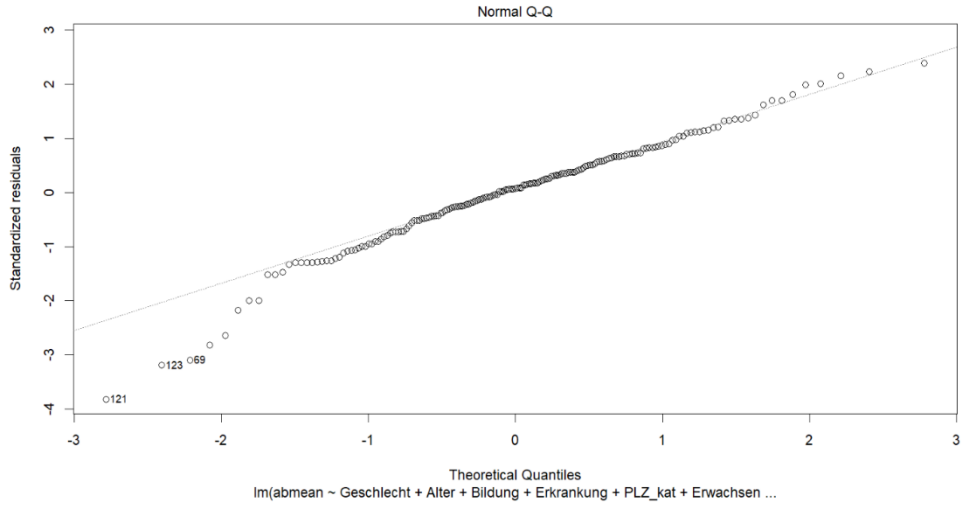

Figure 28: QQ-plot for the regression model with all predictor variables

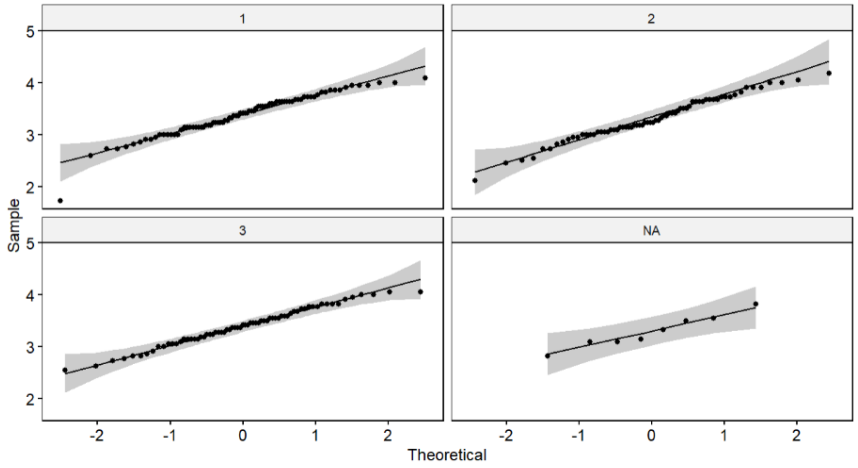

Figure 29: QQ-plots for each level of UHI intensity of neighborhood (1=low, 2= medium, 3=high, NA=not available)

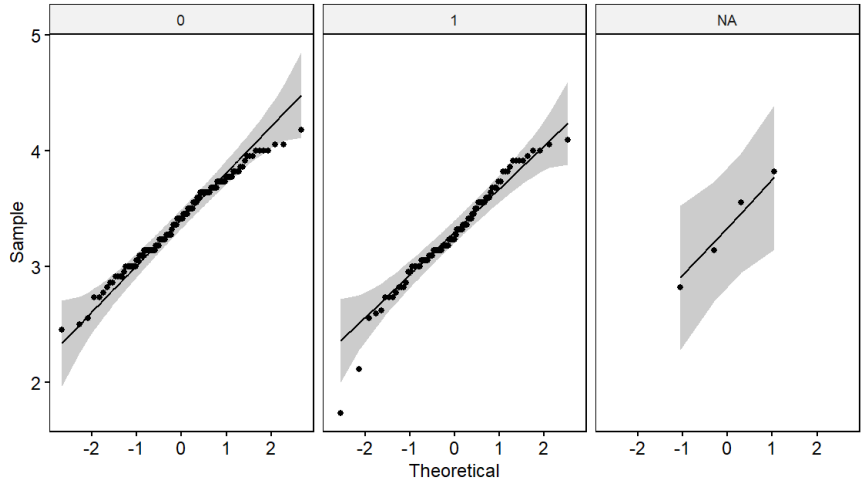

Figure 30: QQ-plots for groups of gender (0=female, 1=male, NA=not available)

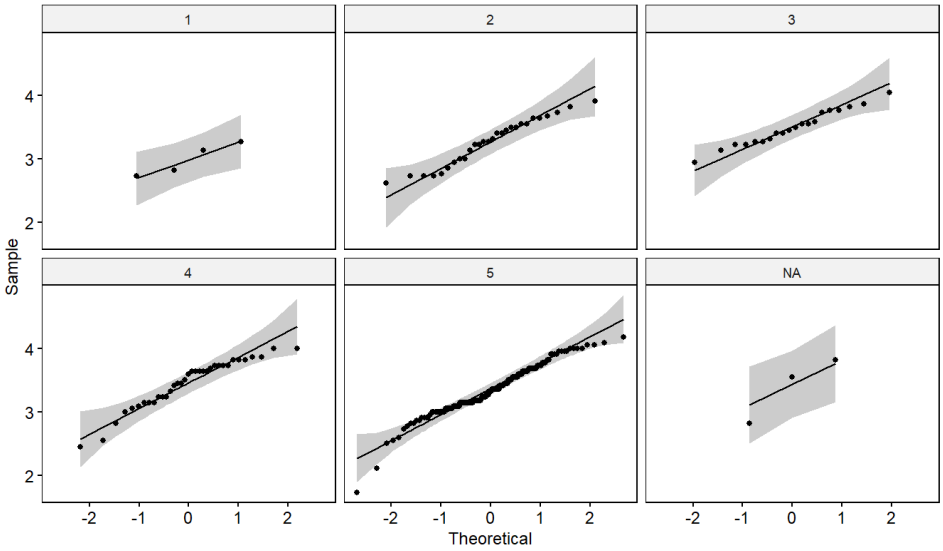

Figure 31: QQ-plots for each level of education (1=compulsory education, 2=vocational education (apprenticeship), 3=baccalaureate or specialized school, 4=colleges of higher education, 5 =universities, NA=not available)

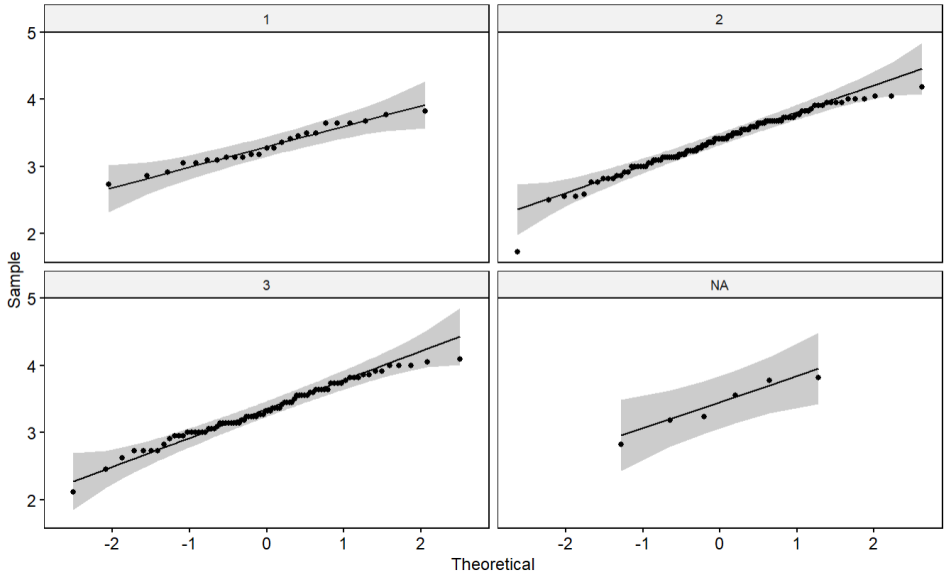

Figure 32: QQ-plots for each age group (1=under 30 years, 2=30-59 years, 3=60+ years, NA=not available)

Declaration of consent

on the basis of Article 30 of the RSL Phil.-nat. 18

Name/First Name: Sabbatini, Doriana

Registration Number: 17-710-864

Study program: Climate Sciences

Bachelor ☐ Master ☑ Dissertation ☐

Title of the thesis: Public perceptions of and behavioral repsonses to urban heat stress in Bern

Supervisor: Prof. Dr. Stefan Brönnimann

I declare herewith that this thesis is my own work and that I have not used any sources other than those stated. I have indicated the adoption of quotations as well as thoughts taken from other authors as such in the thesis. I am aware that the Senate pursuant to Article 36 paragraph 1 litera r of the University Act of 5 September, 1996 is authorized to revoke the title awarded on the basis of this thesis.

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